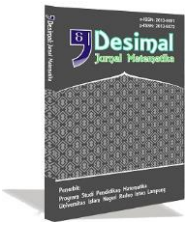
Desimal: Jurnal Matematika Vol 7 No 1 (2024) 95-102

Contents lists available at DJM

DESIMAL: JURNAL MATEMATIKA

p-ISSN: 2613-9073 (print), e-ISSN: 2613-9081 (online), DOI 10.24042/djm

http://ejournal.radenintan.ac.id/index.php/desimal/index



Development of problem-based learning-based student worksheet to improve mathematical problem solving ability in rows and rows material

Ulfa Dwi Indriani*, Rusydi Ananda

Universitas Islam Negeri Sumatera Utara, Indonesia

ARTICLE INFO

Article History
Received : 03-02-2024
Revised : 11-03-2024
Accepted : 08-04-2024
Published : 30-04-2024

Keywords:
Development of Learner Worksheets; Mathematical Problem Solving; Problem Based Learning.

*Correspondence: E-mail:
ulfadwi0730@gmail.com,
rusydiananda@uinsu.ac

Doi:
10.24042/djm.v7i1.22105

ABSTRACT

Problem Based Learning is one form of effort to reduce problems in the process of learning mathematics. The model used in the teaching and learning process is in accordance with the demands of mathematics learning and is centered on students. This research has the main objective of developing and designing problem-based LKPD with the aim of improving students' ability to solve mathematical problems on the material of rows and series. The use of the research and development (R&D) model was chosen by researchers in this study. The type of development used in this model is 4D; as stated, 4D itself consists of four stages, namely introduction (define), planning (design), development (develop), and dissemination (disseminate). Problem Based Learning-based LKPD on the material of rows and series developed is feasible to use as teaching material in learning with the acquisition of a validation value of 92.44%, declared practical with a score of 87.44% based on students' responses to student worksheets, and declared effective with student completeness increasing with an N-Gain value of 0.72, including the high category. The increase in students' mathematics learning outcomes on the material of rows and series using Problem Based Learning-based Learner Worksheets shows that there is an increase in the mathematical problem-solving ability of students.

http://ejournal.radenintan.ac.id/index.php/desimal/index

INTRODUCTION

The current advancement of knowledge and technology requires the education sector to make efforts to improve the quality of education. This is a troubling situation because everyone wants the best education for the next generation of the nation. Mathematics is one of the most important subjects to be taught and can be used from primary school to secondary school and also in higher education. This is because math effectively promotes the development of technological and conceptual knowledge.

Copyright © 2024, Desimal, Print ISSN: 2613-9073, Online ISSN: 2613-9081

This can be seen from how mathematics is organized in a systematic, hierarchical, and logical manner that enables learners to have skills in logical thinking (Jeheman, Gunur, & Jelatu, 2019). This is in line with the objectives of various studies that have been proposed to implement mathematics learning methods, namely to provide students with opportunities to improve their cognitive abilities critically, analytically, and systematically and to teach them what they know about mathematics together (Hatip & Setiawan, 2021).

However, many learners face difficulties with math lessons. Lack of interest from learners further makes math among the most avoided subjects by learners. Teachers who do not adopt innovative approaches to teaching math often cause learners to avoid the subject. This causes most math teachers to use simple learning methods, mainly lectures, questions and answers, and assignments. This problem also occurs in class XI students of MAS Miftahul 'Ulum, whose ability to solve math problems is still relatively low, and the use of monotonous media, namely the 2013 curriculum books distributed by the government both in printed copies, which still have weaknesses, especially the few exercises and the thick appearance of the book, makes students less interested. With such learning, it does not include activities that involve students, making learning less effective. To teach math well, teaching materials are needed to support learning and foster learner interest. Teaching materials are made to support learning and help students achieve their learning goals. There are many types of teaching materials, including LKPD (Lembar Kerja Peserta Didik). Teaching materials are expected to be one of the most important components of the teaching and learning process. According to Nurdin (as cited in Diana, Tahir, & Khair (2022)), LKPD is printed teaching material containing an overview of the material and instructions that outline what learning tasks must be done by students. LKPD helps learners develop better knowledge, skills, and attitudes (Maharani, Arjudin, Novitasari, & Subarinah, 2023).

