

# The Validity of Problem Based Learning (PBL)-Based Global Warming E-Module

Nia Anggraeni<sup>1\*</sup>, Sentot Budi Rahardjo<sup>2</sup>, Harlita<sup>3</sup>

<sup>1</sup> Science Education Study Program FKIP Universitas Sebelas Maret Surakarta, Indonesia.

<sup>2</sup> Chemistry Study Program FMIPA Universitas Sebelas Maret Surakarta, Indonesia.

<sup>3</sup> Biologi Education Study Program FKIP Universitas Sebelas Maret Surakarta, Indonesia.

Received: July 30, 2022

Revised: October 31, 2022

Accepted: November 25, 2022

Published: November 30, 2022

Corresponding Author:

Nia Anggraeni

[niaanggraeni814@gmail.com](mailto:niaanggraeni814@gmail.com)

© 2022 The Authors. This open access article is distributed under a (CC-BY License)



DOI: [10.29303/jppipa.v8i5.1934](https://doi.org/10.29303/jppipa.v8i5.1934)

**Abstract:** This study aims to determine the the validity of problem based learning (PBL)-based global warming e-module as learning media to improve critical thinking ability of students seen from the validation of media, material and language experts. This research was developed using a 4D model which consisted of 4 stages, namely define, design, develop, and disseminate. However, in this study it only reached the develop stage. This study uses an E-Module validation sheet. Based on the validation results, it shows that the developed global warming e-module obtains a percentage for media expert validation of 86.66% with a very valid category, material expert validation gets a percentage of 89.33% with a very valid category and linguist validation gets a percentage of 96.36% are in the very valid category used as learning media to improve critical thinking ability of students.

**Keywords:** E-Module; Problem based learning; Global warming; Critical thinking; Validity

## Introduction

Learning Natural Science is related to how to systematically find out about nature, so that Natural Science is not only the mastery of a collection of knowledge in the form of facts, concepts, or principles, but is a process of discovery (Wenno, 2010). Natural Science has components consisting of products, processes and attitudes (Wahyudiana et al., 2021). The product includes all facts, concepts, principles, laws, theories and knowledge. Processes include thought processes and scientific processes for discovering and developing concepts and knowledge. While attitudes include scientific attitudes such as curiosity, objective and honest. These three components must be fulfilled in its entirety, so that it can be said as a science as a whole (Nurjanah et al., 2021).

Based on the core competencies of graduates of the 2013 curriculum in the skill aspect, students are required to have the ability to think effectively and creatively in

abstract and concrete realms (Kemendikbud, 2013). One of the abilities to think in the abstract realm is the ability to think critically (Pratama et al., 2017). The ability to think critically is an important thing, but the reality on the ground is not as expected. The critical thinking skills of junior high school students in Indonesia are still relatively low. This is based on the four-year International Trends in International Mathematics and Science Study (TIMSS) study conducted on junior high school students with the characteristics of high cognitive level questions that can measure students' critical thinking skills, showing that Indonesian students are consistently ranked lower (Karim et al., 2018).

The problem of low students' critical thinking skills also occurs at SMP Negeri 26 Surakarta. The results of pre-research observations at SMP Negeri 26 Surakarta regarding the learning that has been used so far with the demands of the 2013 curriculum, found a gap between the demands of the 2013 curriculum and the reality on the ground. The implementation of science learning at SMP Negeri 26 Surakarta so far has used the lecture

## How to Cite:

Anggraeni, N., Rahardjo, S. B., & Harlita, H. (2022). The Validity of Problem Based Learning (PBL)-Based Global Warming E-Module. *Jurnal Penelitian Pendidikan IPA*, 8(5), 2335-2340. <https://doi.org/10.29303/jppipa.v8i5.1934>

method more often, including in the delivery of Global Warming material. Global Warming material is one of the natural science materials for class VII SMP/MTs in the 2013 curriculum. So far, Global Warming material has only been taught through teacher-centered learning in class, so in its implementation it must be assisted with teaching materials that support so that students can understand the material. This resulted in when the teacher delivered the lesson, students sat quietly in class, but paid less attention to the teacher because they often looked outside the class. When conducting debriefing and asking students to discuss in groups to work on the LKS, it was only seen that students were good at doing assignments, while other students were not involved in work because they only chatted with their desk mates and even disturbed their other friends. This is one of the causes of students' thinking skills which tend to be low, due to a lack of a sense of responsibility in carrying out the tasks assigned to their respective groups. This is in line with research conducted by Yazdanparast et al. (2013) that only 5.1% of 1035 students could explain the greenhouse effect correctly. Research conducted by Freije et al. (2017) also stated that only 10.18% of a sample of 143 students understood the topic of global warming.

