Development of Basic Physics-Virtual Laboratory Teaching Module Based on Science Literacy

Aziza Anggi Maiyanti*, Eva Alfi Nurlaili, Muhammad Ridwan, & Yulianti Yusal
Tadris Science, Kediri State Islamic Religious Institute, Indonesia
*Corresponding Author: azizaanggimaiyanti@iainkediri.ac.id

Received: 9th October 2024; **Accepted**: 30th November 2024; **Published**: 20th December 2024
DOI: https://dx.doi.org/10.29303/jpft.v10i2.7765

Abstract *– This research aims to develop a basic physics teaching module with a virtual laboratory to improve students' science literacy in terms of attitudes. The results of PISA 2022 illustrate that the literacy skills possessed by students in Indonesia are still in a position that is not good enough, which means that the expectations of the competence of independent curriculum graduates are still far behind. Based on the results of research conducted by Hendri in 2019, data was obtained that out of 138 students at one of the universities in Indonesia, it is known that they have science literacy skills in the low category. Supported by the initial data obtained by researchers on Tadris Science students, a result of was also obtained in the low category. Science literacy ability can be seen through two aspects, namely attitude and cognitive attitudes. Based on the results of the validation test of the teaching module, a result of obtained with very valid criteria, which means that the basic physics teaching module developed is suitable for use for learning. The results of the implementation of the teaching module obtained the significance of the results of the pretest and posttest results of students' science literacy attitudes were obtained with a result that this basic physics teaching module is practically used to improve science literacy in terms of attitudes. This is in accordance with cognitive theory which states that students should be at the level of developing abstract thinking by enriching objects, phenomena and real experiences. This research reflects that technology has a huge influence on the learning process which has direct implications for learning outcomes in cognitive areas, scientific skills and attitude.*

Keywords*: Teaching Module; Virtual Laboratory; Science Literacy*

INTRODUCTION

The Independent Curriculum states that graduates of education in Indonesia must demonstrate literacy skills and preferences, such as interpreting and integrating texts, generating simple inferences, conveying responses to information, and writing experiences and thoughts with simple concepts; and demonstrating numeracy skills, such as reasoning using concepts, procedures, facts, and mathematical tools to solve problems related to oneself, the nearest environment, and the surrounding community (Law of the Republic of Indonesia No. 20, 2003). Literacy skills are one of the graduate competency standards expected by the Independent Curriculum which is currently being implemented in Indonesia. Based on the results of the PISA (*Program for International Student Assessment*) in 2022, it can be seen that Indonesia is ranked 68 out of 79 countries with a literacy score of 379 in mathematics, 398 in science, and 371 in reading (OECD, 2023). This indicates that Indonesia is still one of the countries with a low ranking compared to neighboring countries that have even better rankings.

The results of PISA 2022 illustrate that the literacy skills possessed by students in Indonesia are still in a position that is not good enough, this is still far from the expectations of the competence of Independent Curriculum Graduates where students are expected to have the ability to literate well. The set of abilities that students must have at the end of the learning process is one part of the definition of graduate competencies (Permendikbud No.5, 2022). Literacy is not only the ability to read and write but also means political literacy, technology, critical thinking, and environmental awareness. Science Literacy is described students can draw conclusions from various scientific ideas and concepts that are interrelated with science in the process of making predictions, interpreting data and evidence and can utilize external knowledge from the normal school curriculum. They can distinguish between arguments that are based on scientific and theoretical evidence and those that are based on other considerations and can evaluate the competitive design of complex experiments, field studies or simulations and justify their predictions (OECD, 2022). Based on a study of 138 students in one of the higher education in Indonesia, the results were obtained that as many as 53% of students answered it by rewriting the discourse on the question or even leaving a blank space. Student answers in the nominal, functional, and procedural conceptual categories are all below 10%. With 26% in the multidimensional category, which means that students cannot use science concepts correctly and do not have concepts to solve a phenomenon, this states that out of 138 students do not have good science literacy skills (Hendri, 2019).

