JCAR 4(1) (2022)

Journal of Classroom Action Research

http://jppipa.unram.ac.id/index.php/jcar/index

Feasibility of Science Learning Devices with Integrated PBL Models of STEM Approach to Improve Students' Problem-Solving Ability and Self-Efficacy

Via Monica Devi[1], Susilawati[1], Kosim[1]

[1] Master of Science Education Study Program, University of Mataram, Lombok, West Nusa Tenggara, Indonesia.

DOI: https://doi.org/10.29303/jcar.v5iSpecialIssue.4351

Received: 20 Maret 2023 Revised: 25 Mei 2023 Accepted: 30 Mei 2023

Abstract: Science learning itself aims to help students understand and master the facts and concepts of science in life which can then be applied and developed as a form of instilling a scientific attitude in students. However, learning science at school is one of the scourges of its own difficulties for students. Where students tend to experience difficulties when faced with a problem. Therefore we need a learning model to facilitate this. One of the learning models that can be used is the problem-based learning (PBL) model. The PBL model is a learning model that prioritizes student-centered. This PBL model can be combined with a learning approach to support the achievement of learning objectives, in this case, the problem-solving abilities and self-efficacy of students. One approach that can be chosen is the STEM approach. This research is a type of development research that refers to the steps of the ADDIE model. Based on the calculation of the Likert scale and percentage agreement, it was found that the product being developed was in a very valid category with an average of >90. While product reliability reaches an average of >90%, which means the product being developed is reliable. Because the results of the analysis show that the product being developed is valid and reliable, the product is feasible to use.

Keywords: Science Learning Tools, PBL Models, Problem Solving Ability, and Self-Efficacy.

Abstrak: Pembelajaran IPA sendiri bertujuan untuk membantu siswa memahami dan menguasai fakta dan konsep IPA dalam kehidupan yang selanjutnya dapat diterapkan dan dikembangkan sebagai bentuk penanaman sikap ilmiah pada siswa. Namun, belajar IPA di sekolah merupakan salah satu momok kesulitan tersendiri bagi siswa. Dimana siswa cenderung mengalami kesulitan ketika menghadapi suatu masalah. Oleh karena itu diperlukan suatu model pembelajaran untuk memfasilitasi hal tersebut. Salah satu model pembelajaran yang dapat digunakan adalah model pembelajaran berbasis masalah (PBL). Model PBL merupakan model pembelajaran yang mengutamakan berpusat pada siswa. Model PBL ini dapat dipadukan dengan pendekatan pembelajaran untuk mendukung pencapaian tujuan pembelajaran, dalam hal ini kemampuan pemecahan masalah dan efikasi diri siswa. Salah satu pendekatan yang dapat dipilih adalah pendekatan STEM. Penelitian ini merupakan jenis penelitian pengembangan yang mengacu pada langkah-langkah model ADDIE. Berdasarkan perhitungan skala likert dan persentase kesepakatan didapatkan bahwa produk yang dikembangkan berada pada kategori sangat valid dengan rata-rata >90. Sedangkan keandalan produk mencapai rata-rata >90% yang berarti produk yang dikembangkan dapat diandalkan. Karena hasil analisis menunjukkan bahwa produk yang dikembangkan valid dan reliabel maka produk layak untuk digunakan.

Email: viamonicad@gmail.com

Kata kunci: Perangkat Pembelajaran IPA, Model PBL, Kemampuan Pemecahan Masalah, dan Self-Efficacy.

Introduction

Natural science (IPA) is defined as a scientific discipline that is closely related to everyday life, besides that competence in science allows students to understand the underlying principles of natural phenomena (Hussein, et. al., 2019). Science learning itself aims to help students understand and master science facts and concepts in life which can then be applied and developed as a form of instilling a scientific attitude in students (Nahdi, et. al., 2018). However, learning science at school is one of the scourges of its difficulties for students. Where students tend to experience difficulties when faced with a science problem that occurs in everyday life. Therefore we need a learning model to facilitate this. One of the learning models that can be used is the problem-based learning (PBL) model.