This is caused by several factors, one of which is the learning resources used are still fixated on printed books in the library. The use of electronic school books (BSE) for Science class VII SMP shows that the training in critical thinking skills in these books has not been utilized optimally. Students have not been trained to interpret, self-regulate, evaluate and explain. Students are immediately presented with experimental activities and what is available is the formulation of the problem, the steps of the activities carried out to solve the problem, and asking students to make conclusions (Suhendra, 2020). These problems result in a low level of students' critical thinking so that students cannot solve problems and offer solutions and students become individuals who tend to misinterpret learning concepts (Luzyawati, 2018).

Empowering critical thinking in students needs to be done so that students can solve various problems that exist in everyday life (Zubaidah, 2017). Critical thinking in students can not only be seen from the ability of students to answer or solve problems, but also can be seen from the ability and quality of questions asked by students, because basically students have critical thinking skills in learning, for example skills in asking, hypotheses, classification, observation and interpretation (Yustyan et al., 2016). Critical thinking will not increase if students are not required to be active in the teaching and learning process (Damanik, 2013). Most teachers still apply learning that does not refer to students' critical thinking skills. The teacher's lack of

creativity in using learning models in class causes the implementation of learning to tend to be passive and monotonous (Saputra, 2015; Kasanah et al., 2019).

Critical thinking skills should be empowered through learning in schools, especially science learning, because critical thinking skills are 21<sup>st</sup> century thinking skills that students must have (Rosyida et al., 2016). Critical thinking skills can be grown with material content that is not related to specific knowledge, but tends to be described in problems that students encounter in everyday life (Lai, 2011). One learning model that uses problems in contextual life for students to learn how to think critically is Problem Based Learning (PBL) (Susilawati et al., 2022; Doyan et al., 2020).

PBL presents problems that have occurred then students are asked to find information through other learning resources by involving thinking skills and other skills both individually and collaboratively (Kiswanto, 2017; Doyan et al., 2020). So that in the learning process each student is actively involved in finding that information. It is hoped that by using PBL-based electronic modules, students' critical thinking skills will further improve.

Electronic modules based on PBL were developed by providing problems in everyday life and then students analyze and conduct investigations of the problems that occur. The effectiveness of this module is that students can be more active in thinking and understanding the material by conducting investigations and inquiries of real problems around them so that students get a deeper and more meaningful impression of what they are learning. In addition, when viewed from its function, the module can give students more time to independently study the material being taught. As an effort to adjust to the times, modules are made in electronic form so that they are more practical and efficient (Kimianti et al., 2019).

Science learning at SMP Negeri 26 Surakarta has not used modules as a supplement to student learning resources. Science learning that is implemented does not activate students so that it causes students to be passive in learning, and so far science learning has only focused on aspects of knowledge, this causes critical thinking skills to not be maximized. The solution to this is that learning must be packaged in an interesting learning module and develop students' thinking skills.

Based on the above background, it is hoped that the problem based learning (PBL)-based global warming e-module can be a solution to improve students' critical thinking skills. The purpose of this study was to determine the feasibility of the problem based learning (PBL)-based global warming e-module as a learning medium to improve students' critical thinking skills in terms of media, language and material experts.

## Method

This research is a type of Research and Development (R&D) which refers to the 4D model which consists of 5 stages, namely define, design stage, develop stage, disseminate stage (Muryanto et al., 2016). However, due to time constraints it is limited only to the develop stage. This research resulted in a problem based learning (PBL)-based global warming e-module as learning media to improve critical thinking ability of students.

The e-modules that have been developed are then validated by expert lecturers to determine the feasibility level. Module feasibility data was obtained from validators including material experts, media experts and language experts. The data obtained will be divided into two, namely qualitative data and quantitative data. Qualitative data, namely in the form of a questionnaire by experts and modified with suggestions or input below which can be used for module improvement. Meanwhile, quantitative data will analyze the data by determining the highest value and adding up the values of each validator. Validation assessment uses a Likert scale as in Table 1.

