Turnitin Final Manuscript_Yolanda Tesalonika Sudiro.pdf

Universitas Negeri Semarang - iTh

Document Details

Submission ID
trn:oid:::3618:104786180

Submission Date
Jul 17, 2025, 2:00 PM GMT+7

Download Date
Jul 18, 2025, 12:03 AM GMT+7

File Name
Perbaikan Turnitin_Yolanda Tesalonika Sudiro.pdf

File Size
480.9 KB

19 Pages

8,967 Words

51,383 Characters

16% Overall Similarity

The combined total of all matches, including overlapping sources, for each database.

Filtered from the Report

- Bibliography

Exclusions

- 3 Excluded Matches

Match Groups

106 Not Cited or Quoted 14%
Matches with neither in-text citation nor quotation marks

15 Missing Quotations 2%
Matches that are still very similar to source material

0 Missing Citation 0%
Matches that have quotation marks, but no in-text citation

0 Cited and Quoted 0%
Matches with in-text citation present, but no quotation marks

Top Sources

12% Internet sources
12% Publications
0% Submitted works (Student Papers)

Integrity Flags

0 Integrity Flags for Review

No suspicious text manipulations found.

Our system's algorithms look deeply at a document for any inconsistencies that would set it apart from a normal submission. If we notice something strange, we flag it for you to review.

A Flag is not necessarily an indicator of a problem. However, we'd recommend you focus your attention there for further review.

Match Groups

- **106** Not Cited or Quoted 14%
  Matches with neither in-text citation nor quotation marks
- **15** Missing Quotations 2%
  Matches that are still very similar to source material
- **0** Missing Citation 0%
  Matches that have quotation marks, but no in-text citation
- **0** Cited and Quoted 0%
  Matches with in-text citation present, but no quotation marks

Top Sources

12% Internet sources
12% Publications
0% Submitted works (Student Papers)

Top Sources

The sources with the highest number of matches within the submission. Overlapping sources will not be displayed.

1	Internet	
journal.unnes.ac.id		<1%
2	Publication	
Indra Hayati Putri, Rian Dian Anggraini, Nahor Murani Hutapea. "Development of...		<1%
3	Publication	
Ade Gafar Abdullah, Ida Hamidah, Siti Aisyah, Ari Arifin Danuwijaya, Galuh Yuliani...		<1%
4	Internet	
jes.ejournal.unri.ac.id		<1%
5	Publication	
Ade Gafar Abdullah, Tutin Aryanti, Agus Setiawan, Maizam Binti Alias. "Regionaliz...		<1%
6	Internet	
repository.uinsaizu.ac.id		<1%
7	Internet	
doaj.org		<1%
8	Internet	
ejurnal.iainpare.ac.id		<1%
9	Internet	
journals.eduped.org		<1%
10	Publication	
Dian Marta Wijayanti, Suwito Eko Pramono, Eko Handoyo. "Principal decision-ma...		<1%

11 Internet
e-journal.metrouniv.ac.id <1%

12 Internet
jurnal.unissula.ac.id <1%

13 Internet
seaninstitute.org <1%

14 Publication
Maila D.H. Rahiem. "Towards Resilient Societies: The Synergy of Religion, Educati... <1%

15 Internet
jonedu.org <1%

16 Publication
Dila Anggaraini, Elfis Suanto, Putri Yuanita. "PENGEMBANGAN MODUL AJAR BERB... <1%

17 Publication
Wahyuni H Mailili, Hajerina, Nursupiamin, Sriayulisyah, Windra. "Development ... <1%

18 Internet
ijmmu.com <1%

19 Internet
journal.unpas.ac.id <1%

20 Publication
Irfan Fauzi, Jiraporn Chano, Chi Cheng Wu. "Mathematical Literacy of Indonesian ... <1%

21 Internet
jurnal.fkip.unmul.ac.id <1%

22 Internet
nicsforschoolleaders.tpdatscalecoalition.org <1%

23 Publication
Rabiatul Adawiyah, Susilawati Susilawati, Lenny Anwar S. "Development of Intera... <1%

24 Internet
ejournal.iainkerinci.ac.id <1%

25 Internet

journal.ummat.ac.id <1%

26 Publication

Andri Sattriawan, Sugeng Sutiarso, Undang Rosidin. "Pengembangan Media Pem... <1%

27 Publication

Rahmatya Nurmeidina, Nafisa Nur Zaqiyah, Arif Ganda Nugroho, Andini Andini et... <1%

28 Internet

eprints.walisongo.ac.id <1%

29 Internet

jurnal.upk.ac.id <1%

30 Internet

journal.uhamka.ac.id <1%

31 Publication

Husnul Maisa, Zul Amry, Edy Surya. "Development of Mathematics Module Based ... <1%

32 Internet

mathline.unwir.ac.id <1%

33 Internet

www.3gpp.org <1%

34 Publication

Shafitri Ardiana, Noor Fajriah, Juhairiah Juhairiah. "Development of Teaching Mo... <1%

35 Internet

ijcsrr.org <1%

36 Internet

journal-center.litpam.com <1%

37 Internet

www.ncbi.nlm.nih.gov <1%

38 Publication

Ai Tusi Fatimah, Agus Yuniawan Isyanto, Euis Erlin, Bibin Bintang Andriana. "STEA... <1%

39 Publication

Lina Novita, Stella Talitha, Rohimah Rohimah, Fitri Siti Sundari, Ratih Purnamasar... <1%

40 Internet

jppipa.unram.ac.id <1%

41 Internet

jurnalnasional.ump.ac.id <1%

42 Publication

L Lia, Zulkardi, K Wiyono. "Development of Interactive Learning Multimedia Usin... <1%

43 Publication

Stitt, Tanya Venee. "Problem-Based Learning as an Instructional Model for Stude... <1%

44 Publication

Yuni Haflati Zilda. "Improving learning activities and mathematical reasoning skil... <1%

45 Publication

Yunita Wildaniati. Elementary: Jurnal Ilmiah Pendidikan Dasar, 2019 <1%

46 Internet

fkip.univetbantara.ac.id <1%

47 Internet

journal.uniku.ac.id <1%

48 Internet

jurnal.ulb.ac.id <1%

49 Internet

ojs.fkip.ummetro.ac.id <1%

50 Internet

pdf.ejmse.com <1%

51 Internet

scholarzest.com <1%

52 Internet

www.ijsr.net <1%

53 Internet
www.journal.staihubbulwathan.id <1%

54 Internet
www.researchgate.net <1%

55 Internet
www.sciepub.com <1%

56 Publication
Aliya Kuralbayeva, Ardak Rysbayeva, Kymbat Kabekeyeva, Sultan Pashtanov, Gulz... <1%

57 Publication
Angel Mukuka, Jogymol Kalariparampil Alex. "Fostering students' mathematical r... <1%

58 Publication
Dian Mardiansyah, Heris Hendriana, Tatang Supriatna, Harry Dwi Putra. "Analysis... <1%

59 Publication
Syahlan Syahlan, Rianita Simamora. "IMPROVE STUDENTS' MATHEMATICAL CRITI... <1%

60 Publication
Uçar, Fatma Melike. "The Effect of Project-Based Learning Activities Enriched with... <1%

61 Internet
dergipark.org.tr <1%

62 Internet
e-journal.hamzanwadi.ac.id <1%

63 Internet
e-journal.undikma.ac.id <1%

64 Internet
ejournal.undiksha.ac.id <1%

65 Internet
files.eric.ed.gov <1%

66 Internet
ia601505.us.archive.org <1%

67 Internet
journal.uiad.ac.id <1%

68 Internet
journal.widyakarya.ac.id <1%

69 Internet
jurnal.unimed.ac.id <1%

70 Internet
listens.online <1%

71 Internet
vdoc.pub <1%

72 Internet
www.journal.uad.ac.id <1%

73 Publication
Lendrawati Arif, Putri Yuanita, Nahor Murani Hutapea. "Pengembangan Perangk... <1%

74 Publication
Rachmaniah Mirza, Mega Teguh, Manuharawati Manuharawati. "Traditional Hou... <1%

75 Publication
Stella Teddy Kanyesigye, Jean Uwamahoro, Imelda Kemeza. "The Impact of Probl... <1%

Development of Problem-Based Learning-Based Teaching Module on Number Pattern Content to Facilitate Mathematical Problem-Solving Ability of Grade VII Students

Putri Yuanita[1], Yolanda Tesalonika Sudiro[1], and Sakur[1]

[1]Mathematics Education Study Program, FKIP, Universitas Riau

putri.yuanita@lecturer.unri.ac.id

Abstract

The Merdeka Curriculum emphasize the importance of mathematical problem-solving ability (MPSA) to face the challenges of learning and everyday life. Previous studies have largely focused on learning models without developing contextual and specific teaching materials. This study aims to develop a teaching module based on Problem-based Learning (PBL) for number pattern content to enhance the MPSA of phase D students. The research employed the ADDIE development model (Analysis, Design, Development, Implementation, Evaluation). Research instruments included validation sheets and practicality questionnaires. The validation results indicated a very valid category with an average score of 3.65, while the LKPD practicality reached a very practical category with an average score of 3.35. Based on the research results, it can be concluded that the problem-based learning-based teaching module can facilitate the mathematical problem-solving skills of seventh-grade students. This research also shows a significant increase in the students' MPSA after the implementation of the PBL Teaching Module, marked by an increase in the average score from pre-test to post-test, and students also demonstrated a more positive attitude and higher self-confidence towards mathematics. The development of the PBL-based teaching module not only enhances the quality of mathematics learning but also helps students develop the Pancasila learner profile.

