Jurnal Riset Ilmu Pendidikan
Vol. 4, No. 4, November 2024, pp. 249~254

Development Of Problem Based Learning Student Worksheet on Chemical Bonding Materials

Baiq Anita Febriana[1], Siti Masitah[2], M. Agus Satriawan[3]
[1,2,3]Institut Studi Islam Sunan Doe, Indonesia
Email: baiqanita.17@gmail.com

ABSTRAK

Perkembangan ilmu pengetahuan dan teknologi menuntut manusia untuk tetap aktif dan dinamis dalam menghadapi berbagai perubahan, termasuk dalam bidang pendidikan. Salah satu pendekatan pembelajaran yang efektif dalam mengembangkan kemampuan berpikir kritis dan pemecahan masalah adalah Problem Based Learning (PBL). Dalam pembelajaran kimia, khususnya pada materi ikatan kimia yang abstrak, diperlukan bahan ajar yang mampu mendukung penerapan PBL secara optimal. Penelitian ini bertujuan untuk mengembangkan Lembar Kerja Siswa (LKPD) berbasis PBL pada materi ikatan kimia yang valid dan layak digunakan dalam pembelajaran. Hasil uji validitas menunjukkan bahwa LKPD yang dikembangkan memiliki nilai rata-rata validitas sebesar 0,84 yang termasuk dalam kategori sangat tinggi. Selain itu, respon siswa terhadap penggunaan LKPD berbasis PBL mencapai rata-rata 78,27% yang termasuk dalam kategori baik, sehingga LKPD ini dapat diterapkan secara efektif dalam pembelajaran.

Keyword: Pembelajaran Berbasis Masalah (PBL); Lembar Kerja Siswa (LKPD); Ikatan Kimia; Motivasi Belajar; Keterampilan Berpikir Kritis

ABSTRACT

The development of science and technology requires humans to remain active and dynamic in facing various changes, including in the field of education. One of the effective learning approaches in developing critical thinking and problem-solving skills is Problem-Based Learning (PBL). In chemistry learning, especially in abstract chemical bonding materials, teaching materials that are able to support the optimal application of PBL are needed. This research aims to develop a PBL-based Student Worksheet (LKPD) on chemical bonding materials that are valid and suitable for use in learning. The results of the validity test show that the LKPD developed has an average validity value of 0.84, which is included in the very high category. In addition, students' responses to the use of PBL-based LKPD reached an average of 78.27%, which was categorized as good, so that this LKPD can be applied effectively in learning.

Keyword: Problem-Based Learning (PBL); Student Worksheet (LKPD); Chemical Bonding; Learning Motivation; Critical Thinking Skills

Corresponding Author:
Baiq Anita Febriana,
Institut Studi Islam Sunan Doe,
Jl. Soekarno Hatta, Rumbuk, Kec. Sakra, Kabupaten Lombok Timur, Nusa Tenggara Barat 83671, Indonesia
Email: baiqanita.17@gmail.com

1. INTRODUCTION

Along with the rapid development of science and technology, humans are required to remain active and dynamic in facing various changes, including in the field of education. Therefore, the Indonesian government continues to evaluate and adjust the education system, one of which is through curriculum updates. Currently, Indonesia implements the Independent Curriculum which has various characteristics, including balancing the development of spiritual and social attitudes, curiosity, creativity, and cooperation with intellectual and psychomotor abilities.

Chemistry is a branch of science that studies the properties of matter, the changes that occur, as well as the elements and compounds that make it up (Chang, 2005). One of the main topics in chemistry is chemical

bonds, which includes the concepts of ionic bond formation, covalent bonds, coordinated covalent bonds, and metal bonds. In addition, this material also discusses the interaction between particles and the degree of polarity of a compound. Based on the understanding of the concept of chemical bonds, the researcher conducted observations in a school to obtain information about the learning process of students in understanding chemical materials.