The PBL model is a learning model that prioritizes student-centered, where students are encouraged to be able to carry out research activities which then combine theory with practice, and apply their knowledge and skills in solving problems (Septiani, et. al., 2020). This PBL model is considered suitable for solving student problems because this model can help students try to find solutions or solutions independently. This is in line with the statement of Mardiyanti (2020) where the PBL model is a learning model that applies a problem as a condition for students to solve problems so they can make decisions about each problem and train students to think critically so they can gain new knowledge within themselves. This PBL model can be combined with a learning approach. The purpose of using a learning approach is to maximize the use of the selected learning model to achieve certain learning objectives, in this case, problem solving. One learning approach that facilitates this is the STEM approach.

The STEM approach has the advantage of being able to connect students with various disciplines such as science, technology, and mathematics. (Ananda & Salamah, 2021). Integrating the STEM approach into problem-solving in an effort to create meaningful learning for students requires special acceleration. (Adiwiguna, et. al., 2019). Where this can be done by developing learning tools which in this case is science learning.

As for science learning at school in terms of problem solving students tend to experience problems to solve it. This is due to the lack of trained students in solving a problem during learning. Therefore, students' problem-solving abilities are low.

According to Arningsih, et. al. (2018) problem-solving ability is one of the higher-order thinking skills that a person must have in facing educational competition in the future where this ability can also help students to be trained in building independent concepts in a holistic, meaningful, authentic, and applicable manner. Solving ability is the main thing that needs to be the main focus because it aims to familiarize students to develop a high-level mindset in solving problems. But in learning it is still common to find learning methods that only make students listeners without being actively involved which certainly affects students' problem-solving abilities (Agustina, et. al., 2020). In addition, one aspect that students must also have to be able to solve a problem is student self-efficacy toward their abilities(Safithri, et. al., 2021).

Alwisol in (Aprilia, et. al., 2020) states that self-efficacy is a form of self-assessment regarding actions that are good or bad, right or wrong, and can or can't do a certain thing according to predetermined conditions. Based on the description of the problem, educators need to innovate development, in this case, the development of science learning tools. The intended development of science learning tools is the PBL model integrated with the STEM approach to improving students' problem-solving abilities and self-efficacy. This research aims to determine the feasibility of the PBL model of science learning tools integrated with the STEM approach in improving students' problem-solving abilities and self-efficacy.

Method

The type of research used in this research is research and development (Research and Development). R&D research is development research, which is a research method used to produce certain products and to test products (Rahmawati et al., 2023). This development research uses the ADDIE model by Dick and Carry, where the ADDIE model includes the stages of analysis, design, development, implementation, and evaluation (Sugiyono, 2016). The selection of the ADDIE development model in this study is based on the assumption that the ADDIE development model has clear and easy-to-understand stages.

Then the data analysis technique to measure the feasibility of the product being developed is to analyze the validity and reliability of the product. As

for measuring the validity of the integrated PBL model learning tool, the STEM approach made by researchers is to use a Likert scale calculation. The validity of the instrument is then categorized into several levels of validity as shown in Table 1 below.

Table 1: Instrument Validity Level

Score	Average Score	Classification
4	3,26−4,00	Very Valid
3	2,51−3,25	Valid
2	1,76−2,50	Less Valid
1	1,01−1,75	Invalid

(Setiawan & Indana, 2021)

Furthermore, to determine product reliability in this study using the Borich method. The Borich method referred to is commonly known as the Percentage Agreement (PA), where the Percentage Agreement is the percentage of agreement or conformity between experts in assigning scores. The instrument is said to be reliable if the percentage agreement value is more or equal to 75%. If yields are less than 75%, they should be tested for clarity and approval from observers (Borich, 1994).

Result and Discussion

This study aims to determine the feasibility of the PBL model of science learning tools integrated with the STEM approach to improve students' problem-solving abilities and self-efficacy. The development stages carried out refer to the ADDIE development model, namely analysis, design, develop, implementation, and evaluation. In the analysis phase, an initial analysis is carried out which includes needs analysis, student analysis, to the formulation of learning objectives.

After the analysis phase is carried out, then the design phase is carried out. The design stage is a stage that focuses on selecting materials and designing the structure of the device framework (Athifah et al., 2022). So that at this stage a draft of the product will be produced (syllabus, lesson plans, worksheets, KPM test questions, and self-efficacy questionnaires). From the design stage, it continues with the development stage.