Keywords: Teaching Module; Number Pattern; Problem-Based Learning; Mathematical Problem-Solving Ability.

Abstrak

Kurikulum Merdeka menekankan pentingnya kemampuan pemecahan masalah matematis (KPPM) untuk menghadapi tantangan belajar dan kehidupan sehari-hari. Penelitian sebelumnya lebih banyak menyoroti model pembelajaran tanpa mengembangkan perangkat ajar yang kontekstual dan spesifik. Penelitian ini bertujuan mengembangkan modul ajar berbasis Problem-Based Learning (PBL) untuk konten pola bilangan guna meningkatkan KPMM peserta didik kelas VII. Penelitian menggunakan model pengembangan ADDIE (Analysis, Design, Development, Implementation, Evaluation). Instrumen penelitian berupa lembar validasi dan lembar praktikalitas. Hasil validasi modul menunjukkan kategori sangat valid dengan rata-rata skor 3,65, sedangkan praktikalitas LKPD mencapai kategori sangat praktis dengan rata-rata skor 3,35. Berdasarkan hasil penelitian dapat disimpulkan bahwa modul ajar berbasis problem-based learning dapat memfasilitasi kemampuan pemecahan masalah matematis peserta didik kelas VII. Penelitian ini juga menunjukkan adanya peningkatan yang signifikan dalam KPMM peserta didik setelah penerapan Modul Ajar PBL, ditandai dengan peningkatan rata-rata skor dari pre-test ke post-test, serta peserta didik juga menunjukkan sikap positif dan kepercayaan diri yang lebih tinggi terhadap matematika. Pengembangan modul ajar berbasis PBL tidak hanya meningkatkan kualitas pembelajaran matematika, tetapi juga membantu peserta didik mengembangkan profil pelajar Pancasila.

INTRODUCTION

Mathematics is a fundamental academic field that significantly contributes to the education system and the development of qualified human resources. In learning mathematics, students are encouraged to apply mathematical reasoning in everyday situations, enhance their logical thinking, build confidence, and refine their mathematical competencies. The mathematical problem-solving ability (MPSA) is a central aim of mathematics education, supporting problem-solving in both academic and real-life contexts (Purwasi & Fitriyana, 2019; Novita & Hartono, 2012). MPSA extends beyond merely applying previously acquired rules; it involves engaging in higher-order thinking processes to formulate new rules or strategies at a more advanced cognitive level.

MPSA is very important and must be demonstrated in the mathematics learning process. The significance of students' MPSA is reflected in several key aspects: (1) problem-solving serves as a foundational objective of mathematics instruction, (2) it encompasses essential techniques, methods, and strategies at the heart of the mathematics curriculum, and (3) it represents a core competency in mathematical learning processes (Branca, 1980). This is also emphasized by (Purwasi & Fitriyana, 2019; Andayani & Lathifah, 2019) that developing problem-solving abilities is a primary purpose of mathematics instruction, as mathematics enables students to address challenges across various disciplines and in everyday life. Consequently, enhancing MPSA stands as a key objective of mathematics education.

However, many students have not mastered MPSA so that they are not optimal in solving a problem. Teachers play a pivotal role in cultivating students' problem-solving skills in mathematics, both through the instructional strategies they employ and through assessments that incorporate guiding and supportive questions (Sri Sumartini, 2016; Mukuka et al., 2020). At the junior high school/MTs level, students' thinking skills are relatively low, especially in problem-solving competencies (Rochmad et al., 2016).

Based on the obstacles and low MPSA of students, teachers should be more creative and innovative in modifying learning that can make students active learning subjects, teachers must be able to develop teaching modules that are in accordance with the characteristics or needs of students, set classroom conditions so that they can create a sense of comfort and interest in students so that optimization of learning in the classroom can be achieved.

In the Decree of the Minister of Education and Culture Number 033/H/KR/2022, it is emphasized that one of the objectives of learning is to improve mathematical problem-solving abilities. This shows that MPSA is a crucial skill that students must have to effectively overcome real-world challenges. With MPSA, students are expected to be able to think logically, make the right decisions, and apply mathematical concepts in various situations. Therefore, learning strategies that encourage the development of MPSA are very important in the design of teaching modules (Ridwan et al., 2021).

Actual conditions in the field show that students' problem-solving abilities are still low. Students in grades VIII-10 of SMP Negeri 4 Tambang took the initial MPSA test on the Number Pattern content to assess their level of proficiency. The test results showed that question understanding was in the range of 40–46.66%. Students' difficulties in recognizing problems, formulating solutions, and implementing problem-solving can be seen from the achievement of aspects that only reached 13.33–33.33%. Even in the aspect of drawing conclusions, no students wrote down the results in full.

The development of learning tools is an important part of the implementation of the Merdeka Curriculum, which encourages independent learning and strengthening the profile of Pancasila students. One of the essential tools is the teaching module, which functions as a structured guide in the learning process.

A teaching module is defined as a systematic teaching material that includes learning objectives, learning activities, assessments, and related learning resources. According to (Tinggi & Islam Binamadani, 2022) a teaching module is an instructional resource designed in alignment with the curriculum, aiming to support learners in achieving specific competency benchmarks. Teaching modules must be designed considering the characteristics of students, the relevance of the material to the real world, and the demands of 21st century learning. With teaching modules, educators can more easily develop problem-based learning and encourage students to think critically and independently to solve a problem. To support the development of these teaching modules, it is necessary to apply the right learning model so that the application of teaching modules can be realized with satisfactory results.

Based on the pre-test results that have been presented, there are problems in the class. The core of the problem lies in monodirectional learning, where students are less actively involved, and the main problem is the inability of students to solve problems using problem-solving, which results in their low MPSA. Overcoming this problem is important because MPSA has a significant impact on students' academic success and the application of mathematics in real life. The PBL model is one of the learning models that is appropriate and easy to correlate with number pattern material in everyday life (Osman & Kriek, 2021).

PBL is an instructional approach that engages learners through real-world problems, encouraging them to apply prior knowledge to develop effective solutions and thinking creatively, analytically, systematically, and logically through empirical data exploration to foster a scientific attitude (Cahyo Winoto et al., 2020; Kurniawati et al., 2023). PBL requires teachers to design learning that is tailored to students' perspectives, namely based on what is known, used and organized in everyday life so that students can solve problems in real-world life (Suryanti & Nurhuda, 2021; Fardian & Dasari, 2023). The importance of PBL is in line with the

opinion of (Marchy et al., 2022; Ramadhani et al., 2019) that PBL model is instrumental in enhancing students' higher-order thinking abilities, fostering increased engagement and improved learning outcomes. It promotes the construction of knowledge through problem contexts provided by teachers.

This learning model emphasizes students' information-processing abilities, which involve interpreting stimuli, organizing data, identifying challenges, forming concepts, solving problems, and utilizing both verbal and non-verbal representations (Ati & Setiawan, 2020). The PBL model emphasizes concepts and information derived from academic disciplines.

Furthermore, this ability is also critical in preparing students to face future challenges, especially in an era marked by rapid change and increasing complexity of problems. One way that can be done to overcome this problem is to apply the PBL model. The PBL model is a learning method that focuses on solving a problem as the basis for learning activities (Santika et al., 2020). Problem-based learning is designed to support the development of problem-solving skills through the application of reflective, rational, analytical, and synthetic reasoning. Implementing PBL has been shown to enhance students' mathematical problem-solving abilities and foster deeper mathematical connections (Armiati, 2018). Additionally, it has a more substantial impact on these skills compared to traditional learning approaches (Brahim et al., 2023). This is reinforced by (Wildaniati, 2019) that the implementation of PBL has been proven to support improvements in mathematical problem-solving skills. So it can be concluded that this will also increase learning outcomes.

Some of the advantages of the PBL model are (1) students develop a deeper understanding of mathematical ideas by discovering concepts independently; (2) active engagement in problem-solving demands higher-level thinking; (3) students perceive the practical value of mathematics, as the problems are drawn from real-life contexts which can increase students' motivation and interest in mathematics; (4) making students more independent and more mature; (5) fostering students' inquiry (research) nature; (6) Concepts become strong; and (7) problem discovery can increase creativity (Surya et al., 2017).

