JPPIPA 9(9) (2023)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education

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

The Emergence of Scientific Literacy in Science E-Module Learning Devices

Rizky Nafaida[1], Raja Novi Ariska[2], Dini Fitria[2], Nursamsu[2], Nurhasnah Manurung[3]

[1]Department of Physics Education, Universitas Samudra, Langsa, Indonesia
[2]Department of Biology Education, Universitas Samudra, Langsa, Indonesia
[3]Department of Biology Education, Universitas Islam Sumatera Utara, Medan, Indonesia

Received: August 11, 2023
Revised: September 5, 2023
Accepted: September 25, 2023
Published: September 30,2023

Corresponding Author:
RizKy Nafaida
kiki87fauzi@unsam.ac.id

DOI: 10.29303/jppipa.v9i9.4949

Abstract: Learning tools need to be implemented in today's learning innovations. Currently the government is implementing a new curriculum with a new policy in the form of scientific literacy learning. This learning focuses on daily problem-solving activities related to natural science. Therefore, there is a need for teacher innovation in developing E-Module teaching materials as a form of modern learning application. The purpose of this study was to determine the emergence of scientific literacy in science e-module learning tools. The method in this research using descriptive method. The results of this study indicate that the e-module used by teachers is related to content aspects worth 84% which is stated as good, process aspects with a percentage worth 78% stated well and in terms of context with a percentage of 81%. related to the emergence of scientific literacy while the results of interviews with science teachers indicated that the science e-module learning tools used had scientific literacy in each science material

Keywords: IPA E-Module; Learning Media; The Emergence of Scientific Literacy

Introduction

The results of the Program of International Student Assessment (PISA) study, the scientific literacy ability of Indonesian students in 2009 was ranked 60th out of 65 participating countries with an average score of 383. This result is not much different from the results of the 2012 PISA study with an average score of 382 in 64th place out of 65 participating countries or in other words Indonesia is ranked first and bottom of all PISA PISA study stated that the average science score of Indonesian students was 403 where Indonesia was ranked 62nd out of 70 participating countries (Pisa, 2012). participating countries. Likewise, the results of the 2015 That's why learning in scientific literacy is very important to be applied in the learning process for developments in the 21st century (Phearson et al., 2008). Literacy learning statements are learning based on reading and solving everyday problems with good logical thinking and reasoning (Akmal et al., 2022).

This scientific literacy ability is something that is very basic, especially for all stakeholders involved in science education (Hendri et al., 2017). Scientific Literacy is defined as a vessel for using scientific knowledge, identifying questions so as to be able to draw conclusions based on facts in understanding the universe as well as being able to make decisions about changes that have occurred due to human activities (OECD 2006; Hidayati 2020). The application of local excellence-based learning can improve the ability of content, context, and students' science processes (Mufida & Teguh, 2018). Inquiry-based scientific literacy learning in the form of capable laboratory activities (Rakhmawan, 2015).

The results of the analysis of scientific literacy skills show that the ability of students to make graphs accurately based on data and the ability to solve problems using quantitative skills, including basic statistics, obtains a higher percentage of 68.8% (Anggun, 2018). In line with scientific literacy, it is problem-solving-based learning related to science in everyday life

How to Cite:
Nafaida, R., Pandia, E.S., Fitria, D., Nursamsu, N., & Manurung, N. (2023). The Emergence of Scientific Literacy in Science E-Module Learning Devices. *Jurnal Penelitian Pendidikan IPA*, *9*(9), 7547–7552. https://doi.org/10.29303/jppipa.v9i9.4949

using logical thinking and reasoning as well as tips in learning science (Yosef & Supardi, 2019).

The low scientific literacy ability of Indonesian students is influenced by many things, including the curriculum and education system, the selection of teaching methods and models, learning facilities and amenities, learning resources, teaching materials, and so on.

One of the factors that directly intersects with student learning activities and influences the low scientific literacy ability of Indonesian students is the existence of student learning resources, still using conventional learning tools. Thus, student learning is only centered on the teacher. To change learning patterns like that, we use technology learning tools, namely E-modules in practical learning.

The electronic module is a part in the form of an independent presentation which is carried out systematically in which there are learning objectives that can be presented in animation, audio and navigation programs that are used more interactively (Nurmayanti et al., 2015). This module can provide knowledge for students both individually and in groups which increases achievement so it is not boring (Setyoko, 2014). Modules can also provide new colors that can make students younger in carrying out real learning process activities and also develop the creativity of each student to the fullest (Gamaliel, 2014).