Problem-based learning is one form of effort to reduce problems in the process of learning mathematics. As stated by Larasati (2020), the problem-based learning model, or problem-based learning, is a model used in the teaching and learning process that is in accordance with the demands of mathematics learning, is centered on or relies on students rather than teachers, and is the starting point of student learning.

In the 1970s, problem-based learning was publicized by McMaster University, Faculty of Medicine, Canada, as a solution to finding ways to solve problems by presenting questions related to circumstances that exist in life. Ibrahim and Nur (as cited in Fortuna, Yuhana, & Novaliyosi (2021)) that problem-based learning (PBL) is an educational strategy developed to develop learners' critical thinking skills in the context of real-world challenges and increase proficiency, especially in mathematics.

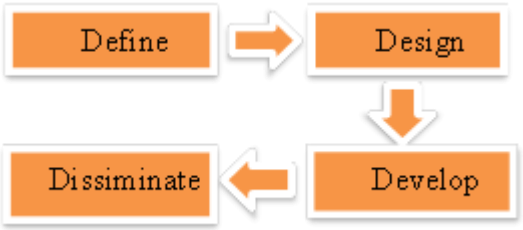
Mathematical problem-solving ability is one of the mathematical abilities needed to help students learn mathematics. With this ability, students are expected to be able to understand and be able to identify what is in the problem, plan how to solve it, implement the solution plan, and draw conclusions about how the solution to the problem exists. Problem-solving ability is a very important skill in learning mathematics and is an important part of the curriculum. So basically, every learner must have the ability to solve problems (Sumartini, 2018). Thus, the mathematical problem-solving ability of students is strengthened, resulting in the objectives of the learning process that have been formulated being achieved.

Copyright © 2024, Desimal, Print ISSN: 2613-9073, Online ISSN: 2613-9081

The development of this LKPD by utilizing the problem-based learning model has previously been used for research (Hasanah, Sarjono, & Hariyadi, 2021), which shows a significant effect and students experience an increase in learning achievement. Following this statement, research from Haryanti & Sari (2019) also obtained research results stating that the use of problem-based learning models improves student learning outcomes by improving their mathematical problem-solving skills. Previous research shows that teaching materials are very important for learning, especially those that aim to improve the problem-solving abilities of students. In this study, the learner worksheet developed has two problems, where the work on the first problem is done in a guided manner. The purpose of this research is to produce teaching materials for learner worksheets to improve the mathematical problem-solving skills of students in class XI MAS Miftahul 'Ulum in the material of rows and series. With the LKPD developed from this research, it is hoped that the Learner Worksheets can be used as teaching materials in teaching mathematics and will help teachers deliver material that will improve students' ability to solve mathematical problems.

METHOD

The use of the research and development (R&D) model was chosen by the researcher in this study. This research model aims to make certain products and test how effective they are. This model is not to test theory but is an attempt to make useful products in the field of education (Nicomse & Tambunan, 2022). The type of development used in this model is 4D, as stated by Jusar (2020). 4D itself consists of four stages, namely introduction (define), planning (design), development (develop), and dissemination (disseminate), whose main purpose is to develop and design problem-based LKPD with the aim of improving students' ability to solve mathematical problems on the material of rows and series.