Meanwhile, some of the shortcomings of the PBL model are: (1) it cannot be applied to all mathematics learning materials. Only certain materials can be taught with problem-based learning. (2) requires thorough preparation. (3) takes a relatively long time, so that it can result in learning materials sometimes not being completed (Desi et al., 2019).

Mathematics learning with the PBL model provides students with the opportunity to explore their abilities. In addition, the PBL model has a gradual and systematic syntax of learning activities. According to (Rizky et al., n.d.) the PBL model consists of five key stages: (1) introducing students to the problem; (2) organizing collaborative learning; (3) guiding investigations individually or in groups; (4) facilitating the development and presentation of solutions; and (5) evaluating and analyzing the problem-solving process.

The urgency of developing Problem-based Learning (PBL)-based teaching modules is increasingly evident to answer the challenges of mathematics learning that requires high-level thinking skills. PBL focuses on providing authentic problems, encouraging students to build their own understanding, and practicing collaborative skills (Klegeris & Hurren, 2011; Merritt et al., 2017; Maidiyah et al.,

2021). The PBL model aligns closely with the Merdeka Curriculum, which prioritizes experiential, real-world learning. Accordingly, developing teaching modules based on PBL is a strategic way to enhance mathematics instruction quality.

This condition shows the need for innovation in the preparation of learning tools, especially teaching modules that are able to direct students not only to understand concepts, but also to apply them in real contexts. The development of PBL-based teaching modules is a strategic effort to answer this challenge. PBL-based modules allow students to actively explore problems, collaborate to find solutions, and communicate their ideas critically and creatively.

Number pattern content was chosen as the focus of module development because of its relevance to everyday life and its great potential in training students' logical thinking. By studying patterns, students learn to recognize regularities, analyze data, and make generalizations. The PBL-based number pattern teaching module is expected to form strong mathematical thinking skills, while increasing students' self-confidence in facing new problems.

Thus, the development of a PBL-based teaching module is not only a response to the challenge of low KPMM students, but also a proactive effort in enriching mathematics learning strategies. This module is expected to be one of the innovations in teaching tools that support the implementation of the Merdeka Curriculum effectively and sustainably.

METHOD

This research is a research and development with the aim of producing a product in the form of a Problem-based Learning (PBL) teaching module for number pattern content for phase D students. The development method used is the ADDIE model, which consists of the Analysis, Design, Development, Implementation, and Evaluation stages.

In the Analysis stage, three main activities are carried out, namely curriculum analysis, learning achievement analysis, and student characteristic analysis. Curriculum analysis aims to understand the demands of the Merdeka Curriculum, especially in algebra elements and number pattern content. Learning achievement analysis is carried out to formulate specific, measurable, and contextual learning objectives. Meanwhile, student analysis helps identify the needs, characteristics, and challenges faced by grade VIII students, which are the basis for developing relevant and applicable modules.

The Design stage is the main strength in the development of this module. The uniqueness of the developed teaching module lies in the integration of number pattern exploration with the PBL approach based on authentic problems from everyday life. Each activity in the module is designed to contain elements of critical thinking, collaboration, and self-reflection. In addition, the module is equipped with contextual trigger questions, investigation-based student worksheets (LKPD), and formative assessments in the form of exploratory tasks. At this stage, the module format and systematics, validation instrument design, and practicality questionnaire are also prepared.

At the Development stage, the designed teaching module was then validated by three mathematics education experts to assess aspects of content, design, completeness of components, and suitability of the PBL approach. Validation aims to test the extent to which the module meets the

principles of active and problem-based learning. After validation, the module was revised according to the validator's input. Then a readability test (one-to-one evaluation) was carried out on three (3) heterogeneous students.

At the Implementation stage of the teaching module, a small group test consisting of 6 heterogeneous students will be conducted with the aim of obtaining input and evaluation of the product developed by the researcher, so that revisions and improvements can be made before being applied to a larger group. A large group trial (field group) was also conducted consisting of 30 students with heterogeneous academic abilities. The purpose of this large group test is to see the practicality of whether the product or program developed is easy to use and understand by students in real conditions so that the product developed can be more feasible to be tested in a larger group.

The Evaluation stage is carried out in each ADDIE phase to maintain the quality of development. Formative evaluation is carried out after the analysis, design, development and implementation stages through internal reflection and expert assessment. Summative evaluation is carried out at the final implementation stage through measuring the validity of the module and the level of practicality of the LKPD. This evaluation serves to ensure that the resulting product is not only theoretically feasible, but also practically used in learning.

The data collection instruments consisted of validation sheets and practicality questionnaires. The validation sheets were designed to measure the clarity of the content, the suitability of learning objectives, the integration of activities with PBL principles, and the quality of language and appearance. The practicality questionnaire was used to measure readability, ease of use, attractiveness of appearance, and the relevance of the material to everyday life. Each instrument was compiled based on a previously developed indicator grid.

Data analysis was conducted quantitatively using a 4-point Likert scale. The average score of the validator's assessment and student responses was calculated to determine the validity and practicality categories. The teaching module is declared valid if the average score reaches at least 2.50 with a valid category, and is declared practical if the average score reaches at least 2.50 in the practicality assessment (Arikunto, 2012).

According to Sugiyono (2017), there are three ways to test validity, namely:

1. Construct validity testing, is a validity that constructs aspects that will be measured based on a certain theory. Construct validity testing can use expert opinions (judgment experts).
2. Content validity testing, this testing is done by comparing the contents of the instrument with the content of the lesson that has been taught.
3. External validity testing, this testing is done by comparing (to find similarities) between the criteria in the instrument with empirical facts that occur in the field.

The measurement of the validity of learning devices by Akbar (2017) consists of the syllabus, RPP and LKPD based on the 2013 Curriculum. While the measurement of the validity of the relevant research teaching module based on the Merdeka Curriculum consists of ATP, teaching modules, LKPD. Based on the description above, the measurement of validity based on the 2013 Curriculum and the Merdeka Curriculum have similarities, especially ATP with the syllabus, RPP with teaching modules and LKPD in the appendix. Measurement of the validity of the

teaching module by Widayanti (2023) which will be modified by researchers in this study.

The module is declared successfully developed if it meets both criteria, with valid and practical categories. Thus, the developed teaching module is expected to be a quality teaching tool to improve students' problem-solving abilities according to the demands of the Merdeka Curriculum.

The desired results obtained in this research are valid teaching modules and practical LKPD.

RESULT AND DISCUSSION

Results

This study resulted in the development of a PBL-based instructional module on number patterns, specifically designed to support phase D students in enhancing their MPSA.

Analysis Stage

Curriculum analysis

During the curriculum analysis stage, the process involves identifying, providing detailed information, and organizing relevant topics to be taught. The content used is the number pattern for grade VIII SMP/MTs students. This teaching module refers to the Merdeka Curriculum for grade VIII SMP/MTs level as stipulated by the Head of the Education Standards, Curriculum and Assessment Agency of the Ministry of Education, Culture, Research and Technology Number 033/H/KR/2022.

The next stage is to examine the gap in educational resources between the Merdeka Curriculum and the 2013 Curriculum. According to (Surya & Pebrian, 2022) the 2013 Curriculum differs from the Merdeka Curriculum in various ways. The class-level organization ensures a comprehensive approach to attitudes, knowledge, and skills in the 2013 Curriculum. The phase-based Merdeka Curriculum emphasizes essential content. In addition, the 2013 Curriculum offers limited variety of materials, limiting teachers' ability to create contextual learning experiences. In contrast, the Merdeka Curriculum provides teachers with the opportunity to design teaching resources tailored to the needs and characteristics of their students.

Learning achievement analysis

At the learning achievement analysis stage, researchers determine specific material related to number patterns in algebraic elements and provide a complete picture of the learning objectives that must be achieved by students in stage D, grade VIII.

The learning achievements of grade VIII students in the content of number patterns in algebraic elements are as follows: Upon completing phase D, students can recognize, predict, and generalize patterns in the form of arrangements of objects and numbers.

Researchers prepare a learning activity plan based on learning achievements which are arranged into three meetings with 2 lesson hours each.

Student analysis

This study involves analyzing students to determine their characteristics during the learning process. The findings of the student analysis are used as an illustration in compiling a teaching module that is in accordance with the characteristics of the students.

The teaching module produced is specifically designed for grade VIII SMP/MTs students, aged between 12 and

14 years. Findings from interviews conducted by researchers indicate that the use of conventional models with lecture methods in classroom learning is not an effective approach for students to overcome problem-solving tasks. This learning approach fails to foster student independence and eliminates their opportunities to be actively involved in the learning process. To engage and motivate students, educators must have teaching techniques designed to stimulate students' problem-solving abilities.