**Table 1.** Likert Scale (Riduwan, 2015)

Category	Scale
Invalid	1
Less valid	2
Valid enough	3
Valid	4
Very valid	5

The value obtained is then converted into a percentage using the percentage formula and measured by category because it is interval data.

$$P(\%) = \frac{\sum \text{Data Collection Result Score}}{\text{Criteria score}} \times 100\% \quad (1)$$

The assessment criteria are obtained from the criteria score = highest score x number of aspects x number of respondents. The data obtained is then interpreted on a percent scale as in Table 2.

**Table 2.** Likert Scale Percentage (Riduwan, 2015)

Category	Scale Value (%)
Invalid	0-20
Less valid	21-40
Valid enough	41-60
Valid	61-80
Very valid	81-100

The developed media is said to be valid if the validator's assessment meets the percentage results  $\geq 61\%$  with valid to very valid categories.

## Result and Discussion

The development of the problem based learning (PBL)-based global warming e-module as learning media to improve critical thinking ability of students uses a 4D development model which consists of 4 stages, but in this study it only reached the third stage. The results of the research based on the 4D model can be described as follows:

### Define Stage

The defining stage is carried out to formulate and describe various needs in learning activities and accumulate various information related to e-module development products. At this stage an analysis is carried out to identify the problems faced by students in the learning process. The analysis carried out is an analysis of curriculum, basic competencies, learning indicators and material analysis of global warming. After that, the student's analysis of the learning resources that have been used so far in learning resulted that so far the teacher used printed books from the library more often, and had never used E-Modules in learning. Students also need new learning resources that can make students more active in the learning process.

### Design Stage

The next stage is design or planning which is a continuation of the defining stage. The planning stage is carried out to design a content framework and outline of a product to be developed, namely the problem based learning (PBL)-based global warming e-module as learning media to improve critical thinking ability of students. Planning includes the preparation of material that is in accordance with the competencies and learning objectives as well as learning that is adapted to the syntax of the PBL model and is equipped with students' critical thinking questions. The preparation of the E module is packaged using the Flip-PDF Corporate application because this application is not limited to just writing but can include motion animation, video and audio which can make an interesting interactive learning media.

### Develop Stage

The develop or development stage is a continuation of the analysis stage which includes product creation and validation assessment by experts. Making teaching materials begins with determining the teaching materials to be used, namely E-Modules that are able to improve students' critical thinking skills. The initial creation of the e-module begins with compiling material based on learning objectives. Making a cover design using Canva as well as images related to global warming material. The following is the cover display in Figure 1.

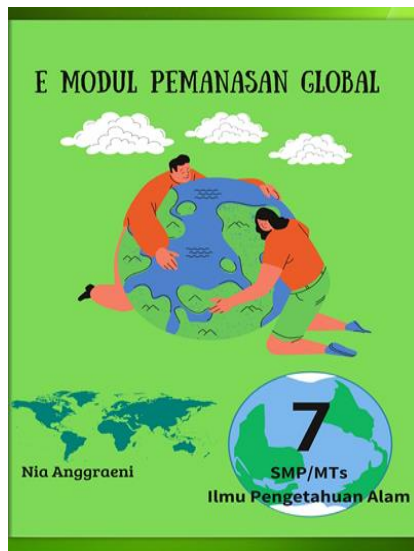


Figure 1. Display of the e-module cover

The creation of the e-module is then adjusted to the storyboard that has been made by compiling the elements of the e-module using the Flip-PDF Corporate application into an interactive e-module equipped with materials, discussions, critical thinking questions and illustration pictures and explanatory videos. The following is a picture of the material and discussion contained in the e-module.

Next is the assessment of the experts. Assessment or validation from experts aims to determine the quality of the learning media that has been made. This assessment was carried out by 3 expert lecturers from Sebelas Maret University Surakarta. The aspects assessed include media, material and language experts. Assessment is carried out using a rating scale of one to five on each question. The results of media, material and language validation can be seen in table 3.