After analyzing the learning outcomes, science students found that in physics materials that are partly abstract, for example, atoms and electron travel in electricity, they have difficulty using concepts they know theoretically with real phenomena. In addition to the type of abstract material, the laboratory infrastructure also does not support these abstract materials, making it difficult for them to find and synthesize their own concepts. Laboratory-based learning is indispensable for finding concepts in physics and is very helpful for students in mastering physics concepts (Wati, 2020). In accordance with the theory of processing levels where the deepest processing level will derive meaning from the information received (Salvin, 1997). However, not all laboratories have very complete equipment for all the physics concepts needed. The development of technology today is very helpful in the world of education. One of them is in the science laboratory. Nowadays, lecturers/teachers can take advantage of virtual laboratories that have been prepared by technology developers. Virtual laboratories are computer-based media used to conduct virtual experiments (Triza, 2020). The teaching module development process must be based on the desired objectives. The Science Literacy Stage is very possible to be applied to the development of teaching modules, the development of teaching modules by lecturers will greatly affect student learning outcomes because learning modules will guide students when carrying out the learning process either guided or independently. Virtual laboratory-based teaching modules will help students in finding or proving abstract physics concepts such as atomic theory, electricity and other materials. The basic physics teaching module developed differs in complexity from the teaching module developed by other researchers. Where the teaching module developed will follow the indicators of science literacy attitudes and this module can be dual mode where the module can be accessed online through the web and can also be accessed offline in the form of hard files. This module is also equipped with a cognitive science literacy assessment instrument so that it can also be used to measure cognitive science literacy. Based on the description above, the researcher intends to develop a Physics teaching module based on Science Literacy assisted by a virtual laboratory. It is hoped that with the development of this virtual laboratory-assisted science literacy-based teaching module, it can train the science literacy skills of science students so that they have sufficient literacy skills if they later become a science teacher. The learning module in this research can not only be used to improve aspects of scientific literacy attitudes but can also be used to improve aspects of science skills and scientific understanding simultaneously.

RESEARCH METHODS

Type of Research

This research is a *development research* with a device development model that will be used by the researcher is *the "Four-D Model Model"* developed by Thiagarajan, Semmel and Semmel which consists of 4 stages, namely:

1. Define

a. Needs Analysis

Based on the basic competencies and learning objectives that must be achieved by students in this gas kinetic theory material, the implementation of KBM must be carried out by carrying out practicums. However, the reality in the field is that there is a lack of facilities that support abstract material practicum activities. So that students are able to achieve learning objectives, it is hoped that students can carry out practicums even though they do not use real laboratory equipment, namely by using the PhET application where this practicum will help students achieve learning objectives, and students will also carry out practicums even using computers. It is hoped that by using the PhET application students will be able to have fun learning and can practice scientific attitudes, as well as improve learning outcomes

b. Student Analysis

Based on data held by Tadris IPA, the average age of students for the 2023-2024 academic year is between 18-20 years. At this age, students are at the formal operational stage or they are able to think abstractly. Students are able to solve problems in a better and more complex way than children who are still in the concrete operational stage. Therefore, in developing abstract thinking it is necessary to link objects, phenomena and real experiences.

c. Concept Analysis

Concept analysis is aimed at mathematically compiling relevant concepts based on needs analysis in the kinetic theory of gases. The ideal gas concept and Boyle's law concept conditions include isothermal, isochoric and isobaric.

d. Task Analysis

Task analysis is a procedural collection to determine the content in a learning unit. The task that needs to be carried out during the learning process by students is working on LKM, in this development the LKM used is LKM using the stages of scientific literacy. The LKM developed is used to train students to make observations and identify problems according to everyday problems. The analysis of the assignment that will be given to students is a content structure analysis. The learning activities in this research are on the kinetic theory of gases.

e. Analysis of the Formulation of Learning Objectives

The formulation of learning objectives is carried out as a basis for designing teaching modules. Learning objectives are prepared based on learning indicators related to the Kinetic Theory of Gas material created in the teaching module. The aim remains to pay attention to students' basic abilities.

2. Design,

a. Media Selection

Media selection activities are carried out to determine the appropriate media for presenting the material contained in the learning tool. The learning media chosen to develop physics teaching modules is using the PhET application which contains virtual practicums to carry out virtual Kinetic Theory of Gas practicums, where practicum activities are carried out using this media which looks like equipment in a conventional laboratory. Utilizing the PhET application in practicum activities is very possible because by using a virtual practicum laboratory it will be more optimal and does not require expensive practicum equipment and can motivate students in an interesting way.

b. Format Selection

The choice of format for the learning tools developed is adapted to the format created by the Department of National Education based on the 2013 Curriculum and the National Education Standards Agency (BSNP). The learning tools developed include lesson plans, BAS, THB instruments, observation sheets (implementation of lesson plans and student activities, attitudes and skills).

c. Test Preparation

This test is selected based on the formulation of the indicators. The test developed in this research includes test items to measure student achievement which are used for the initial test and final test.