Based on the results of observations and interviews conducted at MA Al-Falah, students stated that the available package books were not enough to help them understand chemical materials well (Interview, June 22, 2024). The chemistry teacher at MA Al-Falah also revealed that students' interest in learning is still low, with only a small percentage being active in learning. Therefore, learning media that can attract students' interest and encourage their involvement in the learning process is needed. One of the alternatives that can be used is the Student Worksheet (LKPD). Research conducted by Umbaryati (2020) shows that the use of LKPD can increase students' learning activities and achievements. LKPD itself is a teaching material that contains a series of tasks that must be completed by students, complete with instructions and steps that refer to the Basic Competencies (KD) that are set (Prastowo, 2019). In its preparation, LKPD must meet several requirements, namely didactic, construction, and technical requirements to be effective in supporting the learning process.

Student Worksheets (LKPD) are one of the learning resources that can be developed by teachers to support the learning process. Some experts define LKPD from various perspectives. Arsyad (2020) stated that LKPD is a print media resulting from the development of printing technology in the form of a book containing visual materials. LKPD functions as a guide for students in conducting investigation or problem-solving activities. In addition to serving as a learning resource, LKPD also functions as a learning medium that helps students understand concepts more systematically. Thus, LKPD can be concluded as a learning guide sheet containing materials, learning activities, and exercises designed to help students understand the material in accordance with the basic competencies that must be achieved (Trianto, 2017).

Student Worksheets (LKPD) can be integrated with a scientific approach to improve students' understanding through the scientific thinking process. The scientific approach is a learning method that emphasizes scientific steps, such as identifying problems, formulating problems, proposing hypotheses, collecting and analyzing data, and drawing conclusions. This approach can be applied through the Problem Based Learning (PBL) learning model, which places students as the center of learning. With the PBL model, students are encouraged to think critically, actively seek solutions, and be more independent in understanding the concepts learned. This not only improves their understanding of concepts, but also helps them in developing higher-order thinking and problem-solving skills.

Problem Based Learning (PBL) is a learning model that begins with the presentation of a problem that must be solved by students, thus encouraging them to acquire new knowledge. The problems used in PBL come from real phenomena in daily life (Pratiwi, 2020). Based on the results of interviews with chemistry teachers, it is known that students are easier to understand concepts and are more interested in learning associated with real phenomena around them. In addition, the students' needs questionnaire also showed that they were more motivated when learning was associated with events they experienced on a daily basis. PBL allows students to integrate their various knowledge to develop a deeper understanding and improve their problem-solving skills.

The Problem Based Learning (PBL) model is related to the use of individual intelligence in a group or environment to solve problems that are meaningful, relevant, and contextual (Rusman, 2020). PBL-based learning is a learning model that integrates real-world problems as a context for students in developing critical thinking skills, problem-solving, and understanding essential concepts from the subject matter (Putra, 2023). According to Riyanto (2019), the Problem Based Learning (PBL) model is a learning approach that encourages students to be active and independent in developing critical thinking skills and solving problems through data search and analysis, so that the solutions obtained are rational and authentic. In addition, PBL also helps students to be more active in investigation activities, as well as hone their argumentative skills in formulating and solving problems systematically.

In the context of chemistry learning, chemical bond materials can be integrated with the PBL model, especially in understanding the factors that affect the formation of chemical bonds (Nurhayati, 2023). Thus, PBL can be an effective strategy to increase students' understanding of chemical concepts in a more in-depth and applicable way. Based on the above presentation, the researcher is interested in developing a Student Worksheet (LKPD) based on Problem Based Learning (PBL) on chemical bonding material at MA Al-Falah. The development of this LKPD is expected to increase students' understanding of chemistry concepts, encourage them to be more active in the learning process, and foster interest and fun in learning chemistry. With the PBL approach, students will be more involved in learning based on real problem solving, so that they can build a deeper and more applicable understanding of the material being studied.

Several previous studies on Student Worksheets (LKPD) based on Problem Based Learning (PBL) showed positive results in the validity and feasibility of its use in learning. Research conducted by Yuliandri (2019) with the title "Development of Problem-Based Learning Student's Worksheets on Class X Chemical Bond Material" shows that the results of LKPD validation by three validators obtained an average score of 11.66 with a percentage of 97.1%, so that this LKPD was declared valid and suitable for use in learning. Similar results were also found in Mayang Larasati's (2018) research entitled "Development of Problem-Based Learning Modules on Polymer Materials". This study shows that the modules developed obtained a feasibility percentage of 89%, which is categorized as very feasible to be used in learning. In addition, Julha's (2021) research entitled "Development of PBL-Based LKPD on Chemical Bond Materials at SMA Negeri 2 Lambu" also showed high validation results. Based on the assessment of experts, the LKPD developed obtained an average percentage of 85.2%, which is included in the very feasible category after going through the validation and revision process. The results of the study show that PBL-based LKPD has been proven to be valid and effective in supporting learning, especially in helping students understand chemistry concepts better.