The application of this PBL model helps increase students' confidence in articulating their perspectives and fosters their active involvement in the learning process, thus facilitating effective collaboration between students. PBL facilitates an in-depth learning experience, allowing students to independently overcome the challenges they face by utilizing their personal knowledge and experience. Furthermore, they can apply the knowledge they have gained in practical situations, thereby integrating their skills and knowledge together and applying them in relevant contexts. In addition, PBL promotes critical thinking, student autonomy, and intrinsic learning motivation, and enhances their ability to build interpersonal relationships in a group environment.

Design Stage

Selection and compilation of format

Researchers collected several references related to number pattern content taken from several relevant sources, namely the Mathematics Book for Class VIII SMP/MTs Semester 1 Revised Edition 2017 from the Ministry of Education and Culture and the Mathematics Learning Module for Junior High Schools Number Patterns, Sequences and Series from the Directorate of Madrasah Teachers and Education Personnel, Ministry of Religion of the Republic of Indonesia 2020.

In this step, the learning objectives are described based on the results of the analysis of learning achievements and the analysis of the Pancasila student profile. These objectives are then combined with the development of teaching modules. The learning objectives of this module include: 1) Explaining the concept of number patterns, 2) Recognizing the elements of number patterns, 3) Recognizing examples of number patterns in everyday life, 4) Finding the next from an arrangement of objects or numbers, 5) Determining odd, even, square, rectangular and triangular sequence patterns, 6) Solving problems related to odd, even, square, rectangular and triangular sequence patterns, 7) Determining Pascal and Fibonacci's triangular sequence patterns, and 8) Solving problems related to Pascal and Fibonacci's triangular sequence patterns.

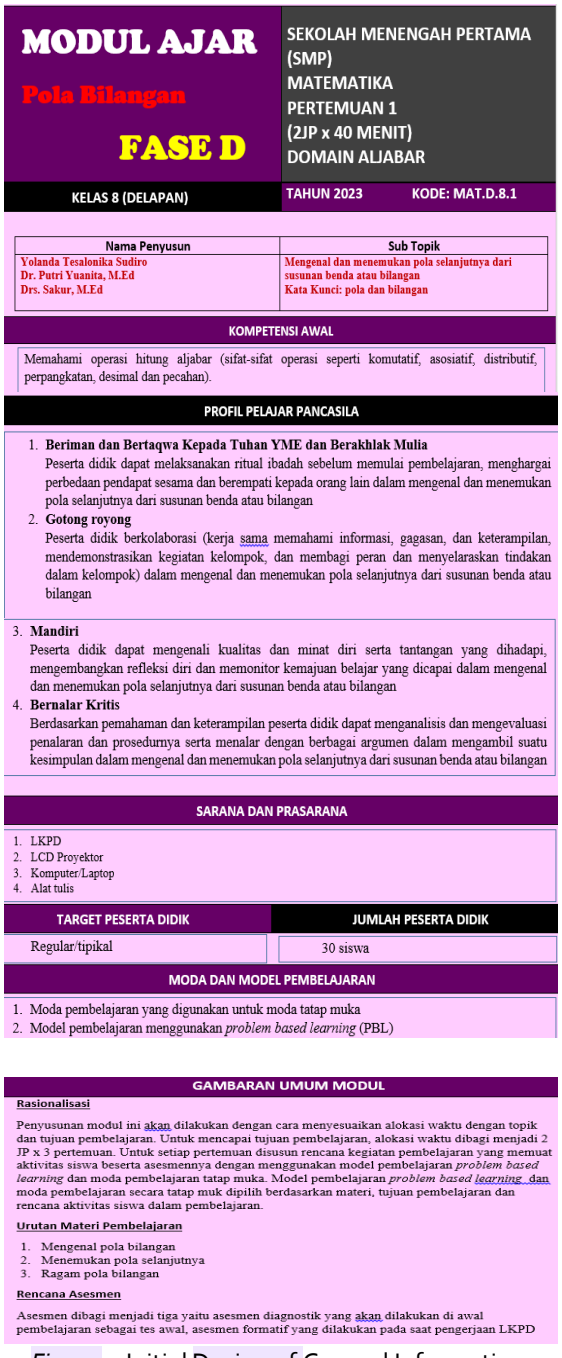
The selection of media developed based on the results of the previous analysis, namely developing a printed teaching module for grade VIII SMP/MTs students with number pattern content with algebraic elements. The selection of media developed is also based on the facilities owned by the school.

The teaching module is arranged in the form of printed media or books, namely A4 format with a width of 21 cm and a length of 29.7 cm. The types of fonts used are Calibri, Cooper Black, and Times New Roman. The teaching module is arranged into three parts, namely general information, core components, and appendices. The activities carried out at the format selection stage are guided by (Anggreaena et al., 2022).

Initial Design

General information on the teaching

module includes the following components: (1) module identity; (2) initial competencies; (3) Pancasila student profile; (4) facilities and infrastructure; (5) target students; (6) number of students; (7) learning modes and models and (8) general description of the module as shown in the Figure 1.



MODUL AJAR
Pola Bilangan
FASE D

SEKOLAH MENENGAH PERTAMA (SMP)
MATEMATIKA
PERTEMUAN 1
(2JP x 40 MENIT)
DOMAIN ALJABAR

KELAS 8 (DELAPAN) | TAHUN 2023 | KODE: MAT.D.8.1

Nama Penyusun	Sub Topik
Yolanda Tesalonika Sudiro Dr. Putri Yuanita, M.Ed Drs. Sakur, M.Ed	Mengenal dan menemukan pola selanjutnya dari susunan benda atau bilangan Kata Kunci: pola dan bilangan

KOMPETENSI AWAL

Memahami operasi hitung aljabar (sifat-sifat operasi seperti komutatif, asosiatif, distributif, perpangkatan, desimal dan pecahan).

PROFIL PELAJAR PANCASILA

1. **Beriman dan Bertaqwa Kepada Tuhan YME dan Berakhlak Mulia**
   Peserta didik dapat melaksanakan ritual ibadah sebelum memulai pembelajaran, menghargai perbedaan pendapat sesama dan berempati kepada orang lain dalam mengenal dan menemukan pola selanjutnya dari susunan benda atau bilangan
2. **Gotong royong**
   Peserta didik berkolaborasi (kerja sama memahami informasi, gagasan, dan keterampilan, mendemonstrasikan kegiatan kelompok, dan membagi peran dan menyelaraskan tindakan dalam kelompok) dalam mengenal dan menemukan pola selanjutnya dari susunan benda atau bilangan
3. **Mandiri**
   Peserta didik dapat mengenali kualitas dan minat diri serta tantangan yang dihadapi, mengembangkan refleksi diri dan memonitor kemajuan belajar yang dicapai dalam mengenal dan menemukan pola selanjutnya dari susunan benda atau bilangan
4. **Bernalar Kritis**
   Berdasarkan pemahaman dan keterampilan peserta didik dapat menganalisis dan mengevaluasi penalaran dan prosedurnya serta menalar dengan berbagai argumen dalam mengambil suatu kesimpulan dalam mengenal dan menemukan pola selanjutnya dari susunan benda atau bilangan

SARANA DAN PRASARANA

1. LKPD
2. LCD Proyektor
3. Komputer/Laptop
4. Alat tulis

TARGET PESERTA DIDIK	JUMLAH PESERTA DIDIK
Regular/tipikal	30 siswa

MODA DAN MODEL PEMBELAJARAN

1. Moda pembelajaran yang digunakan untuk moda tatap muka
2. Model pembelajaran menggunakan *problem based learning* (PBL)

GAMBARAN UMUM MODUL

Rasionalisasi

Penyusunan modul ini akan dilakukan dengan cara menyesuaikan alokasi waktu dengan topik dan tujuan pembelajaran. Untuk mencapai tujuan pembelajaran, alokasi waktu dibagi menjadi 2 JP x 3 pertemuan. Untuk setiap pertemuan disusun rencana kegiatan pembelajaran yang memuat aktivitas siswa beserta asesmennya dengan menggunakan model pembelajaran *problem based learning* dan moda pembelajaran tatap muka. Model pembelajaran *problem based learning* dan moda pembelajaran secara tatap muk dipilih berdasarkan materi, tujuan pembelajaran dan rencana aktivitas siswa dalam pembelajaran.

Urutan Materi Pembelajaran

1. Mengenal pola bilangan
2. Menemukan pola selanjutnya
3. Ragam pola bilangan

Rencana Asesmen

Asesmen dibagi menjadi tiga yaitu asesmen diagnostik yang akan dilakukan di awal pembelajaran sebagai tes awal, asesmen formatif yang dilakukan pada saat pengerjaan LKPD

Figure 1. Initial Design of General Information

The core components of the developed teaching module consist of (1) learning objectives, (2) assessment, (3) meaningful understanding, (4) trigger questions, (5) learning activities, and (6) teacher and student reflections, as can be seen in the Figure 2.

