

SCIENCE LEARNING AND CRITICAL THINKING ABILITIES OF JUNIOR HIGH SCHOOL STUDENTS

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Submit : 10 Agustus 2024

Accepted : 19 September 2024

Publish : 25 September 2024

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Abstract

This research was conducted to produce learning tools that are suitable to support the improvement of students' critical thinking skills. More specifically, the tools developed are learning implementation plans, student worksheets, teaching materials, and learning outcome tests. The development model uses the Dick and Carey research model with research limitations on the validity and practicality aspects of learning tools. The results of the study show that in terms of validity, the tools developed have very valid results with achievements in the very good category as a result of the development carried out seriously in order to improve the quality of teaching and learning in the classroom.

Keywords: Critical thinking, device development, science learning.

INTRODUCTION

Science learning directs students to learn about things around them to train students to think deeply and be able to apply them in everyday life. The science learning process emphasizes providing direct experience to develop competencies so that students are able to understand various events in nature from a certain perspective (Fahmi et al., 2021; Irhasyuarna et al., 2022; Fajeriadi et al., 2023; Farida and Fahmi, 2024). The expected abilities can emerge over time so as to foster high-level (critical) thinking skills in students (Fahmi, 2018; Fahmi et al., 2019; Putri et al., 2021; Irhasyuarna et al., 2023).

Critical thinking skills in science learning can be trained by making students learn to think about finding the relationship between natural phenomena and school subject matter (Fahmi and Irhasyuarna, 2019). Improving critical thinking skills for students is expected to bring improvements in various aspects of life to face the challenges of the development of the times (Norhasanah et al., 2021; Noor et al., 2023; Kusasi et al., 2024). So that the learning process in schools will produce students who are able to make good contributions to progress, even though it is still on a small scale.

Science learning in schools until now still tends to be delivered conventionally where the focus of learning only focuses on aspects of memorizing and being able to answer questions (Fahmi et al., 2022; Nikmah et al., 2023). Teachers are more dominant in teaching and learning interactions, resulting in students tending to be passive and causing boredom in the classroom (Istiyadji et al., 2022; Hidayah et al., 2023; Lestari et al., 2023). This has an impact on the lack of training in students' critical thinking skills. In fact, students' critical thinking skills must be trained early and as often as possible so that students are able to make decisions quickly and accurately when a problem occurs.

This study was conducted as an initial study to present learning problems experienced by students based on various sources of research data and questionnaires to teachers at school. The first data source was taken from data from the Ministry of Education and Culture's education assessment center, showing that the average achievement results for the 2019 National Science Examination were less than 50% of the total number of junior high school students in Indonesia. This shows that the critical thinking skills of junior high school students in Indonesia are still far from the expected level.

This data shows the need for innovation to help students improve their thinking skills (Fahmi et al., 2021; Istiyadji et al., 2022; Putra et al., 2023). Among the steps that can be taken are by making improvements in the implementation of learning, including developing learning tools that are designed to be able to improve students' critical thinking skills. The development of learning tools is seen as very necessary as a solution so that learning objectives can be achieved with encouraging results.

METHOD

This research was conducted using research on the development of learning devices with Tessmer's (1998) formative evaluation development model, namely by developing learning implementation plans (RPP), student worksheets (LKPD), teaching materials, and evaluation questions.

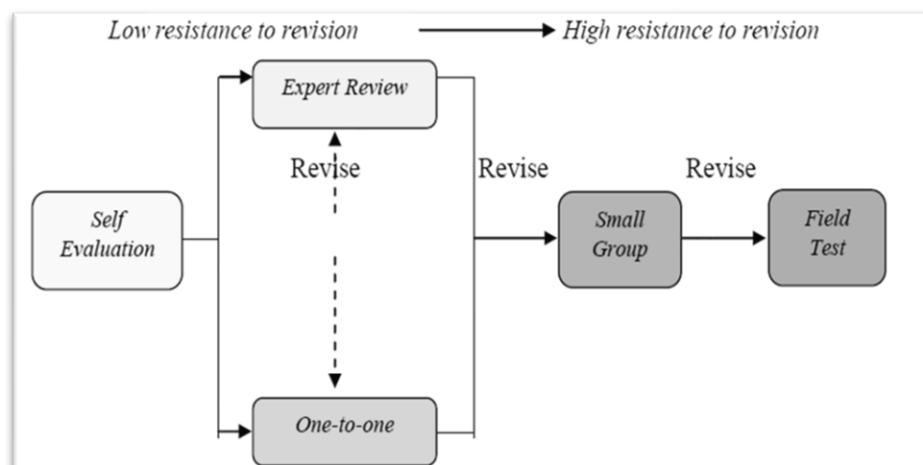


Figure 1. Tessmer's Formative Evaluation Development Model

All developed devices are given limitations until the stage of developing teaching materials and validation by experts. The results of the development of the developed devices are validated by 3 science learning experts and 2 field practitioners who are senior teachers. Furthermore, the validity value is the average score given by the five validators divided by the maximum score multiplied by 100; then adjusted to the validity criteria: 80.00% - 100% (very valid); 70.01% - 79.99 (valid); 50.00% - 69.99% (less valid); and <50.00% (invalid).