Based on the background that has been presented, this study aims to:

a) Develop a valid Problem Based Learning (PBL)-based Student Worksheet (LKPD) on chemical bonding material in class X. b) Analyze the students' response to the use of PBL-based LKPD on chemical bonding materials. This development is expected to be a reference for the development of teaching materials and contribute to enriching insights in the field of education, especially in chemistry learning innovations.

2. RESEARCH METHOD

The development method is a research approach that aims to produce a product and measure its effectiveness in use (Sugiyono, 2012:407). In this study, the development model used is the 4-D model, developed by Trianto (2019), which consists of four main stages: define, design, develop, and disseminate. This model ensures that the resulting product, in this case, the LKPD based on Problem-Based Learning (PBL), has high validity, effectiveness, and usefulness in learning. The respondents in this study were 35 students from class X MA Al-Falah, who participated in a limited trial to provide feedback on the use of PBL-based LKPD in chemical bond learning.

The research instruments used in this study include a validation sheet, which was used by expert validators to assess the validity of the developed LKPD, an interview question sheet to collect observational data regarding learning needs and obstacles, and a questionnaire to determine students' responses in terms of readability, ease of understanding, and effectiveness in learning. These instruments ensure that the developed LKPD meets the standards of validity, suitability, and effectiveness in supporting the learning process.

This study employed the 4-D development model (Define, Design, Develop, and Disseminate). However, due to financial and time constraints, only the first three stages—define, design, and develop—were carried out. The define stage aimed to identify the main issues underlying the development of PBL-based LKPD in chemistry learning, particularly on chemical bonding materials, ensuring its effectiveness as an alternative teaching material. The design stage involved creating a prototype of the PBL-based LKPD, while the develop stage focused on evaluating and revising the prototype based on expert input and testing its practicality and validity.

Data analysis in this study was conducted to identify and interpret the collected data from interviews, questionnaires, and documentation. To ensure the validity of the developed LKPD, the study employed several techniques. The validity test was conducted by experts using predetermined validation instruments and considering input from validators. The Aiken validation method with the Aiken's V index was used to test content validity. If the validator assessment indicated that the LKPD was not valid, revisions were necessary before implementation. Additionally, data on teacher and student responses to the PBL-based LKPD were collected through questionnaires. The obtained data were analyzed descriptively by calculating response percentages to measure the validity and practicality of the developed LKPD objectively, ensuring reliable results in the learning process.

3. RESULTS AND DISCUSSION

A. Define

The definition stage in this study aims to obtain an overview of the conditions of chemistry learning in MA Al-Falah Pancor Dao. At this stage, several analysis steps are carried out, including: needs analysis (initial analysis), interviews with chemistry teachers, textbook analysis, curriculum and syllabus analysis, as well as analysis of students and learning objectives. Based on the results of observations and interviews with MA Al-Falah Pancor Dao chemistry teachers, namely Mrs. Heni Kusniati, S.Pd., and Mr. Ubaidillah, S.Pd., on June 6, 2024, information was obtained about several problems in chemistry learning at the school. The main problems identified are as follows: Limited teaching materials: The available package books are still limited, so students must look for additional references to complete their understanding of the learning material. Low

motivation to read: Although some books are available, only a small percentage of students take the initiative to borrow and study them. Mismatch of material with learning objectives: Some textbooks used have not fully supported the achievement of the learning objectives that have been set. Lack of development of teaching materials by teachers: Teachers have not developed additional teaching materials that can help students understand the material more effectively. The use of less varied learning methods: The lecture method is still the main method in the learning process, which causes students to feel bored and less actively involved in learning. Low motivation to read: Although some books are available, only a small percentage of students take the initiative to borrow and study them. Mismatch of material with learning objectives: Some textbooks used have not fully supported the achievement of the learning objectives that have been set. Lack of development of teaching materials by teachers: Teachers have not developed additional teaching materials that can help students understand the material more effectively. The use of less varied learning methods: The lecture method is still the main method in the learning process, which causes students to feel bored and less actively involved in learning. Low critical thinking skills of students: Lack of involvement of students in discussion and exploration of concepts leads to low critical thinking skills.