2 KOMPONEN INTI

Tujuan Pembelajaran	Dengan menggunakan model pembelajaran PBL peserta didik diharapkan dapat: 1. Menjelaskan pengertian pola bilangan 2. Mengenal unsur-unsur pola bilangan 3. Mengenal contoh pola bilangan dikehidupan sehari-hari 4. Menemukan pola selanjutnya dari suatu susunan benda dan bilangan
Asesmen	1. Asesmen diagnostik : Tes tertulis *(terlampir)* 2. Asesmen formatif : LKPD *(terlampir)* 3. Asesmen sumatif : Tes tertulis *(terlampir)*
Pemahaman Bermakna	Peserta didik dapat mengenal, menjelaskan dan menemukan pola bilangan pada soal yang diberikan untuk membantu kehidupan sehari-hari
Pertanyaan Pemantik	1. Apakah kamu tau dengan pola bilangan? 2. Apakah 2,4,6,8,.... termasuk pola bilangan? 3. Dapatkah kamu menyebutkan pola bilangan yang lain?

LANGKAH-LANGKAH PEMBELAJARAN

- Kegiatan Pendahuluan (±5 *menit*)
  - Peserta didik menyiapkan diri secara fisik dan psikis untuk mengikuti proses pembelajaran melalui kegiatan berikut:
    a. Peserta didik memberi salam dan berdoa sesuai kepercayaan masing-masing
    b. Pendidik mengecek kehadiran siswa
    c. Peserta didik mempersiapkan perlengkapan dan peralatan yang diperlukan untuk pembelajaran
  - Peserta didik dimotivasi dengan cara mengaitkan materi dengan masalah yang terdapat dalam kehidupan sehari-hari dengan menggunakan konsep pola bilangan sehingga dapat menjelaskan manfaat pola bilangan yang ditampilkan dalam PPT.

Figure 2. Initial Design of Core Component

The attachment components in the teaching module are as follows: (1) LKPD; (2) enrichment and remedial; (3) reading materials for educators and students; (4) glossary; (5) bibliography, as can be seen in the Figure 3.

3 LAMPIRAN

LEMBAR KERJA PESERTA DIDIK	PENGAYAAN DAN REMEDIAL
❖ Lembar Kerja Peserta Didik *(lembar terlampir)*	❖ Remedial untuk siswa berpencapaian rendah : Ya / ~~Tidak~~ *(lembar terlampir)* ❖ Pengayaan unuk siswa berpencapaian tinggi : Ya / ~~Tidak~~ *(lembar terlampir)*

BAHAN BACAAN PESERTA DIDIK

❖ Kemendikbud. 2017. Matematika SMP/MTs Kelas VIII: Buku Siswa. Jakarta: Pusat Kurikulum dan Perbukuan

BAHAN BACAAN PENDIDIK

❖ Kemendikbud. 2017. Matematika SMP/MTs Kelas VIII: Buku Guru. Jakarta: Pusat Kurikulum dan Perbukuan
❖ Adinawan, M. Cholik. 2017. Matematika Untuk SMP/MTs Kelas VIII Semester 1: Buku Siswa. Jakarta: Erlangga
❖ Modul Pembelajaran Matematika Madrasah Tsanawiyah Pola Bilangan, Barisan dan Deret dari Direktorat Guru dan Tenaga Kependidikan Madrasah Kementrian Agama RI 2020

GLOSARIUM	DAFTAR PUSTAKA
Barisan : daftar urutan bilangan yang mempunyai karakteristik atau pola tertentu Deret : jumlah dari elemen-elemen yang berurutan Aritmatika : teori bilangan Suku (bilangan): bilangan yang menjadi bagian dari suatu barisan bilangan	Kemendikbud. 2017. Matematika SMP/MTs Kelas VIII: Buku Siswa. Jakarta: Pusat Kurikulum dan Perbukuan Kemendikbud. 2017. Matematika SMP/MTs Kelas VIII: Buku Guru. Jakarta: Pusat Kurikulum dan Perbukuan Adinawan, M. Cholik. 2017. Matematika Untuk SMP/MTs Kelas VIII Semester 1: Buku Siswa. Jakarta: Erlangga Modul Pembelajaran Matematika Madrasah Tsanawiyah

Figure 3. Initial Design of Attachment Component

Designing a validation sheet

In the development of this teaching module, the validity testing used is construct validity testing (validity testing in terms of learning activities that are adjusted to the learning model used and student characteristics) and content validity (testing by comparing the contents of the instrument with the content of the lessons that have been taught). The validity assessment aspect is divided into 4 parts, namely 1) validity of the contents of the teaching module, 2) identity and general information, 3) core components and 4) attachments.

Designing a response questionnaire

The evaluation of practicality in this study was conducted by analyzing students' responses to the LKPD made through a questionnaire. The assessment components of the student response questionnaire were categorized into three parts, including 1) LKPD appearance, 2) LKPD content/material and 3) language.

Development Stage

The development stage consists of two activities, namely expert assessment and product testing.

Expert assessment

The resulting teaching module is then validated. The findings of the validation of the teaching module for number pattern content for grade VIII are presented in the Table 1, Table 2, Table 3, and Table 4.

Table 1. Validation Results of Teaching Module Content Components

Assessment Aspects	Validator Score Average		
	V1	V2	V3
Compliance of material with CP and ATP	4,00	3,50	3,50
Accuracy of material	4,00	3,00	3,00
Learning support materials	4,00	3,00	3,33
Average	4,00	3,16	3,27

Source: Researcher data processing

Table 2. Validation Results of Teaching Module General Information Components and Identity

Assessment Aspects	Validator Score Average		
	V1	V2	V3
Teaching module components	4,00	4,00	4,00
Teaching module information	4,00	4,00	4,00
Initial competencies	4,00	3,00	4,00
Pancasila student profile	4,00	3,00	4,00
Learning model	4,00	3,00	4,00
Average	4,00	3,40	4,00

Source: Researcher data processing

Table 3. Validation Results of Teaching Module Core Activity Components

Assessment Aspects	Validator Score Average		
	V1	V2	V3
Learning objectives	4,00	3,00	3,00
Meaningful understanding	4,00	3,00	4,00
Initiator questions	4,00	3,00	3,00
Learning activities	4,00	4,00	4,00
Introductory activities	4,00	4,00	4,00
Suitability of learning activities with PBL phases	4,00	4,00	4,00

Suitability of learning activities with KPMM indicators	4,00	3,00	4,00
Suitability of learning activities with scientific approaches	4,00	3,00	4,00
Closing activities	4,00	4,00	4,00
Average	4,00	3,44	3,77

Source: Researcher data processing

Table 4. Validation Results of Teaching Module Attachment Components

Assessment Aspects	Validator Score Average		
	V1	V2	V3
Assessment of learning outcomes	4,00	3,00	3,33
Compilation of LKPD	4,00	3,33	4,00
Compilation of reading materials	4,00	3,00	4,00
Assessment	4,00	3,00	3,00
Average	4,00	3,08	3,58

Source: Researcher data processing

One-to-one evaluation trial

One-to-one trial was conducted to assess the readability of the LKPD created. The trial was conducted on three heterogeneous students in class XI4 of one of the junior high schools in Tambang. After that, the LKPD was given to be read and understood by the students. Furthermore, the researcher revised the LKPD according to the students' suggestions and comments, such as the narrative being too long.

Implementation Stage

Small group test

After conducting a one-to-one evaluation trial to measure the readability of the LKPD, a small group test was then conducted. The small group test was conducted on a group of 6 heterogeneous students in class IX2 at one of the junior high schools in Tambang. Table 5 shows the results of the practicality of the LKPD in learning number pattern material for class VIII in the small group test.

Table 5. Small Group Student Response Questionnaire Results

Assessment Aspects	Average score of LKPD			$\overline{R_p}$
	1	2	3	
LKPD display	3,51	3,69	3,75	3,65
Content/material in LKPD	3,30	3,66	3,63	3,53
Linguistics	3,41	3,58	3,70	3,56
Average	3,40	3,64	3,69	3,58

Source: Researcher data processing

Large group test

The large group test was conducted on a group of 30 students of class IX10 at one of the junior high schools in Tambang. The results of the practicality of the LKPD for the number pattern material for class VIII in the large group test are presented in the Table 6.

Table 6. Large Group Student Response Questionnaire Results

Assessment Aspects	Average score of LKPD			$\overline{R_p}$
	1	2	3	
LKPD display	3,44	3,44	3,39	3,42
Content/material in LKPD	3,12	3,32	3,26	3,23
Linguistics	3,38	3,44	3,39	3,40
Average	3,31	3,40	3,35	3,35

Source: Researcher data processing

Student engagement increases when formative tests are given during learning activities. By doing these activities, learning deficiencies are reduced so that the learning process becomes better. In the indicator of understanding the problem, the percentage obtained was 86.67-93.33% who achieved the maximum score. In this range, there were 26-28 students who got the maximum score.