Picture 1. Model 4-D
Source: (Sirait & Lubis, 2023)

The output created is a problem-based LKPD in learning that focuses on discussing the material of rows and series, which will be used by mathematics teachers to improve students' understanding of mathematical concepts. After the LKPD was developed, the validator stated that it was feasible. The product trial itself aims to collect data to determine student responses to the practicality and effectiveness of problem-based LKPD. XI MIPA class students in the odd semester of the 2023–2024 academic year, totaling 36 students, were the subjects of this study. The implementation of this research is at MAS Miftahul 'Ulum, which is located in Dusun I, Suka Mulia, Desa Tegal Sari, Kec. Dolok Masihul, Kab. Serdang Bedagai, North Sumatra. Data is a series of information or facts that are obtained by observation as well as from sources. The data obtained by means of data collection can be in the form of the results of the expert team validation sheet, questionnaire sheet, and also pretest-posttest questions. After the data is collected, data analysis is carried out by using the results of the data analysis to determine research findings. The results of this data analysis offer solutions to existing questions. The data from this study were analyzed to validate and assess the feasibility, practicality, and effectiveness of the learner worksheet.

1. Validity

Copyright © 2024, Desimal, Print ISSN: 2613-9073, Online ISSN: 2613-9081

Data analysis of the results of the validity of the expert team was done with a Likert scale. The assessment score is very unworthy (1), less worthy (2), quite worthy (3), worthy (4), and very worthy (5). The following equation is used to calculate the validity results from the validator team:

$$Percentage\ of\ validity = \frac{\sum score\ from\ validators}{\sum total\ ideal\ score} \times 100\%$$

The validity criteria for the problem-based learner worksheet in this study were used to interpret the validation score, which was declared valid if the percentage reached a score ≥ 61%.

2. Practicality

The analysis of practicality data obtained using a response questionnaire sheet containing student answers is carried out on the student worksheet with answers given by students after learning. LKPD is declared effective based on students' responses if it gets a score of ≥ 61%.

$$Persentage\ of\ Practicality\ = \frac{\sum Resulting\ score}{\sum Total\ maximum\ score} \times 100\%$$

3. Effectiveness

Analyzing effectiveness data in terms of student test results is determined by the N-gain score approach to assess whether learning outcomes have improved. The completeness of the pretest-posttest results is seen from the specified KMM limit, which is ≥77. The formula for calculating the increase in posttest results from pretest results is as follows:

$$N - Gain = \frac{Posttest\ score - Pretest\ score}{100 - Pretest\ score} \times 100\%$$

Furthermore, the N-gain level category is used to understand the N-gain value, resulting in student completeness increasing with an N-gain value of 0.70, including the high category (Hake, 1999).

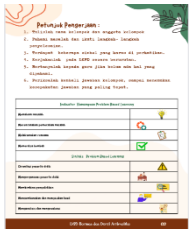
RESULTS AND DISCUSSION

The resulting research product is a Problem Based Learning-based Learner Worksheet that can improve problem-solving skills on Rows and Series consisting of the first two sub-materials of LKPD 1 (Arithmetic Rows and Series) and LKPD 2 (Geoemetry Rows and Series). The resulting Learner Worksheets have been adjusted to the guidelines for developing Learner Worksheets and based on Problem Based Learning syntax, which contains indicators of problem-solving skills. The learner worksheet developed has two problems, where the work on the first problem is done in a guided manner. The learner worksheet includes a cover, instructions for use, a summary of the material, and mathematical problems.

Data on the Results of the Validation of Problem-Based Learning-Based Learner Worksheets Validation of Problem Based Learner Worksheets was carried out by several experts and mathematics teachers, which aims to determine the feasibility level of Problem Based Learning based Learner Worksheets that have been developed. Validation is divided into three categories: media experts, material experts, and mathematics teachers. The validation result data is presented in Table 2.

Copyright © 2024, Desimal, Print ISSN: 2613-9073, Online ISSN: 2613-9081

Tabel 1. Display and Features of LKPD

No.	Display	Description
1		Main cover. The main cover of the LKPD contains the title, material, school level, group name column, and learning indicators. There are interesting pictures on the LKPD cover.
2		Instruction sheet. This sheet contains instructions on how to use the LKPD, indicators, and syntax of problem-based skills.
3		This feature signals learners to understand the problem.
4		This feature signals learners to plan how to solve the problem.
5		This feature signals learners to implement the plan to find a solution to the problem.
6		This feature signals learners to double-check the solution and draw a conclusion.