Based on the problems that have been identified, this study offers an alternative solution in the form of the development of Problem-Based Learning (PBL)-based Student Worksheets (LKPD). The use of PBL-based LKPD is expected to increase students' learning motivation by presenting more structured material, clear summaries, and problem-solving-oriented tasks. Encourage students to be more active in finding solutions to problems related to chemical concepts. Developing students' critical thinking skills through exploration and discussion-based learning. Thus, the development of PBL-based LKPD can be an effective solution in improving the quality of chemistry learning at MA Al-Falah Pancor Dao.

B. Design

The PBL-based LKPD is designed and developed for class X Semester 1 on chemical bonding materials. The development of Student Worksheets (LKPD) in this study is adjusted to the components of the Problem-Based Learning (PBL) model. The structure of the LKPD consists of three main parts, namely the Introduction, the Core Section, and the Closing Section.

Tabel 1. PBL-Based LKPD Structure

No	LKPD	Component
1	Introduction	- Foreword
		- Table of Contents
		- List of Images
		- Table List
		- Introduction
		- Instructions for the Use of PBL-Based LKPD
		- Instructions for the Use of Image Icons in LKPD
		- Core Competencies (KI) and Basic Competencies (KD)
2	Core Sections	- Learning Objectives Indicators
		- Concept Map
		- Students' Orientation to Problems
		- Organizing Students to Learn
		- Guiding Group Investigations
		- Developing and Presenting Results and Works
		- Analyzing and Evaluating the Problem Solving Process
		- Material Description

This structure is designed to ensure that the LKPD not only contains systematic information, but also supports problem-based learning (PBL). The Introduction section contains general information and instructions for using the LKPD, the Core Section contains the main components in problem-based learning, while the Closing Section can later include reflection, summary, and evaluation of the learning process that has been carried out. With this structure, it is hoped that LKPD can help students improve their understanding of concepts and critical thinking skills through a more interactive and exploratory learning approach.

C. Develop

At this stage, the activities carried out are to create problem-based learning-based LKPD that is tailored to the learning objectives and needs of students. The first step is to produce a draft consisting of a preface, a table of contents, an introduction consisting of a description, instructions for using LKPD, an elaboration of KD/Indicators/Learning Objectives and a concept map. The second step is to design the content of the LKPD which consists of a level of material about various chemical bonds and the physical properties of compounds, learning activities that are related to the material presented with PBL learning steps, and a competency test containing practice questions as a review in learning. After the product manufacturing process, the next step is product validation and product testing which can be seen in the next discussion.

The test aims to understand how students respond in using PBL-based LKPD in the learning process. Test the responses by distributing questionnaires to students. Students fill out a questionnaire after being given learning that is carried out in 4 meetings. Various activities carried out at the product trial stage include, introduction (introduction to LKPD), learning, and dissemination of student response questionnaires. In this first meeting, students were invited to understand the introduction included in the LKPD. This introduction was carried out to provide explanations to students which included descriptions of LKPD, instructions in using LKPD, KD, indicators and learning objectives as well as concept maps. At the next meeting, the learning activity began with an understanding of chemical bonding material adjusted to KD 3.5 and 4.5. In the KD, it is broadly discussed about the various chemical bonds along with the physical properties of compounds.

Based on the table above, it can be seen that the average percentage of student responses to PBL-based LKPD on chemical bonding material is 78.27% and is included in the good criteria, so it can be used in learning. There are 4 aspects of material validity assessment, namely the feasibility of content, presentation, language, and problem-based learning. In the first aspect of the feasibility of the content, an average validation value of 0.75 (high) was obtained.

This aspect includes 3 indicators, namely the suitability between KI and KD, the accuracy of the material, and the up-to-date material. The second aspect is the eligibility of the presentation. This aspect obtained an average score of 0.87 with a high level of validity. There are 2 indicators in this aspect, namely the presentation of learning which is obtained with a value of 0.75 (high) and the supporting presentation which is included in a very high level of validity with a validity value of 1.