Figure 2. Description of the material in the e-module

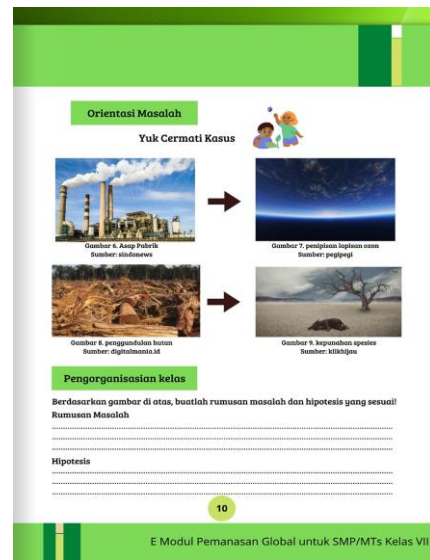


Figure 3. Discussion on the e-module

Table 3. Validation Results

Aspect	Score (%)	Category
Media	86.66	Very Valid
Theory	89.33	Very Valid
Language	96.36	Very Valid

Viewed from the aspect of validation by media experts, the level of validity of this e-module is 86.66% with a very valid category. The high level of validity from the media aspect is because this e-module is equipped with videos, as well as supporting images that can support students' understanding of the material (Kamila et al., 2018). Media validation consists of aspects of media introduction, media display and utilization. The results of the media expert validator's assessment of the resulting e-module products can be seen in Table 4.

Table 4. Media Validation Results

Aspect	Score (%)	Category
Media Introduction	93.33	Very Valid
Media View	86.66	Very Valid
Utilization	80.00	Valid

In terms of material, the validity level of the e-module is 89.33% with a very valid category. The purpose of material validation is to determine the accuracy and suitability of the learning materials contained in the e-module. Material validation consists of preliminary aspects, material aspects, and learning aspects. The results of the material expert validator's assessment of the resulting e-module products can be seen in Table 5.



**Table 5.** Material Validation Results

Aspect	Score (%)	Category
Introduction	90.00	Very Valid
Theory	87.27	Very Valid
Learning	90.00	Very Valid

**Table 6.** Language Validation Results

Aspect	Score (%)	Category
Straightforward and Communicative	100.00	Very Valid
Dialogic and interactive	100.00	Very Valid
Suitability with student development	100.00	Very Valid
Conformity with the rules of language	80.00	Very Valid
Consistency and integration of thought flow	100.00	Very Valid

Meanwhile, from the language aspect, the e-module gets a very valid category with a percentage of 96.36%. The high level of validity from the language aspect is because the language written in the e-module is adjusted to the level of understanding of seventh grade students of junior high school. The language used is Indonesian which is communicative. One indicator of language feasibility is the use of communicative language. Communicative language is a way of using language in accordance with the functions of language communication so that it is easy for readers to understand (Nur Yastini et al., 2018). Linguist validation consists of straightforward and communicative, dialogic and interactive aspects, suitability for student development, conformity with language rules and coherence and integration of thought lines. The results of the linguist validator's assessment of the resulting e-module products can be seen in Table 6.

Based on the validation analysis from media, material and language experts, it can be concluded that the problem based learning (PBL)-based global warming e-module is appropriate for use as a learning medium to improve critical thinking ability of students.

## Conclusion

Based on the results of the analysis and discussion, it can be concluded that the problem based learning (PBL)-based global warming e-module that was developed is suitable for use as a learning medium to improve the critical thinking ability of class VII students in terms of the validation of media experts, material experts and linguists with very valid categories.

## Acknowledgements

The researchers would like to thank the principal of SMP Negeri 29 Surakarta, the science teacher and all students

of class VII and VIII who have allowed and provided opportunities for field observations on research and development of global warming e-module based PBL model as learning media to improve critical thinking ability of students.