RESULTS AND DISCUSSION

The design of the learning device development developed is described in Table 1 below.

Table 1. Lesson Plan Validation Results

Assessment Aspects	Value	Criteria
1. Completeness of lesson plan components	90	Very valid
2. Completeness of student preparation activities for learning.	85	Very valid
3. Clarity and logic of learning objective formulation	90	Very valid
4. Completeness of learning objective formulation.	80	Very valid
5. There is integration of problem-solving skills in lesson plan	90	Very valid
6. Completeness of preliminary (beginning), core, and closing (end) activities	90	Very valid
7. Appropriateness of steps with learning objectives and time allocation	85	Very valid
8. There are activities to practice problem-solving skills	90	Very valid
9. Learning steps are aligned between teachers and students	90	Very valid
10. Student-centered	85	Very valid
11. Utilization of learning resources available in the environment	95	Very valid
12. Including assessment instruments	90	Very valid
Average	97.75	Very valid

Table 1 shows that the results of the assessment of the validation of the RPP learning implementation plan by the five validators are in the very valid category with an average of 97.75. The suggestions for improvement from the validators include motivation needs to be equipped with pictures, apperception needs to be clarified what is being asked, remember ABCD in the learning objectives, re-learn about the closing process standards.

Table 2. LKPD Validation Results

Assessment Aspects	Value	Criteria
1. LKPD emphasizes the problem-solving process aspect	95	Very valid
2. Accuracy of the cases presented with the material being taught	90	Very valid
3. Systematic sequence to train problem-solving skills	95	Very valid
4. Use of interesting images that support the cases presented	95	Very valid
5. LKPD design attracts students' interest in reading LKPD	85	Very valid
Average	92	Very valid

Table 2 shows the results of the validation assessment of student worksheets covering 5 aspects of sheet development assessment with 4 aspects in the very valid category. The overall average validation result is 92 in the very valid category. Input and suggestions from the validator include the following: It is necessary to simplify the format and presentation of the LKPD, for example, the observation data table is made clearer, some terms about variables are likely not understood by students, add images that are relevant to the LKPD and learning objectives and use more detailed writing to explain the work steps in the LKPD so as to prevent errors in carrying out practicums.

Table 3. Results of Validation of Teaching Materials

Assessment Aspects	Value	Criteria
1. Assessment categories according to problem-solving ability indicators	90	Very valid
2. Suitability of questions with the material that has been taught	100	Very valid
3. Clear scoring guidelines to measure problem-solving ability	100	Very valid
4. Suitability of the time limit for completing the work with the number of questions given	100	Very valid
5. Design that attracts students' attention	90	Very valid
Average	96	Very valid

Table 4. Evaluation Question Validation Results

Assessment Aspects	Value	Criteria
1. The teaching material is relevant to the competencies that must be mastered by students	100	Very valid
2. The depth of the description is in accordance with the level of development of the students	95	Very valid
3. The teaching material presented is in accordance with scientific truth	100	Very valid
4. The teaching material presented is in accordance with the latest developments	90	Very valid
5. The teaching material presented is in accordance with everyday life	100	Very valid
6. Encourage students' curiosity to read teaching materials	90	Very valid
7. Encourage interaction between students and learning resources	95	Very valid
8. Encourage students to build their own knowledge	90	Very valid
9. The systematic sequence of teaching materials is in accordance with the RPP guidelines	95	Very valid
10. The sentence structure is in accordance with the level of understanding of students	95	Very valid
11. Making paragraphs/paragraphs in accordance with the level of understanding of students.	85	Very valid
12. Use of images that support the explanation/description of teaching materials	95	Very valid
13. Presentation of images is accompanied by image captions	100	Very valid

Assessment Aspects	Value	Criteria
14. Accuracy of the use of spelling that refers to EYD standards	85	Very valid
15. Accuracy of the arrangement of sentence structures that refer to EYD standards	85	Very valid
Average	93,33	Very valid

From Table 3, it is known that the results of the teaching material validation assessment include 15 aspects of teaching material assessment with all aspects categorized as very valid with an overall average of 93.33 in the very valid category. The suggestions from the validator include the following: Improve the cover then make it more attractive, try to make the images and letters used clear and must be the right size, add information on examples of the latest optical devices.

Table 4 shows that the results of the evaluation question sheet validation assessment in 5 aspects then all aspects are in the very valid category. Overall, the results of the learning outcome assessment validation have an average of 96 with a very valid category. The suggestions from the validator include the use of authentic problems in learning, not conceptual, adjusting questions to learning objectives, explaining the division of scores in each question, especially for qualitative questions.