The linguistic aspect includes 2 indicators, namely information clarity and EYD suitability. Both received a validity value of 0.75 with a high level of validity. The last aspect is Problem Based Learning which includes the stages in the learning process in PBL. The validity results obtained in this aspect are valid criteria with a value of 1. Overall, in the material validity test for PBL-based LKPD, an average validity value of 0.84 was obtained, which is classified as a very high level of validity so that it can be used in the learning process.

4. CONCLUSION

The structure of LKPD based on Problem Based Learning (PBL) for learning chemical bonding material consists of several main components, namely: cover, preface, table of contents, introduction, material summary, learning activities, competency test, and bibliography. The quality of PBL-based LKPD on chemical bonding materials is evaluated through validation by experts, as well as questionnaires of responses from chemistry teachers and students.

The validation results showed that the assessment from media experts reached 0.79, which was categorized as high, while the validation from material experts obtained a score of 0.89, which was included in the very high category. The response of chemistry teachers to the PBL-based LKPD was also very positive, with an average percentage of 82.5%, which was categorized as very good. Meanwhile, the students' response to the use of LKPD obtained an average score of 78.27%, which is included in the good category. Thus, this PBL-based LKPD is suitable for use in learning chemical bonding materials.

REFERENCES

Agripa, T. S. (2013). Workload and motivation affect employee performance at PT. Bank Tabungan Negara Tbk Manado Branch. *Jurnal EMBA, 1*(4), 1123–1133.

Cahyanti, W., Damayanti, A. T., Wigati, T., & Suyoto, S. (2024). Implementation of the problem-based learning (PBL) model to improve the learning outcomes of Pancasila education for class V. *Journal of Innovative Students Evaluation and Learning Development (JIEPP Learning), 4*, 223–229. https://doi.org/10.54371/jiepp.v4i2.467

Chang, R. (2015). *Basic chemistry: Core concepts (Vol. 1, Third edition).* Jakarta: Erlangga.

Fitriyah, A., & Ramadani, S. D. (n.d.). The effect of PjBL-based STEAM learning (project-based learning) on creative thinking and critical thinking skills.

Maimufi, R., Haviz, M., Delfita, R., & Fajar, N. (2021). Validity of student worksheets (LKPD) based on problem-based learning (PBL) model on circulatory system material class XI high school. *Edusainstika: Journal of Mathematics and Natural Sciences Learning, 1*(1), 49–55.

Maulina, R., Nazar, M., & Hanum, L. (2020). Development of problem-based student worksheets (LKPD) on colloidal material in class XI of SMAN 5 Banda Aceh. *Scientific Journal of Chemistry Education Students, 4*(4).

Mayesti, J., Mutmainah, P. A., & Agustina, S. (2021). Development of problem-based learning (PBL) student worksheets for chemical bond materials for grade X students at SMAN 2 Lambu. *Dalton: Journal of Chemistry and Chemical Science Education, 4*(2).

Mulyasa, E. (2018). *Competency-based curriculum of concepts, characteristics, implementation, and innovation.* Bandung: Rosdakarya.

Nurmasita, N., Enawaty, E., Lestari, I., Hairida, H., & Erlina, E. (2023). Development of e-LKPD based on problem-based learning (PBL) on redox reaction material. *Jambura Journal of Educational Chemistry, 5*(1), 11–20.

Prastowo, A. (2019). *Creative guide to making innovative teaching materials.* Jakarta: Kencana Prenada Media Group.

Suhari, A., Kurniawan, E., & Rahayu Ningsi, J. (2023). Development of student worksheets (LKPD) based on problem-based learning (PBL) on chemical reaction equation material class X science SMAN 1 Pangean. *JOM FTK UNIKS (Online Journal of FTK UNIKS Students), 3*(2), 14–21.

Trianto. (2017). *Constructivist-oriented innovative learning models.* Yogyakarta: Diva Press.

Yuliandriati, Y., Susilawati, S., & Rozalinda, R. (2019). Development of problem-based learning worksheets for students on chemical bonding materials in class X. *JTK (Tadris Kimiya Journal), 4*(1), 105–120.

Yuni, D. P. (2020). The impact of heavy metal pollution (lead, copper, mercury, cadmium, chrome) on aquatic organisms and human health. *Aquatic Journal, 1*(1), 59–65.