## References

- Damanik. (2013). *Analisis kemampuan berpikir kritis dan sikap ilmiah pada pembelajaran fisika menggunakan model pembelajaran* (Vol. 2, Issue 2).
- Doyan, A., Susilawati, S., & Hikmawati, H. (2020). Pengaruh Penerapan Model Pembelajaran Berbasis Masalah Terhadap Hasil Belajar Pada Matakuliah Fisika Kuantum Bagi Mahasiswa Calon Guru. *ORBITA: Jurnal Kajian, Inovasi Dan Aplikasi Pendidikan Fisika*, 6(2), 278. <https://doi.org/10.31764/orbita.v6i2.2819>
- Freije, A. M., Hussain, T., & Salman, E. A. (2017). Global warming awareness among the University of Bahrain science students. *Journal of the Association of Arab Universities for Basic and Applied Sciences*, 22, 9–16. <https://doi.org/10.1016/j.jaubas.2016.02.002>
- Kamila, A., Fadiawati, N., & Tania, L. (2018). Efektivitas Buku Siswa Larutan Penyangga Berbasis Representasi Kimia dalam Meningkatkan Pemahaman Konsep. *Jurnal Pendidikan Dan Pembelajaran Kimia*, 7(2), 211–222. <https://doi.org/http://jurnal.fkip.unila.ac.id/index.php/JPK/article/view/14610>
- Karim, K., & Rahmalia, D. (2018). Kemampuan Berpikir Kritis Siswa Dalam Pembelajaran Matematika Dengan Menggunakan Model Reciprocal Teaching Di Sma Negeri 1 Rantau. *EDU-MAT: Jurnal Pendidikan Matematika*, 5(2). <https://doi.org/10.20527/edumat.v5i2.4643>
- Kasanah, S. A., Damayani, A. T., & Rofian, R. (2019). Keefektifan Model Pembelajaran Role Playing Berbantu Media Multiply Cards terhadap Hasil Belajar Siswa. *Jurnal Ilmiah Sekolah Dasar*, 3(4), 529. <https://doi.org/10.23887/jisd.v3i4.22308>
- Kemendikbud. (2013). Materi Pelatihan Guru Implementasi Kurikulum 2013 SMP/ MTs Ilmu Pengetahuan Alam. In *Badan Pengembangan Sumber Daya Manusia Pendidikan dan Kebudayaan dan Penjaminan Mutu Pendidikan Kementerian Pendidikan dan Kebudayaan* (Vol. 5, Issue 1, pp. 45–53).
- Kimianti, F., & Prasetyo, Z. K. (2019). Pengembangan E-Modul Ipa Berbasis Problem Based Learning Untuk Meningkatkan Literasi Sains Siswa. *Kwangsan: Jurnal Teknologi Pendidikan*, 7(2), 91. <https://doi.org/10.31800/jtp.kw.v7n2.p91--103>
- Kiswanto, A. (2017). The Effect Of Learning Methods And The Ability Of Students Think Logically To The Learning Outcomes On Natural Sciences Of