An increase also occurred in the indicator of planning problem-solving, namely 53.33-63.33% with the number of students who achieved the maximum score of 16-19 students. The indicator of implementing the problem-solving plan obtained a percentage of 76.67-83.33% with the number of students who achieved the maximum score of 23-25 students. In the indicator of interpreting the results obtained, there was a significant increase, namely 96.67-100% with the number of students who achieved the maximum score of 29-30 students.

Discussion

Detailed data processing results on pre-test and post-test data show a significant increase in the average scores of students. This increase indicates that the PBL model contributes significantly to increasing students' MPSA.

In addition, unexpected findings emerged from the analysis of the questionnaire data showing that students not only experienced improvements in MPSA, but also showed significant improvements in positive attitudes towards mathematics and confidence in solving mathematical problems. This indicates that the PBL model not only affects the cognitive aspect of mathematics learning, but also the affective aspect of students. This increase in confidence may be due to the structure of the PBL model which allows students to be actively involved in the learning process and gain a deeper understanding through direct practice in solving problems (Hidayatati et al., 2022). These findings suggest that the implementation of the PBL model can have a broader impact on students' learning experiences, including increasing motivation and positive attitudes towards mathematics, which are important aspects in mathematics learning.

Statistical findings indicate a significant improvement in students' MPSA after applying the PBL approach. The rise in post-test scores compared to pre-test results suggests better conceptual understanding and effective application of mathematical knowledge in real-life problem contexts.

This is in line with the constructivist theory that supports problem-based learning, which states that knowledge is built through direct experience and interaction with the environment. This increase not only reflects the positive influence of problem-based learning on the cognitive aspect of learning, but also shows the potential of this approach to make students more visible and motivated in learning mathematics.

Furthermore, the findings on the increase in students' positive and self-confidence towards mathematics provide additional evidence of the affective benefits of problem-based learning. This suggests that the PBL model is not only effective in improving students' academic abilities but also strengthens emotional and motivational factors that contribute to learning success. The active involvement of students in the learning process seems to help students overcome psychological barriers to mathematics, such as anxiety or fear, and build a more positive attitude towards this subject. These findings are consistent with prior studies (Yunita et al., 2024) which also demonstrated that PBL not only strengthens students' MPSA, but also promotes more positive attitudes and greater confidence in addressing mathematical challenges.

This study contributes to answering the main questions raised in the introduction by providing empirical evidence that the application of the PBL model has a positive influence not only on improving students' MPSA, but also on increasing

their positive attitudes and self-confidence towards mathematics. This finding reaffirms the importance of adopting a more interactive and learner-centric learning model in mathematics education, which not only focuses on cognitive learning outcomes but also pays attention to students' affective development. The results of the study (Setiawati & Agoestanto, 2023) strengthening the findings of this study where in addition to a significant increase in MPSA, students also showed positive attitudes and self-confidence in solving mathematical problems.

During the initial orientation stage, students are provided the opportunity to grasp the challenges presented in the LKPD. In this indicator, students are expected to comprehend the problems and identify the given information. Phases 1 and 2 in the PBL model facilitate students very well in this indicator.

In the learning organization stage, learners are prompted to inquire about aspects of the LKPD they find unclear and are guided to identify both the given and required elements in each problem. Phase 3 in the PBL model facilitates quite well in this indicator. In this third indicator, some students still have difficulty in making problem-solving plans, estimating the strategies to be used and solving problems through the knowledge they have. So the results of the post-test are not too significant.

The third stage—conducting individual and group investigations—requires students to gather information through discussions to address the challenges presented in the LKPD. The collected data is then analyzed to solve the problems, a process well-supported by phase 3 of the PBL framework.

In the final stages, students interpret their problem-solving outcomes and present their group findings through oral or written formats. This phase, involving presentation and discussion, is supported by teacher-led reflections, clarification, and peer feedback, which aligning with phases 4 and 5 of the PBL model that can support the fourth indicator of MPSA.

These PBL stages foster shared responsibility between teachers and students, enhancing learner engagement in developing MPSA. This supports (Kodariyati et al., 2016), who noted that PBL encourages effective problem-solving, teamwork, and interpersonal development.

The PBL model guides students in constructing problem-solving strategies and frameworks, allowing them to build knowledge from real-world experiences (Pertiwi et al., 2021). Students are encouraged to identify known and unknown elements, determine relevant methods, and apply diverse cognitive skills. As they collaborate, teachers recognize their efforts, fostering a positive and motivating environment (Zahira et al., 2020).

lanjIn large group trial classes, PBL effectively encourages group collaboration to address practical mathematical tasks, enhancing students' participation and higher-order thinking. This real-life problem orientation helps learners experience the relevance of mathematics. The PBL stages contribute significantly to developing students' MPSA, consistent with findings from (Maharani et al., 2024; Yanti et al., 2024), who also obtained a very practical category in the results of their large group trials.

Findings from this research align with prior study (Sumartini, 2016) showing that students exposed to PBL exhibit greater improvements in MPSA than those using traditional methods. (Yusri et al., 2018) similarly found that PBL enhances students' understanding of challenges, encourages structured problem

planning, and improves solution interpretation.

Considering the very low results of the students' MPSA test at the pre-test stage. In the problem-solving process, students must write answers carefully and accurately. Based on the answer sheet according to the data, there are several students who have not written the answers correctly and completely. Some students struggled to arrive at correct answers and demonstrated limited comprehension of the solutions produced. Many of them failed to provide proper conclusions in their responses, while others included inaccurate or incomplete conclusions due to partial misunderstandings.

The findings suggest that implementing PBL-based instructional modules has a notable impact on enhancing students' problem-solving competence. This is consistent with (Heleni et al., 2022) and (Sawilda et al., 2022)), who emphasized that PBL fosters advanced cognitive skills and learning independence, enabling students to tackle problems independently.

This research focused on creating a PBL-driven teaching module on number patterns to enhance the mathematical problem-solving ability of seventh-grade students, aligned with the Merdeka Curriculum. The teaching module underwent a thorough assessment of its validity and practicality through evaluations by mathematics education experts and practitioners. The results offer valuable perspectives on the teaching module's effectiveness, relevance, and educational potential.

The study demonstrates that the developed teaching module satisfies key instructional design principles, such as clear objectives, strong content alignment, conformity with PBL strategies, and comprehensive structure. As (Nieven et al, 2019) noted, a module is deemed valid when grounded in theory, logically coherent, and pedagogically sound. The validators' confirmation of these aspects reinforces the module's credibility and effectiveness.

Crucially, the validation included qualitative input from reviewers, who offered detailed suggestions—such as enhancing instruction clarity, refining lengthy contextual problems, and reorganizing task sequences. These insights were applied in a revised version of the module, reflecting a continuous improvement approach aligned with the design-based research model (Anderson & Shattuck, 2012).

Student feedback also identified areas needing refinement, such as simplifying language and reducing lengthy explanations. This aligns with (Kemendikbudristek, 2022), which emphasized that such modules support MPSA within the Merdeka Curriculum's goals of learner-centered and competency-oriented education. The feedback validates both the module's quality and its alignment with inquiry- and problem-based national education strategies.

On a broader level, this research adds to the expanding literature advocating PBL in mathematics instruction. Previous studies (Hung et al., 2022; Mergendoller et al., 2006) confirm that PBL enhances comprehension, critical reasoning, and teamwork. By incorporating these teaching philosophies into the module, this study affirms its validity and practicality while encouraging PBL's adoption in competency-based curricula like Merdeka.

This study's outcomes are consistent with findings from (Putri et al., 2025), which validated the effectiveness of a PBL-based module on linear equations and inequalities. Experts verified its alignment with instructional standards,

and educators acknowledged its classroom relevance. Feedback integration led to enhanced design quality, reinforcing the module's role in advancing PBL-based resources in the Merdeka Curriculum and setting a basis for further innovation.

Implication of Research

The study's implications suggest that implementing PBL-based teaching modules elevates mathematics education quality while fostering characteristics of the Pancasila student profile, which are independence, creativity, critical thinking, collaboration, and effective communication. Therefore, teachers are advised to integrate PBL-based modules in daily learning to achieve the learning outcomes of the Merdeka Curriculum (Fajri et al., 2021).

Limitation

However, this study also has several limitations. First, the long-term effectiveness test of the teaching module on student learning outcomes has not been carried out widely. Second, this study is still limited to one school context so that generalization of the results needs to be done carefully. Third, external factors such as teacher readiness in implementing the PBL approach have not been evaluated comprehensively. Further research is recommended to examine the effectiveness of the module in a broader context and scale.

By integrating a systematic problem-based model into the teaching module, students are anticipated to enhance their creative and critical thinking abilities and become better equipped for real-life challenges. These findings offer meaningful contributions to the advancement of innovative educational tools grounded in the Merdeka Curriculum.