3. Develop

a. Expert Validation

The purpose of device validation is to obtain advice from competent experts. The teaching module that has been produced (Draft I) is then revised according to the validator's suggestions.

b. Trials

The trial begins with a pretest and continues with learning over two meetings and ends with a posttest.

4. Disseminate

The dissemination stage referred to in this research is the dissemination of a comprehensive paper in the form of a research journal which will be published in the Sinta 3 journal and IPR submissions as well as on Google Scholar.

Research Subject

There are 97 students of Tadris Science, one of the universities in Indonesia.

Research Instruments

Learning Module Validation Sheet

Validation by experts. The device validation data obtained was in the form of scores ranging from 1-4, with categories 1 = not good, 2 = not good, 3 = good, and 4 = very good. The score of each aspect obtained from all validators is calculated on average, then interpreted in the form of the score described in table 1.

Table 1. Validation Average Score Criteria

Average score interval	Average score criteria
1,0 – 1,5	Invalid
1,6 – 2,5	Less valid
2,6 – 3,5	Valid
3,6 – 4	Highly Valid

(Adapted from Ratumanan & Laurens, 2003)

Attitude Aspect Science Literacy Assessment Sheet

The science literacy assessment instrument for the attitude aspect is assessed using a science literacy attitude questionnaire with indicators in Table 2.

Table 2. Science Literacy Indicators

Competence	Indicator
Explaining the phenomenon scientifically	1. Remembering and applying appropriate scientific knowledge 2. Identify, use, and generate clear models and representations 3. Explaining the potential implications of scientific knowledge for society
Designing and evaluating investigations scientific	1. Propose a way to scientifically explore the question given 2. Evaluate how to scientifically explore the question given 3. Describe and evaluate the various ways used by scientists to determine the validity and objectivity of data and the generality of explanations
Interpreting data and evidence scientifically	1. Changing data from one representation to another 2. Analyze and interpret data and draw the right conclusions

(adapted from Thompson, 2013)

Table 3. Science Literacy Indicators Attitude Aspect

Competence	Indicator
Observation	Using the senses of hearing, sight and touch to obtain data according to the experiment being carried out
Grouping	Group tools and learning materials in experiments appropriately and clearly
Interpret the results of observations	Record and summarize the results of the experiment and write answers to questions in the worksheet according to the results of the group discussion on the sheet in the worksheet
Estimate	Make temporary estimates or conjectures before carrying out experiments
Communicate	Convey the results of discussions clearly, precisely and effectively
Hypothesize	Complete predictions that have been made using the theory and material taught
Planning an experiment	Determine the tools and materials to be used and arrange work steps in carrying out experiments
Using tools or materials	Use tools in accordance with the work steps that have been created to carry out experiments
Apply concepts or principles	Using theory from various sources and experimental data by looking for supporting references to strengthen the conclusions to be made
Ask questions	Answer and ask questions and provide solutions or opinions in answering questions in group discussions

(adapted from Thompson, 2013)

The validity, reliability of the questionnaire items, and the practicality of the module will then be tested by a two-party average test (paired-sample t test) conducted using the SPSS version 17.0 program at a significance level of 95% with the following interpretation if the data is distributed normally and homogeneously. If the significance value of the sig (2-tailed) is greater than 0.05, H0 is accepted, which means that there is no significant difference between the pretest score and the mean treatment class postes. Conversely, if the significance value of the sig (2-tailed) is less than 0.05, H0 is rejected, which means that there is a significant difference between the mean pretest score and the postes of the treatment class.

RESULTS AND DISCUSSION

Result

The results of the Validation of the Science Literacy-Based Basics Physics Virtual Laboratory Teaching Module are presented in Table 3.