The development stage, a feasibility test of the initial draft produced in the previous stage is carried out. This feasibility test is carried out using an expert validation sheet. The assessment of the validation sheet for the product being developed consists of 4 rating scales. A score of 4 indicates very good quality, a score of 3 indicates good quality, a score of 2 indicates poor quality and a score of 1 indicates a poor score. The total score obtained will later be classified based on Table 1. Furthermore, when the product validity data has been obtained, a reliability analysis is carried out. This reliability is obtained based on the acquisition of expert validator scores which are then calculated by the PA equation. This reliability is obtained based on the acquisition of expert validator scores which are then calculated by the PA equation. The number of validators used consisted of 3 lecturers as expert validators and 3 teachers as practitioner validators. The aspects assessed on the validated product include content and language aspects. The acquisition of the validity of science learning tools with the integrated PBL model of the STEM approach can be seen in Table 2 below.

Table 2: Product Validity Analysis By Experts

Product	Average	Category
Syllabus	3.81	Very Valid
RPP	3.75	Very Valid
LKPD	3.67	Very Valid
Problem Solving Ability Test Instrument	3.70	Very Valid
Self-Efficacy Questionnaire	3.78	Very Valid

Table 3: Product Validity Analysis By Practitioners

Product	Average	Category
Syllabus	3.81	Very Valid
RPP	3.74	Very Valid
LKPD	3.66	Very Valid
Problem Solving Ability Test Instrument	3.70	Very Valid
Self-Efficacy Questionnaire	3.77	Very Valid

Based on Table 2 and Table 3 above, the products made show a very valid category. The product reliability analysis is described as follows.

Table 4: Product Reliability Analysis By Experts

Product	$PA_{Average}$	Category
Syllabus	97.88%	Reliable
RPP	97.20%	Reliable
LKPD	98.27%	Reliable
Problem Solving Ability Test Instrument	97.88%	Reliable
Self-Efficacy Questionnaire	98.41%	Reliable

Table 4: Product Reliability Analysis By Experts

Product	$PA_{Average}$	Category
Syllabus	98.94%	Reliable
RPP	99.44%	Reliable
LKPD	98.27%	Reliable
Problem Solving Ability Test Instrument	86.83%	Reliable
Self-Efficacy Questionnaire	96.83%	Reliable

Table 4 and Tabel 5 above shows that the products made are reliable with an average PA of 75%.

The results of the validity and reliability obtained show that the PBL integrated STEM approach to science learning tools is feasible to use. However, there are still some suggestions for product improvement from expert validators such as adding reward activities to lesson plans, then improving color contrast on LKPD, and simplifying sentence structure in self-efficacy questionnaires and instruments about problem-solving skills.

These suggestions are then used as a reference for researchers in improving the product, even though the validity and reliability results obtained are quite high and the product is feasible to use. It also aims to perfect the product before the implementation stage.

The fourth stage in this research is the implementation stage, where this stage can only be carried out if the results obtained at the development stage show valid and reliable (proper) then the product can be implemented.

The last is the evaluation stage where at this stage data processing is carried out on the results of the assessment and conclusions are drawn (Rustandi & Rismayanti, 2021).

Conclusion

The development of a PBl model of science learning tools integrated with the STEM approach to improving students' problem-solving abilities and self-efficacy is feasible to use. This is indicated by the acquisition of an average validity for the syllabus, lesson plans, worksheets, solving ability test instruments, and the self-efficacy questionnaire is > 3.26, which means it is included in the very valid category. While product reliability reaches an average of >90%, which means that the product being developed is reliable.

References

Adiwiguna, P. S., Dantes, N., & Gunamantha, I. M. (2019). Pengaruh Model Problem Based Learning (PBL) Berorientasi STEM Terhadap Kemampuan Berpikir Kritis dan Literasi Sains Siswa Kelas V SD di Gugus I Gusti Ketut Pudja. *Jurnal Pendidikan Dasar Indonesia*, *3*(2), 94–103.