- Grade IV'S Student. *9th International Conference for Science Educators and Teachers (ICSET 2017)*. <https://doi.org/10.2991/icset-17.2017.168>
- Lai, E. R. (2011). Critical Thinking : A Literature Review Research Report. In *Critical Thinking* (Issue June). Pearson. <https://www.google.com/url?sa=t&rct=j&q=&esc=s&source=web&cd=&ved=2ahUKEwj2Q>
- Luzyawati, L. (2018). Analisis Kemampuan Berpikir Kritis Siswa Sma Materi Alat Indera Melalui Model Pembelajaran Inquiry Pictorial Riddle. *Edu Sains: Jurnal Pendidikan Sains & Matematika*, 5(2), 9. <https://doi.org/10.23971/eds.v5i2.732>
- Muryanto, Sunarno, W., & Ashadi. (2016). Pengembangan Modul Ipa Terpadu Tema Ekosistem Dengan Kepedulian Lingkungan Dan Kemampuan Analisis kelas 7E semester 2 SMP Negeri 1 Sragen. In *Prosiding Seminar Nasional Pendidikan Sains (SNPS)* (pp. 269–278). <https://jurnal.fkip.uns.ac.id/index.php/snps/article/view/9847/0>
- Nur Yastini, Y., Rita Nurdian, A., & Wikanengsih. (2018). Kemampuan Penggunaan Bahasa Baku Mahasiswa Progrm Studi Bahasa Indonesia IKIP Siliwangi di Media Sosial Instagram. *Parole (Jurnal Pendidikan Bahasa Dan Sastra Indonesia)*, 1(4), 475–480. <http://journal.ikipsiliwangi.ac.id/index.php/parole/article/view/821>
- Nurjanah, N., Cahyana, U., & Nurjanah, N. (2021). Pengaruh Penerapan Online Project Based Learning Dan Berpikir Kreatif Terhadap Keterampilan Proses Sains Siswa Kelas IV Pada Pelajaran IPA Di SD Nasional 1 Kota Bekasi. *Buana Pendidikan: Jurnal Fakultas Keguruan Dan Ilmu Pendidikan*, 17(1), 51–58. <https://doi.org/10.36456/bp.vol17.no1.a3161>
- Pratama, G. W., Ashadi, A., & Indriyanti, N. Y. (2017). Efektivitas Penggunaan Modul Pembelajaran Kimia Berbasis Problem-Based Learning ( PBL) Untuk Meningkatkan Kemampuan Berpikir Siswa Pada Materi Koloid Sma Kelas XI Kritis. In *Prosiding Seminar Nasional Pendidikan Sains (SNPS)* (Vol. 21, pp. 150–156). <https://doi.org/https://jurnal.fkip.uns.ac.id/index.php/snps/article/view/11406>
- Riduwan. (2015). *Skala Pengukuran Variabel Variabel Penelitian*. Alfabeta.
- Rosyida, F., Zubaidah, S., & Mahanal, S. (2016). Memberdayakan Keterampilan Berpikir Kritis dengan Model Pembelajaran Remap TmPS ( Reading Concept Map Timed Pair Share ) Empowering Critical Thinking Skills by Remap TmPS ( Reading Concept Map Timed Pair Share ) Learning Model ). *Biologi, Sains, Lingkungan, Dan Pembelajarannya Dalam Upaya Peningkatan Daya Saing Bangsa*, 13(1), 209–214.
- Saputra, D. R. (2015). Penerapan Metode Role Playing Untuk Meningkatkan Hasil Belajar IPS Pada Siswa Kelas V SD Negeri 2 Kecemen, Manisrenggo, Klaten. *Jurnal Pendidikan Guru Sekolah Dasar Edisi 10 Tahun Ke IV*, 4(10), 2.
- Suhendra, O. (2020). Modul Berbasis Masalah Pada Materi Sistem Pencernaan Makanan Untuk Meningkatkan Kemampuan Berpikir Kritis Siswa. *JEC (Journal of Education and Counseling)*, 2(1), 132–149. <http://journal.unugiri.ac.id/index.php/JEC/article/view/153>
- Susilawati, S., Rahmana, F., Kosim, K., & ... (2022). Practicality of Problem-Based Physics Learning Tools with Video Assistance to Improve Problem-Solving Ability of Students. *Journal of Science and Science Education*, 3(1), 55–59. <https://www.jpjppipa.unram.ac.id/index.php/jossed/article/view/1614%0Ahttps://www.jpjppipa.unram.ac.id/index.php/jossed/article/download/1614/1163>
- Wahyudiana, E., Sagita, J., Iasha, V., Setiantini, A., & Setiarini, A. (2021). Problem-Based Learning-Based Ipa Practicum Module To Improve Problem-Solving Ability. *Buana Pendidikan: Jurnal Fakultas Keguruan Dan Ilmu Pendidikan*, 17(2), 161–167. <https://doi.org/10.36456/bp.vol17.no2.a4341>
- Wenno, I. H. (2010). Pengembangan Model Modul IPA Berbasis Problem Solving Method Berdasarkan Karakteristik Siswa Dalam Pembelajaran Di SMP/MTs. *Cakrawala Pendidikan*, 2, 176–188.
- Yazdanparast, T., Salehpour, S., Reza Masjedi, M., Mohammad Seyedmehdi, S., Boyes, E., Stanisstreet, M., & Attarchi, M. (2013). Global warming: Knowledge and views of Iranian students. *Acta Medica Iranica*, 51(3), 178–184.
- Yustyan, S., Widodo, N., & Pantiwati, Y. (2016). Peningkatan Kemampuan Berpikir Kritis Dengan Pembelajaran Berbasis Scientific Approach Siswa Kelas X Sma Panjura Malang. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, 1(2). <https://doi.org/10.22219/jpbi.v1i2.3335>
- Zubaidah, S. (2017). Pembelajaran Kontekstual Berbasis Pemecahan Masalah untuk Mengembangkan Kemampuan Berpikir Kritis. In *Seminar Nasional Universitas Muhammadiyah Makassar* (Vol. 6, Issue June, pp. 1–17).