Table 3. Results of Validation of Basic Physics Teaching Module Based on Science Literacy

It	Assessed aspects	Validator Assessment		Average	Information
		V1	V2		
1	Format	4,0	4,0	4,0	Highly Valid
2	Fill	3,3	3,3	3,3	Valid
3	Language	3,0	3,0	3,0	Valid

Based on Table 3, it can be seen that overall, the teaching module developed has an average for format aspects of 4.0 with very valid criteria, content of 3.3 with valid criteria and language of 3.0 with valid criteria.

The results of the validity and Feasibility of the questionnaire are presented in Table 4 and Figure 1.

Table 4. Results of the Validity of the Science Literacy Attitude Questionnaire Item

Question No.	Significance	Criterion
1	0,000	Valid
2	0,000	Valid
3	0,000	Valid
4	0,000	Valid
5	0,000	Valid
6	0,000	Valid
7	0,000	Valid
8	0,000	Valid
9	0,000	Valid
10	0,000	Valid
11	0,000	Valid
12	0,000	Valid
13	0,000	Valid
14	0,000	Valid
15	0,000	Valid

Based on table 4, it can be seen that the significance of the questionnaire items shows a number below 0.05 which means that all questionnaire items are valid for use.

Reliability Statistics

Cronbach's Alpha	N of Items
.861	15

Figure 1. Results of the Reliability of Science Literacy Attitude Questionnaire Items

Figure 1 shows that Cronbach's alpha of the questionnaire question item is more than 0.6 which means that the science literacy attitude questionnaire is reliable to use.

The results of the effectiveness of the Basic Physic Virtual Laboratory Teaching Module based on Science Literacy are seen in Figure 2.

df	Sig. (2-tailed)
94	.000

Figure 2. Results of Teaching Module Effectiveness

Figure 2 shows that the significance is less than 0.05 which means that the Basic Physic Virtual Laboratory Teaching Module based on Effective Science Literacy is used to improve science literacy in terms of attitude.

Discussion

1. Feasibility of Basic Physics Virtual Laboratory Teaching Module Based on Science Literacy

Teaching modules are learning tools used to help students learn. The teaching module consists of learning objectives, learning steps, learning media, and assessment. Teaching modules can be used for various subjects and levels of education (Ministry of Higher Education, 2022). Teaching modules developed by researchers are first validated by experts to determine the feasibility of teaching modules. Teaching modules will be revised according to the results of experts before being used for learning. The results of the Validation of the Teaching Module can be seen in table 3 where the results were obtained that the two experts showed valid results which meant that the teaching module was suitable for use at the research stage.

Based on the validation results, it can be seen that the teaching module developed has fulfilled the components of the complete teaching module set by the Ministry of Education and Culture, including Learning Phase, Learning Achievements and Objectives, Usage Details and Teaching Module Details Per Meeting (Kemdikbud.2020). The development of science literacy skills can be assisted by well-designed teaching module content. This includes explaining science concepts, relating theories to real cases, and encouraging students to use and understand data through activities and experiments. With good teaching modules, students are motivated to actively participate in science learning. Practice, research, and discussion activities encourage students to think critically, solve problems, and present the results of their research. All of these elements are important components of science literacy.

Explaining science concepts in a more interesting and visual way, teaching modules can utilize various media, such as diagrams, infographics, simulations, and videos. It can help students with different learning styles understand the material better and improve their abilities in visual literacy and data interpretation. Data analysis, graph interpretation, contextual problem-solving, or experimental reports are some examples of tests that can be used to evaluate students' abilities in science literacy. This assessment can improve the quality of the educational modules. This analysis provides feedback to teachers and students on material understanding and the development of science literacy (National Research Council, 2012). It is essential to choose and apply the right methods that can engage and encourage student activeness and be structured so that the knowledge provided can be embedded in the student's long-term memory. The teaching module development process must be based on the desired objectives. The Science Literacy Stage is very possible to be applied to the development of teaching modules, the development of teaching modules by lecturers will greatly affect student learning outcomes because learning modules will guide students when carrying out the learning process either guided or independently. Virtual laboratory-based teaching modules will help students in finding or proving abstract physics concepts such as atomic theory, electricity and other materials.