Tabel 2. Results of expert validation

Validator	Score Assessment	Level of achievement (%)	Criteria
Media expert	72	96%	Very worthy
Material expert	68	90.66%	Very worthy
Math teacher	68	90.66%	Very worthy
Average score		92.44%	Very worthy

Based on the results obtained from distributing questionnaires to students, it shows that Problem Based Learning-based LKPD on the material of rows and series is included in the very practical category with a value of 87.44%. This indicates that students carry out activities in LKPD in a structured manner with their groups. The Problem Based Learning learning model can have a positive impact on the ability to solve problems because, in learning, students are required to understand the content of the material by trying to solve an authentic problem. In solving the problem, students exchange ideas and share ideas with their groupmates so that their insights and problem-solving skills will develop. Learning activities carried out in groups and carried out correctly and appropriately can reduce the tendency to compete among students.

The effectiveness of LKPD is determined by the completeness of the test results and the achievement of indicators. The problem-solving ability test is carried out by developing each indicator of problem-solving skills into appropriate items. Completeness in working on pretest and posttest questions is obtained if it meets the specified KKM limit of ≥ 77.

Based on the results of the pre-test and post-test, the completeness of students increased with an N-Gain value of 0.72, including the high category. The average score on the pretest results of 59.833 is classified as incomplete. The average of the posttest results of 85.75 is

Copyright © 2024, Desimal, Print ISSN: 2613-9073, Online ISSN: 2613-9081

classified as complete. The data indicates that the test results of students increased from pretest scores to posttest scores. The difference from the average pretest score to the posttest is the result of the achievement of the utilization of Problem Based Learning-based LKPD, so there is an increase in the test. This increase was obtained because during learning activities with the Problem Based Learning model, students actively participated in every learning process so that they were able to produce a positive impact on the learning outcomes of students (Setyawan, 2022). The improvement of students' mathematics learning outcomes on the material of rows and series using Problem Based Learning-based Learner Worksheets shows that there is an increase in the mathematical problem-solving ability of students. Based on these results, it is determined that Problem Based Learning-based Learner Worksheets on the material of rows and series are declared effective for use in learning activities and can be used as teaching materials that can support Problem Based Learning-based learning and are able to improve students' mathematical problem-solving skills.

CONCLUSIONS AND SUGGESTIONS

This research and development produces a product in the form of teaching materials, Problem-Based Learning-based LKPD (Lembar Kerja Peserta Didik), that can improve problem-solving skills on Rows and Series, consisting of the first two sub-materials, LKPD 1 (Arithmetic Rows and Series) and LKPD 2 (Geometry Rows and Series). Problem Based Learning based LKPD on the material of ranks and series developed is feasible to use as teaching material in learning with the acquisition of a validation value of 92.44% based on the presentation aspect, content aspect, and linguistic aspect. Problem Based Learning-based LKPD products are declared practical with a score of 87.44% based on students' responses to student worksheets. Problem Based Learning based LKPD products are also declared effective, with student completeness increasing with an N-Gain value of 0.72, including the high category. The improvement of students' mathematics learning outcomes on the material of rows and series using Problem Based Learning-based Learner Worksheets shows that there is an increase in the mathematical problem-solving ability of students. Thus, Problem Based Learning based LKPD to improve mathematical problem solving ability has good quality so that it can be used in the learning process to familiarize students to carry out problem solving activities so that students can keep up with the times and can compete in the future.

Based on the research conducted, several suggestions can be made, namely that researchers need to estimate the time used by students in identifying problems in the stage of orienting students to the problems given in the LKPD because in the learning process, the time used by students is quite long, and how to make learning run optimally.

REFERENCES

Diana, A., Tahir, M., & Khair, B. N. (2022). Pengambangan lembar kerja peserta didik (LKPD) berbasis discovery learning pada pembelajaran ipa materi sumber daya alam untuk kelas iv sdn 23 ampenan. *Jurnal Ilmiah Profesi Pendidikan*, *7*(1), 141–150. https://doi.org/10.29303/jipp.v7i1.419

Fortuna, I. D., Yuhana, Y., & Novaliyosi. (2021). Pengembangan lembar kerja peserta didik dengan problem based learning untuk kemampuan berpikir tingkat tinggi. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, *05*(02).