CONCLUSION

The learning and development of teaching modules in this study have produced high-quality products in the content of number patterns for grade VIII junior high school students. The developed teaching module has proven effective in improving students' mathematical problem-solving abilities. The results of validation by experts showed an average score of 3.65 which is included in the very valid category. Likewise, the practicality of the Student Worksheet (LKPD) obtained an average score of 3.35, which is classified as very practical.

The findings of this study also strengthen the validity and practicality of the PBL model teaching module in facilitating mathematical problem-solving abilities. Based on the test results, the average MPSA score of students increased significantly from 22.49% in the initial test to 81.66% in the formative test after the implementation of the teaching module. In this finding, students showed that the application of PBL in mathematics learning was able to provide a significant positive impact on the development of problem-solving abilities and showed a positive attitude and self-confidence in solving mathematical problems, especially in grades VIII-10 at one of the junior high schools in Tambang. Through this approach, students are expected to not only master mathematical concepts, but also be able to apply them in various life situations.

RECOMMENDATION

Based on the research results, the researcher recommends that educators and academics develop teaching modules that are tailored to the specific needs of each institution. In addition, teachers and other researchers are advised to adapt

various innovative learning models in compiling modules, according to the characteristics of students and the learning context. The researcher also recommends that further research be conducted to test the effectiveness of this teaching module on a wider scale, as well as assess the long-term impact on improving students' mathematical problem-solving abilities.

The researcher also recommends that teachers start getting students used to solving contextual problems that can facilitate students' MPSA. For other researchers who are interested in developing teaching modules, they can develop them on the topic of mathematics and facilitate other mathematical skills.

REFERENCES

Afdareza, M. Y., Yuanita, P., & Maimunah, M. (2020). Development of Learning Device Based on 21st Century Skill with Implementation of Problem-based Learning to Increase Critical Thinking Skill of Students on Polyhedron for Grade 8th Junior High School. *Journal of Educational Sciences*, *4*(2), 273. https://doi.org/10.31258/jes.4.2.p.273-284

Amalia, E., Surya, E., & Syahputra, E. (2017). *The Effectiveness of Using Problem-Based Learning (PBL) in Mathematics Problem-solving Ability for Junior High School Students*. International Journal of Advance Research and Innovative Ideas in Education, *3*(2), 3402–3406. https://doi.org/10.30596/jmea.v1i2.10553

Andayani, F., & Lathifah, A. N. (2019). *ANALISIS KEMAMPUAN PEMECAHAN MASALAH SISWA SMP DALAM MENYELESAIKAN SOAL PADA MATERI ARITMATIKA SOSIAL*. *3*(1), 1–10.

Anggreaena, Ginanto, Felicia, Andiarti, Herutami, Alhapip, Iswoyo, hartini, M. (2022). Panduan Pembelajaran dan Asesmen. *Badan Standar, Kurikulum, Dan Asesmen Pendidikan Kementerian Pendidikan, Kebudayaan, Riset, Dan Teknologi Republik Indonesia*, 123.

Armiati, A. (2018). Mengembangkan Higher Order of Thinking Skill Melalui Pembelajaran Matematika pada Siswa Sekolah Menengah Kejuruan. *Jurnal LEMMA*, *4*(2), 7–19. https://doi.org/10.22202/jl.2017.v4i2.2729

Ati, T. P., & Setiawan, Y. (2020). *EFEKTIVITAS PROBLEM-BASED LEARNING-PROBLEM-SOLVING TERHADAP KEMAMPUAN BERPIKIR KRITIS DALAM PEMBELAJARAN MATEMATIKA SISWA KELAS V*. *04*(01), 294–303.

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

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

Badan, Standar, Kurikulum dan Asesmen Pendidikan Kementerian Pendidikan Kebudayaan Riset dan Teknologi. (2022). Kajian Akademik Kurikulum untuk Pemulihan Pembelajaran

Badan, Standar, Kurikulum dan Asesmen Pendidikan Kementerian Pendidikan Kebudayaan Riset dan Teknologi. (2022). Buku Saku Tanya Jawab Kurikulum Merdeka

Brahim, R., Huda, N., & Anggereini, E. (2023). Pengaruh Model Problem-based Learning Terhadap Kemampuan Pemecahan Masalah Matematika Ditinjau Dari Self Confidence Siswa. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *12*(1), 1178. https://doi.org/10.24127/ajpm.v12i1.6737

Cahyo Winoto, Y., Prasetyo, T., Kristen Satya Wacana, U., & Tengah, J. (2020). *EFEKTIVITAS MODEL PROBLEM-BASED LEARNING DAN DISCOVERY LEARNING TERHADAP KEMAMPUAN BERPIKIR KRITIS SISWA SEKOLAH DASAR* (Vol. 4, Issue 2).

Desi, Lesmini, B., & Hidayat, I. (2019). Enhancing student problem-solving skills through worksheets-assisted problem-based learning. *Journal of Physics: Conference Series*, *1166*(1). https://doi.org/10.1088/1742-6596/1166/1/012005

Dorimana, A., Uworwabayeho, A., & Nizeyimana, G. (2022). *Enhancing Upper Secondary Learners' Problem-Solving Abilities Using Problem-Based Learning in Mathematics*. International Journal of Learning, Teaching and Educational Research, *21*(8), 14–28. https://doi.org/10.26803/ijlter.21.8.14

Endah Wulandari, P., & In, A. (2023). Mathematical Problem-solving in E-Learning Based on David Kolb's Learning Style. *Jurnal Matematika Kreatif-Inovatif*, *14*(1), 123–135.

Fardian, D., & Dasari, D. (2023). The Effects of Problem-Based Learning on ... | 100. *Journal of Didactic Studies*, *1*(2), 99–113. https://doi.org/10.17509/jds.v1i2.65591

Heleni, S., Syahfitri, S. A., & Yuanita, D. P. (2022). Validitas dan Praktikalitas Perangkat Pembelajaran Matematika Berbasis Model Problem-based Learning untuk Memfasilitasi Kemampuan Pemecahan Masalah Matematis Siswa Kelas IX Materi Persamaan Kuadrat. In *Journal for Research in Mathematics Learning) p* (Vol. 5, Issue 3).

Hidayatati, E., Pendidikan Matematika, J., & Negeri, S. (2022). Penerapan Model Pembelajaran Problem-based Learning untuk Meningkatkan Kemampuan Pemecahan Masalah Matematika (Studi Kasus Peserta didik kelas x KKBT2 Smk Negeri 4 Pekanbaru). *Jurnal Karya Ilmiah Multidisiplin (JURKIM)*, *2*(1), 24–35.

Jurnal, W., Nur Fajri, A., & Suryani, M. (2025). Indonesian Research Journal on Education Penerapan Model Problem-based Learning (Pbl) terhadap Kemampuan Pemecahan Masalah Matematika Siswa Kelas XI Fase F SMA Negeri 1 Rambatan-ShareAlike 4.0 International (CC BY-SA 4.0). In *Indonesian Research Journal on Education* (Vol. 5).

Khoirian Sawilda, U., & Yuanita, P. (2022). Perangkat Pembelajaran Berbasis Model Problem-based Learning. In *Journal for Research in Mathematics Learning) p* (Vol. 5, Issue 1).

Klegeris, A., & Hurren, H. (2011). Impact of problem-based learning in a large classroom setting: Student perception and problem-solving skills. *American Journal of Physiology - Advances in Physiology Education*, *35*(4), 408–415. https://doi.org/10.1152/advan.00046.2011

Kodariyati, L., Astuti, B., PGRI Metro Lampung, S., Banjarrejo, J., & Batanghari Kec Lampung Timur, B. (2016). PENGARUH MODEL PBL TERHADAP KEMAMPUAN KOMUNIKASI DAN PEMECAHAN MASALAH MATEMATIKA SISWA KELAS V SD THE EFFECTS OF THE PBL MODEL ON THE MATHEMATICAL COMMUNICATION AND PROBLEM-SOLVING SKILLS OF FIVE-GRADERS OF ELEMENTARY SCHOOL STUDENTS. *Jurnal Prima Edukasia*, *4*(1), 93–106.

Kurniawati, A., Wardani, S., & Asikin, M. (2023). The Effectiveness of the Problem-based Learning Model with a Realistic Mathematics Education Approach to Problem-solving Ability. *International Journal of Research and Review*, *10*(1), 491–497. https://doi.org/10.52403/ijrr.20230156

Maharani, et al. (2024). *DEVELOPMENT OF PROBLEM-BASED LEARNING MATHEMATICS MODULES TO ENHANCE STUDENTS ' MATHEMATICAL PROBLEM-SOLVING*. *7*(1), 51–60.