2. The Effectiveness of Basic Physics Virtual Laboratory Teaching Modules Based on Science Literacy

The procedure for preparing teaching modules has also been explained by the government through guidelines for the preparation of teaching modules which include analysis of conditions and needs, identification of dimensions of Pancasila student profiles, Flow of Learning Objectives, preparation based on available components, implementation of learning, evaluation and further investigation (Ministry of Research, Technology and Higher Education, 2022). Effectiveness Test Teaching modules are needed to find out whether the developed teaching modules are effective in using in the research stage. The test of the effectiveness of the teaching module starts from testing the validity and reliability of the science literacy attitude questionnaire items. The results of the validity and reliability test can be seen in table 4 and Figure 1 where the results of the valid and reliable science literacy attitude questionnaire are obtained for research. This is in accordance with research that states that the science literacy attitude questionnaire can be used to improve science literacy attitude skills (Kumala et al., 2020).

After conducting a validity and reliability test of the questionnaire, the questionnaire will be used in research to improve science literacy attitudes. Given at the beginning before learning and at the end after learning. The results of the Pretest and Posttest were analyzed using a paired T test which obtained a significance of less than 0.05 which stated that there was a significant change in science literacy attitudes before and after the learning process. This is in line with research that states that teaching modules can be used to improve science literacy attitudes (Muzijah et al. 2020). The module developed by the researcher is effectively used to increase science literacy because this module is equipped with a virtual laboratory. The module is based on virtual laboratory effectiveness and can be used to improve science literacy (Manurung, 2020). The virtual laboratory can also be used for the initial test of students in carrying out an experimental activity before students jump into the real laboratory so that it can minimize the damage to laboratory equipment.

The results of the effectiveness of the teaching module are also in accordance with the theory of processing levels (Slavin, 1997) which states that the deeper the information is processed, the better the information is remembered. Virtual laboratory-based learning provides opportunities for students to process the information obtained in several stages. Usually, students only process the information they get by seeing, listening and reading, while by using a virtual laboratory, students can process information more deeply. Initially, students get information by listening to the initial description from the researcher and observing the events shown by the researcher, they will process the information into a question and hypothesis independently, after the formulation of the problem and hypothesis is arranged, students process the information by conducting an experiment with a virtual laboratory. Based on the experiment, students will find more information that complements the previous information, the information that students have just obtained through experiments with a virtual laboratory is reprocessed by conducting analysis to answer the questions that students made at the beginning by conducting group discussions to find a final conclusion.

After getting the final conclusion by conducting a group discussion assisted by a teaching module, students must present the results in front of the class so that there is a class discussion that allows for the exchange of information between groups so that the class conclusion will be obtained which will be reaffirmed by the lecturer. Information that goes through many of these processes is expected to be remembered by students for a longer time so that students' science literacy attitudes can increase.

Virtual laboratories offer a transformative approach to teaching introductory physics, particularly for abstract concepts. By providing interactive simulations, these tools allow students to visualize and manipulate abstract concepts, such as forces, fields, and waves, in a dynamic and engaging manner. This visual representation bridges the gap between theoretical concepts and real-world applications, fostering a deeper understanding. Furthermore, virtual labs offer a safe and controlled environment for experimentation, enabling students to make mistakes without consequences and encouraging a more exploratory learning style. The flexibility of virtual labs allows for individualized learning experiences, accommodating diverse learning styles and paces. Consequently, students are more likely to develop a strong foundation in physics and a genuine interest in the subject.

While numerous studies have explored the efficacy of virtual laboratories in enhancing science learning outcomes, our research contributes to this field by specifically focusing on the development of a physics module designed to foster scientific literacy. Unlike previous studies that primarily examined cognitive gains, our work delves into the affective domain, investigating the impact of virtual laboratories on students' attitudes toward science. This study aligns with findings from (Wahid A, 2024) who emphasized the importance of virtual laboratories in promoting inquiry-based learning and critical thinking. However, our research goes beyond by providing empirical evidence on the specific relationship between virtual laboratory experiences and the development of a scientific literate disposition. Similar to (Brown, 2021), we found that students who engaged with virtual laboratories exhibited a more positive attitude towards science and a greater sense of agency in their learning.

CONCLUSION

The Basic Physic Virtual Laboratory teaching module based on science literacy is suitable to be used to improve science literacy in the aspect of attitude with valid criteria. The Basic Physic Virtual Laboratory teaching module based on science literacy is effectively used to improve science literacy in the attitude aspect with a significance result of < 0.05 which means that the basic physics virtual laboratory teaching module based on science literacy can increase students' science literacy in terms of attitude.