Hake, R. R. (1999). Analyzing change/gain scores. *Unpublished.[Online] URL:*

Copyright © 2024, Desimal, Print ISSN: 2613-9073, Online ISSN: 2613-9081

Http://Www. Physics. Indiana. Edu/\~ Sdi/AnalyzingChange-Gain. Pdf, *16*(7).

Haryanti, S., & Sari, A. (2019). Pengaruh penerapan model problem based instruction terhadap kemampuan pemecahan masalah matematis ditinjau dari adversity quotient siswa madrasah tsanawiyah. *JURING (Journal for Research in Mathematics Learning)*, *2*(1), 077. https://doi.org/10.24014/juring.v2i1.6712

Hasanah, U., Sarjono, S., & Hariyadi, A. (2021). Pengaruh model problem based learning terhadap prestasi belajar ips smp taruna kedung adem. *Aksara: Jurnal Ilmu Pendidikan Nonformal*, *7*(1), 43. https://doi.org/10.37905/aksara.7.1.43-52.2021

Hatip, A., & Setiawan, W. (2021). Teori kognitif bruner dalam pembelajaran matematika. *PHI: Jurnal Pendidikan Matematika*, *5*(2), 87. https://doi.org/10.33087/phi.v5i2.141

Jeheman, A. A., Gunur, B., & Jelatu, S. (2019). Pengaruh pendekatan matematika realistik terhadap pemahaman konsep matematika siswa. *Mosharafa: Jurnal Pendidikan Matematika*, *8*(2), 191–202. https://doi.org/10.31980/mosharafa.v8i2.454

Jusar, J. (2020). *Pengembangan perangkat pembelajaran matematika berbasis problem based learning pada materi statistika kelas VIII SMP Babussalam Pekanbaru*. Universitas Islam Riau.

Larasati, A. (2020). Peningkatan kualitas pembelajaran melalui implementasi model problem based learning materi interaksi sosial. *INOVASI: Jurnal Diklat Keagamaan*, *14*(1), 68–78.

Maharani, F., Arjudin, A., Novitasari, D., & Subarinah, S. (2023). Pengembangan lembar kerja peserta didik berbasis problem based learning berorientasi kemampuan berpikir kritis siswa smk. *Media Pendidikan Matematika*, *11*(1), 19. https://doi.org/10.33394/mpm.v11i1.8288

Nicomse, N., & Tambunan, L. W. (2022). Pengembangan lembar kerja peserta didik menggunakan model pembelajaran problem based learning pada materi barisan dan deret aritmatika di kelas XI SMA Gajah Mada Medan. *Sepren*. https://doi.org/10.36655/sepren.v4i0.824

Setyawan, A. (2022). Penggunaan model pembelajaran problem based learning meningkatkan hasil belajar matematika materi barisan dan deret. *Journal for Lesson and Learning Studies*, *5*(1). https://doi.org/10.23887/jlls.v5i1.48460

Sirait, A. F., & Lubis, M. S. (2023). Pocket book design based on mathematical puzzles to improve the mathematical logical intelligence of grade XI students. *Mathline : Jurnal Matematika Dan Pendidikan Matematika*, *8*(1), 68–85. https://doi.org/10.31943/mathline.v8i1.378

Sumartini, T. S. (2018). Peningkatan kemampuan pemecahan masalah matematis siswa melalui pembelajaran berbasis masalah. *Mosharafa: Jurnal Pendidikan Matematika*, *5*(2), 148–158. https://doi.org/10.31980/mosharafa.v5i2.270

Copyright © 2024, Desimal, Print ISSN: 2613-9073, Online ISSN: 2613-9081

Copyright © 2024, Desimal, Print ISSN: 2613-9073, Online ISSN: 2613-9081