Maidiyah, E., Anwar, N., Zaura, B., & Harnita, F. (2021). *K R E A N O Mathematical Reasoning Ability of Junior High School Students Through Problem-based Learning Model with Ethnomathematical Nuances*. http://journal.unnes.ac.id/nju/index.php/kreano

Malinda, G. (2021). Efektivitas Pendekatan Kontekstual Terhadap Kemampuan Pemecahan Masalah Matematis Siswa (Studi kasus di SMA dan MA Kota Bengkulu). *Didactical Mathematics*, *3*(1), 8–17. https://doi.org/10.31949/dm.v3i1.915

Marchy, F., Murni, A., & Muhammad, I. (2022). The Effectiveness of Using Problem-Based Learning (PBL) in Mathematics Problem-Solving Ability for Junior High School Students. In *AlphaMath Journal of Mathematics Education* (Vol. 8, Issue 2).

Mergendoller, J. R., Maxwell, N. L., & Bellisimo, Y. (2006). The Effectiveness of Problem-Based Instruction: A Comparative Study of Instructional Methods and Student Characteristics. *Interdisciplinary Journal of Problem-Based Learning*, *1*(2). https://doi.org/10.7771/1541-5015.1026

Merritt, J., Lee, M. Y., Rillero, P., & Kinach, B. M. (2017). Problem-based learning in K-8 mathematics and science education: A literature review. *Interdisciplinary Journal of Problem-Based Learning*, *11*(2). https://doi.org/10.7771/1541-5015.1674

Mokter, M. (2019). *The Influence of Problem-Based Learning (PBL) on Mathematics Learning: Systematic Literature Review*. International Journal of Academic Research in Progressive Education and Development, 8(4), 1–10. https://doi.org/10.6007/IJARPED/v11-i3/15033

Mukuka, A., Balimuttajjo, S., & Mutarutinya, V. (n.d.). *APPLYING THE SOLO TAXONOMY IN ASSESSING AND FOSTERING STUDENTS' MATHEMATICAL PROBLEM-SOLVING ABILITIES*. https://www.researchgate.net/publication/338778457

Novita, R., & Hartono, Y. (2012). *Exploring Primary Student's Problem-Solving Ability by Doing Tasks Like PISA's Question* (Vol. 3, Issue 2).

Osman, A., & Kriek, J. (2021). Science Teachers' Experiences when Implementing Problem-based Learning in Rural Schools. *African Journal of Research in Mathematics, Science and Technology Education*, *25*(2), 148–159. https://doi.org/10.1080/18117295.2021.1983307

Pertiwi, W., Roza, Y., & Yuanita, P. (2021). Development of Mathematics Learning Tools with

Problem-based Learning Model on Matrix Material to Facilitate Students' Critical Thinking Ability. *Journal of Educational Sciences*, *5*(1), 156. https://doi.org/10.31258/jes.5.1.p.156-165

Purwasi, L. A., & Fitriyana, N. (2019). Pengembangan Lembar Kerja Siswa Berbasis Pendekatan Open-Ended Untuk Melatih Kemampuan Pemecahan Masalah Matematis Siswa SMP. *Kreano, Jurnal Matematika Kreatif-Inovatif*, *10*(1), 18–26. https://doi.org/10.15294/kreano.v10i1.16825

Putri, I. H., Anggraini, R. D., & Hutapea, N. M. (2025). Development of Teaching Modules Based on Problem-Based Learning to Facilitate Mathematical Problem-Solving Skills. *Jurnal Pendidikan*, *17*(2), 2203–2217. https://doi.org/10.35445/alishlah.v17i2.5123

Ramadhani, R., Umam, R., Abdurrahman, A., & Syazali, M. (2019). The effect of flipped-problem-based learning model integrated with LMS-google classroom for senior high school students. *Journal for the Education of Gifted Young Scientists*, *7*(2), 137–158. https://doi.org/10.17478/jegys.548350

Ridwan, M. R., Retnawati, H., Hadi, S., & Jailani, J. (2021). The Effectiveness of Innovative Learning on Mathematical Problem-Solving Ability: A Meta-Analysis. *International Journal of Research in Education and Science*, *7*(3), 910–932. https://doi.org/10.46328/ijres.2287

Rizky, O. :, Apriliasari, N., & Ruwanto, D. B. (n.d.). *PENGEMBANGAN LEMBAR KERJA PESERTA DIDIK MATERI ELASTISITAS ZAT PADAT BERBASIS PROBLEM-BASED LEARNING UNTUK MENINGKATKAN PARTISIPASI DAN HASIL BELAJAR PESERTA DIDIK SMA KELAS X DEVELOPMENT PROBLEM-BASED LEARNING OF STUDENT WORKSHEET TO IMPROVE LEARNING PARTICIPATION AND PHYSICS ACHIEVEMENT OF STUDENTS HIGH SCHOOL CLASS X ON ELASTISITY OF SOLID*.

Rochmad, R., Agoestanto, A., & Kurniasih, A. W. (2016). Analisis Time-Line dan Berpikir Kritis Dalam Pemecahan Masalah Matematika Pada Pembelajaran Kooperatif Resiprokal. *Kreano, Jurnal Matematika Kreatif-Inovatif*, *7*(2), 217–231. https://doi.org/10.15294/kreano.v7i2.4980

Sa'dun Akbar, M. P. 2017. Instrumen Perangkat Pembelajaran. PT Remaja Rosdakarya.

Santika, I., Parwati, N. N., Divayana, D., Kunci, K., Pemecahan, K., Matematika, M. ;, Pembelajaran, M., Masalah, B., Prestasi, ;, & Matematika, B. (2020). Pengaruh Model Pembelajaran Berbasis Masalah Dalam Setting Pembelajaran Daring Terhadap Prestasi Belajar Matematika dan Kemampuan Pemecahan Masalah Siswa Kelas X SMA. *Jurnal Teknologi Pembelajaran Indonesia*, *10*(2), 105–117. https://ejournal-pasca.undiksha.ac.id/index.php/jurnal_tp/article/view/3397

Setiawati, E. P., & Agoestanto, A. (2023). Development of Problem-Based Learning Mathematical Module with STEM Approach to Improve Problem-Solving Ability and Self Efficacy. *Unnes Journal of Mathematics Education*, *12*(1), 60–71. https://doi.org/10.15294/ujme.v12i1.68716

Sugiyono. 2017. *Metode Penelitian Pendidikan Pendekatan Kuantitatif, Kualitatif, dan R&D.* Bandung. Alfabeta.

Suharsimi, Arikunto. (2012). Dasar-dasar Evaluasi Pendidikan. Bumi Aksara. Jakarta.

Sri Sumartini, T. (2016). *Peningkatan Kemampuan Pemecahan Masalah Matematis Siswa melalui Pembelajaran Berbasis Masalah* (Vol. 5, Issue 2). http://e-mosharafa.org/

Surya, E., Syahputra, E., & Astriani, N. (2017). *THE EFFECT OF PROBLEM-BASED LEARNING TO STUDENTS' MATHEMATICAL PROBLEM-SOLVING ABILITY* (Vol. 3). https://www.researchgate.net/publication/318562413

Surya, A. D., dan Pebrian, A. 2022. *Bedah Kurikulum Prototipe.* Nganjuk: CV. Dewa Publishing.

Suryanti, N., & Nurhuda, N. (2021). The Effect of Problem-Based Learning with an Analytical Rubric on the Development of Students' Critical Thinking Skills. *International Journal of Instruction*, *14*(2), 665–684. https://doi.org/10.29333/iji.2021.14237a

Tinggi, S., & Islam Binamadani, A. (2022). PENGEMBANGAN MODUL AJAR BERBASIS KURIKULUM MERDEKA Utami Maulida. In *Agustus* (Vol. 5, Issue 2). https://stai-binamadani.e-journal.id/Tarbawi

Wildaniati, Y. (2019). Developing Problem-based Mathematics Teaching Materials to Facilitate Problem-Solving Ability Achievement. *Elemantary*, *5*(1), 27–38.

Yanti, et al. (2024). *THE DEVELOPMENT OF PROBLEM-BASED LEARNING WORKSHEETS TO FACILITATE MATHEMATICAL PROBLEM-SOLVING SKILLS IN*. *7*(1), 85–94.

Yunita, W., Santoso, A., & Dewi, R. S. I. (2024). Problem-based Learning in Improving Studnet's Mathematical Problem-solving Skills. *Eelemetary: Jurnal Ilmiah Pendidikan Dasar*, *10*(1), 12–26. https://doi.org/10.37303/jelmar.v1i1.12

Yusri, A. Y., Yusri, A. Y., Matematika, P., Matappa, A., Andi, P. J., No, M., Kabupaten, P., Kepulauan, S., & Selatan, I. (2018). *Mosharafa*. *7*(1). http://e-mosharafa.org/index.php/mosharafa

Zahira, H., Zulkarnain, Z., & Yuanita, P. (2020). Development of a Problem-based Learning Media to Build Mathematical Communication Capabilities Students of Class VIII Junior High School. *Journal of Educational Sciences*, *4*(3), 487. https://doi.org/10.31258/jes.4.3.p.487-500