The Basic Physic Virtual Laboratory teaching module based on science literacy can also be used to train science literacy skills in cognitive aspects so that researchers can further develop it.

REFERENCES

Brown, C. G. (2021). An interactive & cooperative activity for exploring animal systematics using cards & string. *The American Biology Teacher, 83*(3), 161–164. https://doi.org/10.1525/abt.2021.83.3.161

Hendri, S., & Hasriani, M. (2019). Identifikasi literasi sains mahasiswa (studi kasus mahasiswa STISIP Amal Ilmiah Yapis Wamena). *Journal of Natural Science and Integration, 2*(1), 95–104. https://doi.org/10.24014/jnsi.v2i1.7117

Kementerian Pendidikan dan Kebudayaan. (2020). *Buku panduan Merdeka Belajar Kampus Merdeka.* Jakarta: Direktorat Jenderal Pendidikan Tinggi.

Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi. (2022a). *Modul* *ajar: Panduan penyusunan.* Jakarta: Kemendikbudristek.

Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi. (2022b). *Panduan pengembangan laboratorium virtual.* Jakarta: Kemendikbudristek.

Kumala, I. R., Sumarni, W., & Haryani, S. (2020). Penerapan model pembelajaran brain-based learning untuk meningkatkan kemampuan literasi sains siswa. *Chemistry in Education, 9*(1), 38–44.

Manurung, I. F. U., Mailani, E., & Simanuhuruk, A. (2020). Penerapan model pembelajaran argument-driven inquiry berbantuan virtual laboratory untuk meningkatkan kemampuan literasi sains mahasiswa PGSD. *Js (Jurnal Sekolah, 4*(4), 26–32. https://doi.org/10.24114/js.v4i4

Muzijah, R., Wati, M., & Mahtari, S. (2020). Pengembangan e-modul menggunakan aplikasi Exe-Learning untuk melatih literasi sains. *Jurnal Ilmiah Pendidikan Fisika, 4*(2), 89–98. https://doi.org/10.20527/jipf.v4i2.2056

National Research Council. (2012). *A framework for K-12 science education: Practices, crosscutting concepts, and core ideas.* Washington, DC: The National Academies Press.

Organisation for Economic Co-operation and Development (OECD). (2018). *PISA 2015 results in focus.* Paris: OECD Publishing.

Organisation for Economic Co-operation and Development (OECD). (2023). *PISA 2022 results (Volume 1): The state of learning and equity in education.* Paris: OECD Publishing.

Partnership for 21st Century Skills. (2019). *Framework for 21st century learning.* Tucson, AZ: Partnership for 21st Century Skills.

Permendikbud No. 5 Tahun 2022. Tentang standar kompetensi lulusan. Jakarta: Kementerian Pendidikan dan Kebudayaan.

Ratumanan, T. G., & Laurens, T. (2006). *Evaluasi hasil belajar yang relevan dengan kurikulum berbasis kompetensi.* Surabaya: Unesa University Press.

Slavin, R. E. (1997). *Educational psychology: Theory and practice* (5th ed.). Massachusetts: Allyn and Bacon Publishers.

Thompson, S., Hillman, K., & Bortoli, L. (2013). *A teacher's guide to PISA scientific literacy.* Australia: ACER Press.

Triza, H. (2022). Kegiatan bongkar pasang melalui aplikasi PhET virtual laboratory pada listrik dinamis. *Progressive of Cognitive and Ability, 1*(2), 50–59. https://doi.org/10.56855/jpr.v1i2.33

Undang-Undang Republik Indonesia Nomor 20 Tahun 2003. Tentang Sistem Pendidikan Nasional.

Wahid, A., Takda, A., & Anas, M. (2024). Pengembangan perangkat pembelajaran model INoSIT untuk meningkatkan kompetensi literasi sains siswa pada materi optika geometri kelas XI SMA. *Jurnal Penelitian Pendidikan Fisika, 9*(1), 1–9. https://doi.org/10.36709/jipfi.v9i1.102

Wati, N., Qadar, R., & Matius, B. (2020). Hubungan antara kinerja dengan hasil belajar siswa pada pembelajaran berbasis inkuiri laboratorium terbatas di SMA Negeri 13 Samarinda. *Jurnal Literasi Pendidikan Fisika (JLPF, 1*(1), 73–80. https://doi.org/10.30872/jlpf.v1i01.130