Agustina, K., Sahidu, H., & Gunada, I. W. (2020). Pengaruh Model Pembelajaran Inkuiri Terbimbing Berbantuan Media PheT Terhadap Kemampuan Pemecahan Masalah dan Berpikir Kritis Fisika Peserta Didik SMA. *Jurnal Pendidikan Fisika Dan Teknologi*, *6*(1), 17–24. https://doi.org/10.29303/jpft.v6i1.1514

Ananda, P. N., & Salamah, U. (2021). Meta Analisis Pengaruh Integrasi Pendekatan STEM dalam Pembelajaran IPA Terhadap Kemampuan Berpikir Kritis Peserta Didik. *Jurnal Penelitian Pembelajaran Fisika*, *7*(1), 54–64. https://doi.org/10.24036/jppf.v7i1.111634

Aprilia, T., Sutrio, S., & Sahidu, H. (2020). Pengembangan Perangkat Pembelajaran Model Quantum Learning Untuk Meningkatkan Self-Efficacy Fisika Peserta Didik. *Jurnal Ilmiah Profesi Pendidikan*, *5*(2), 138–144. https://doi.org/10.29303/jipp.v5i2.129

Arningsih, N. P. W. D., Suardana, I. N., & Selamet, K. (2018). Komparasi Model Pembelajaran Kooperatif Tipe Teams Asissted Individualization dan Model Pembelajaran Kooperatif Tipe Student Team Achievement Divisions Terhadap Kemampuan Pemecahan Masalah Ipa Siswa Kelas VIII SMP. *Jurnal Pendidikan Dan Pembelajaran Sains Indonesia (JPPSI)*, *1*(2), 96. https://doi.org/10.23887/jppsi.v1i2.17217

Athifah, N., Zain, M. I., & Ermiana, I. (2022). Pengembangan Media Pembelajaran Pop-Up Book Pada Pembelajaran Bahasa Indonesia Materi Pantun. *Journal of Classroom Action Research*, *4*(3), 187–195. https://doi.org/10.29303/jcar.v4i3.2063

Borich, G. D. (1994). *Observation Skill for Effective Teaching*. Macmillan Publishing Company.

Hussein, M. H., Ow, S. H., Cheong, L. S., Thong, M. K., & Ale Ebrahim, N. (2019). Effects of Digital Game-Based Learning on Elementary Science Learning: A Systematic Review. *IEEE Access*, *7*, 62465–62478. https://doi.org/10.1109/ACCESS.2019.2916324

Mardiyanti, H. S. (2020). Penerapan Model Pembelajaran Problem Based Learning untuk Meningkatkan Kemampuan Berpikir Kritis Siswa Kelas X MIPA-2. *Journal of Classroom Action Research*, *2*(1), 1–8. https://doi.org/10.29303/jcar.v2i1.395

Nahdi, D. S., Yonanda, D. A., & Agustin, N. F. (2018). Upaya Meningkatkan Pemahaman Konsep Siswa Melalui Penerapan Metode Demonstrasi Pada Mata Pelajaran Ipa. *Jurnal Cakrawala Pendas*, *4*(2), 9–16.

Rahmawati, T., Nurhasanah, N., Habibi, M. A. M., & Suarta, I. N. (2023). Journal of Classroom Action Research. *Journal of C;Assroom Action Research*, *5*(1), 163–170. https://doi.org/10.29303/jcar.v5i1.2766

Rustandi, A., & Rismayanti. (2021). Penerapan Model ADDIE dalam Pengembangan Media Pembelajaran di SMPN 22 Kota Samarinda. *Jurnal Fasilkom*, *11*(2), 57–60. https://doi.org/10.37859/jf.v11i2.2546

Safithri, R., Syaiful, S., & Huda, N. (2021). Pengaruh

Penerapan Problem Based Learning (PBL) dan Project Based Learning (PjBL) Terhadap Kemampuan Pemecahan Masalah Berdasarkan Self Efficacy Siswa. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *5*(1), 335–346. https://doi.org/10.31004/cendekia.v5i1.539

Septiani, I., Lesmono, A. D., & Harimukti, A. (2020). Analisis Minat Belajar Siswa Menggunakan Model Problem Based Learning dengan Pendekatan STEM Pada Materi Vektor di Kelas X MIPA 3 SMAN 2 Jember. *Jurnal Pembelajaran Fisika*, *9*(2), 64–70. https://doi.org/10.19184/jpf.v9i1.17969

Setiawan, E., & Indana, S. (2021). Validitas LKPD Berbasis PjBL pada Materi Klasifikasi Tumbuhan Spermatophyta untuk Melatih Ketrampilan Berpikir Kreatif Siswa Kelas X SMA. *Berkala Ilmiah Pendidikan Biologi (BioEdu)*, *10*(2), 250–256. https://doi.org/10.26740/bioedu.v10n2.p250-256