The learning tools developed are declared very valid because they meet various validity criteria by experts and practitioners (Putra et al., 2021; Miranti et al., 2022; Noor et al., 2023; Fajeriadi et al., 2024). It is very valid to be an indicator that the developed device is planned with full sincerity with the aim of improving the teaching and learning process in the classroom (Putri et al., 2021; Istyadi et al., 2022; Kusasi et al., 2022). Maximum preparation is carried out before teaching to prevent various things that might happen that will hinder learning objectives.

CONCLUSION

Innovation in the form of developing learning tools to improve students' thinking levels needs to be continuously carried out. Continuous improvement has been proven to improve critical thinking skills. Innovation and improvement in the learning process have a long-term impact on the progress of education and the progress of the nation and state.

BIBLIOGRAPHY

- Fahmi, F., Abdullah, A., & Irhasyuarna, Y. (2021). Empowering peat lands as a resource of learning natural science to strengthening environment care. *The 2nd International Conference on Social Sciences Education* (ICSSE 2020), 426-429. <https://doi.org/10.2991/assehr.k.210222.072>
- Fahmi, F., Chalisah, N., Istyadi, M., Irhasyuarna, Y., & Kusasi, M. (2022). Scientific literacy on the topic of light and optical instruments in the innovation of science teaching materials. *Jurnal Inovasi Pendidikan IPA*, 8(2). <https://doi.org/10.21831/jipi.v8i2.41343>
- Fahmi, F., Fajeriadi, H., Irhasyuarna, Y., Suryajaya, S., & Abdullah, A. (2021). The practicality of natural science learning devices on the concept of environmental pollution with problem-solving learning models. In *Journal of Physics: Conference Series* (Vol. 2104, No. 1, p. 012025). IOP Publishing. <https://doi.org/10.1088/1742-6596/2104/1/012025>
- Fahmi & Irhasyuarna, Y. (2019). *Pengantar pendidikan: Manusia, pendidikan, dan perkembangan zaman*. Banjarmasin: Program Studi Magister Keguruan IPA PPs ULM.

- Fahmi, F., Setiadi, I., Elmawati, D., & Sunardi, S. (2019). Discovery learning method for training critical thinking skills of students. *European Journal of Education Studies*. <https://doi.org/10.5281/zenodo.3345924>
- Fahmi, F. (2018). Pengembangan perangkat pembelajaran untuk melatih keterampilan berpikir kritis peserta didik SMP pada materi klasifikasi benda. *Tesis*. S2 Keguruan IPA PPs ULM.
- Fajeriadi, H., Zaini, M., Dharmono, D., Nugroho, B. A., Fahmi, F., & Fitriani, A. (2024). The popular scientific book-based coastal gastropod's diversity as local potential: Practicality and effectiveness on student's critical thinking ability. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, 10(2), 580-590. <https://doi.org/10.22219/jpbi.v10.i2.32255>
- Farida, L & Fahmi. (2024). Inkuiri terbimbing dan peningkatan keterampilan proses sains siswa SMA pada materi asam basa. *Indonesian Journal of Science Education and Applied Science*, 4(1), 32-48. <https://doi.org/10.20527/i.v4i1.13311>
- Hidayah, S., Irhasyurna, Y., Istyadji, M., & Fahmi, F. (2023). Implementation of merdeka belajar differentiated instruction in science learning to improve student's science literacy. *Jurnal Penelitian Pendidikan IPA*, 9(11), 9171-9178. <https://doi.org/10.29303/jppipa.v9i11.3637>
- Irhasyurna, Y., Kusasi, M., Fahmi, F., Fajeriadi, H., Aulia, W. R., Nikmah, S., & Rahili, Z. (2022). Integrated science teaching materials with local wisdom insights to improve students' critical thinking ability. *BIO-INOVED: Jurnal Biologi-Inovasi Pendidikan*, 4(3), 328-334. <http://dx.doi.org/10.20527/bino.v4i3.14148>
- Irhasyurna, Y., Yamin, M., Fahmi, Yulianti, Y. E., Muslim, M., Rahmati, P. D., Maulidia., & Sadiqin, I. K., Rahman, M. R., Ali, A. C. (2023). Mapping critical thinking skills of junior high school students in the city of a Thousand Rivers based on local wisdom. *Journal of Banua Science Education* 4(1), 1-9. <https://doi.org/10.20527/jbse.v4i1.235>
- Istyadji, M., Sauqina., Hafizhah, N., & Fahmi. (2022). The validity and practicality of prezi learning media on the role of soil and soil organisms for life sustainability for junior high school students. *Jurnal Penelitian Pendidikan IPA*, 8(2), 481-488. <https://doi.org/10.29303/jppipa.v8i2.1158>
- Istyadji, M., Yulinda, R., Amalina, D., & Fahmi. (2022). Validity and practicality of articulate storyline learning media on environmental pollution materials for junior high school students. *Jurnal Penelitian Pendidikan IPA*, 8(6), 2599-2604. <https://doi.org/10.29303/jppipa.v8i6.1639>
- Kusasi, M., Fahmi, F., Sanjaya, R. E., Riduan, M., & Anjani, N. (2021). Feasibility of STEM-based basic chemistry teaching materials to improve students' science literature in wetland context. In *Journal of Physics: Conference Series* (Vol. 2104, No. 1, p. 012022). IOP Publishing. <https://doi.org/10.1088/1742-6596/2104/1/012022>
- Kusasi, M., Sunarno., Fahmi., & Amin, M. H. (2024). Tetrahedral representative-based reaction kinetics teaching materials with an ethnoscience approach to improve students' critical thinking ability. *J Adv Educ Philos*, 8(5), 336-344. <https://saudijournals.com/journal-details/jaep/167/1721>
- Lestari, W., Sari, M. M., Istyadji, M., & Fahmi, F. (2023). Analysis of Implementation of the Independent Curriculum in Science Learning at SMP Negeri 1 Tanah Grogot Kalimantan Timur, Indonesia. *J Adv Educ Philos*, 7(6), 199-207.
- Miranti, K., Rusyadi, A., & Fahmi, F. (2022). Melatih keterampilan psikomotorik siswa melalui penggunaan lembar kerja siswa (LKS). *Journal of Banua Science Education*, 2(2), 93-98. <https://doi.org/10.20527/jbse.v2i2.106>

- Nikmah, S., Istyadji, M., & Sari, M. M., Fahmi, F. (2023). Analysis of implementation of the merdeka curriculum in science learning at SMP Negeri 4 Hulu Sungai Tengah. *Jurnal Penelitian Pendidikan IPA*, 9(9), 7339-7345. <https://doi.org/10.29303/jppipa.v9i9.3807>
- Noor, A. F., Yunus, R., Suyidno, S., & Fahmi, F. (2023). Development of predict-observe-explain (POE) based authentic problems' instructional package to improve students' critical thinking skills. *Jurnal Pendidikan Matematika dan IPA*, 14(1), 69-81. <http://dx.doi.org/10.26418/jpmipa.v14i1.53932>
- Norhasanah, N., Ruswaty, R., Fahmi, F., & Putri, M. I. (2021). Critical thinking skills and students' learning outcomes in learning biology of mushroom concept at SMA Negeri 4 Barabai. *Journal of Banua Science Education*, 2(1), 25-34. <https://doi.org/10.20527/jbse.v2i1.57>
- Putra, A. P., Suyidno, S., Utami, N. H., Fahmi, F., & Prahani, B. K. (2023). Development of STEM learning based on riverbanks local wisdom. In *E3S Web of Conferences* (Vol. 400, p. 02001). EDP Sciences. <https://doi.org/10.1051/e3sconf/202340002001>
- Putra, A. P., Suyidno, S., Utami, N. H., & Fahmi, F. (2021). *Pembelajaran STEM berbasis kearifan lokal di bantaran sungai Barito*. Banjarmasin: CV Batang.
- Putri, M. H., Fahmi, F., & Wahyuningsih, E. (2021). Efektivitas perangkat pembelajaran IPA untuk melatih keterampilan berpikir kritis peserta didik SMP pada materi pokok listrik statis. *Journal of Banua Science Education*, 1(2), 79-84. <https://doi.org/10.20527/jbse.v1i2.13>
- Tessmer, M. (1998). *Planning and conducting formative evaluation*. London: Kogan Page.

PEMBELAJARAN IPA DAN KEMAMPUAN BERPIKIR KRITIS PESERTA DIDIK SMP

Abstrak

Penelitian ini dilakukan menghasilkan perangkat pembelajaran yang layak untuk menunjang peningkatan kemampuan berpikir kritis peserta didik. Lebih spesifik perangkat yang dikembangkan adalah rencana pelaksanaan pembelajaran, lembar kerja peserta didik, materi ajar, dan tes hasil belajar. Model pengembangan menggunakan model penelitian Dick and Carey dengan batasan penelitian pada aspek kevalidan dan kepraktisan perangkat pembelajaran. Hasil penelitian menunjukkan bahwa pada aspek validitas, perangkat yang dikembangkan memiliki hasil sangat valid dengan ketercapaian dalam kategori sangat baik sebagai akibat dari pengembangan yang dilakukan secara sungguh-sungguh demi memperbaiki kualitas belajar-mengajar di dalam kelas.

Kata kunci: Berpikir kritis, pembelajaran IPA, pengembangan perangkat.