The textbooks used are adapted to the needs of students at several levels. This is in line with the opinion that scientific literacy and numeracy books are adapted to the times and curriculum in the form of electronic modules or E-Modules (Wulandari et al., 2021). In line with the E-Module based on scientific literacy and numeracy is one of the developments in science and technology-based learning in the form of computer-assisted electronic books (Pramono, 2021).

The e-module form is embodied in digital technology prints with the help of computer electronics (Fausih, 2015). Developing modules and honing students' abilities in developing scientific literacy (Dewi & Primayana, 2019). This is in line with the E-Module based on scientific literacy and numeracy, which is an electronic book that has unique features and icons as one of the learning attractions made from applications that make it easier to use and manufacture (Lestari et al., 2021). In line with the E-Module, it is a learning textbook that inserts videos and images as one of its characteristics so that it can attract students' interest in learning and foster students' enthusiasm for solving problems in scientific literacy and numeracy by making (Laili et al., 2019).

Based on the evidence above, the availability of student learning tools to be utilized in the implementation of science learning in the form of e-modules. This e-module will later provide students with knowledge of scientific literacy related to science subject matter, so as to improve students' science process skills. In view of this, the process of selecting good e-module learning tools is considered to be able to trigger an increase in scientific knowledge which in turn can increase scientific literacy. Thus, the aim of the research was to find out the analysis of the emergence of scientific literacy throughscience e-module learning device.

Method

In this study, a qualitative descriptive method was used, because the data collected was in the form of words, writings, and observed behavior, although it only involved supporting behavior that could only be observed passively by outsiders of the organization. Quantitative data is used in observation sheets in the form of indicators that appear in practicum modules related to aspects of scientific literacy. While the qualitative data is in the form of interviews with teachers using interview guidelines. The implementation of this research at the Muhammadiyah Middle School, Langsa City, involved science teachers and lecturers as researchers as well as practicum modules as material for analyzing several aspects of the emergence of scientific literacy related to aspects of content, process and context.

Result and Discussion

Based on the observation sheet of the activities to be carried out at the Muhammadiyah Middle School, Langsa City, it was explained that the research team would examine the emergence of scientific literacy related to the content, process and context aspects of the practicum e-module learning tools used by teachers as a guide in carrying out practicums, so we as researchers will look at the Figure 1.

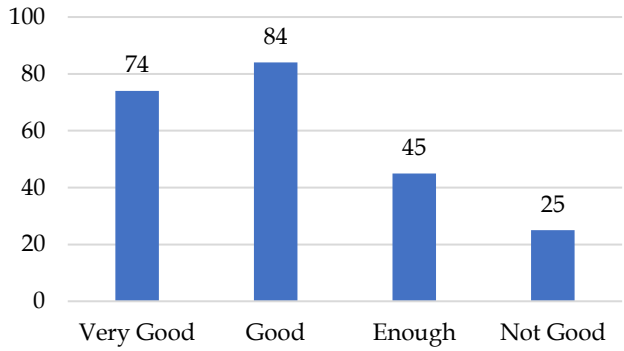

Figure 1. Percentage of Content Aspects of Scientific Literacy Emergence in Science E-Modules

Based on the results of the numbers contained in the graph above, it is stated that 74% is stated very well, 84% is stated as good and 45% is sufficient while 25% is unclear. So, we can state that what often appears from the ten statement sentences assessed in the practicum module are clear alternative answers, it can be concluded that the science e-module made by the science teacher at Muhammadiyah Middle School is clear and in accordance with scientific literacy. The results of this study agree with Winatae (2017) that the validation of scientific literacy-based practicum instructions is categorized as good with an assessment percentage of the validator of 87%. The analyzed science practicum module products consist of three categories with a very valid aspect percentage value with a value of 78% on the module quality element.

Process Aspect

The implementation of the science process refers to a process for answering questions or solving problems, such as identifying and interpreting natural phenomena and explaining the conclusions of phenomena that occur from aspects of the process of emergence of scientific literacy in science e-modules used by teachers in the process of learning activities, the percentage of ratings can be seen in the Figure 2.

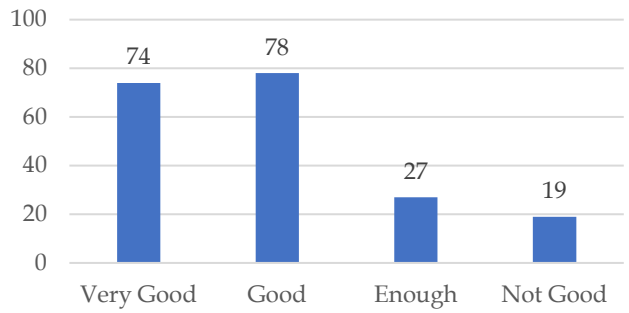

Figure 2. Percentage Percentage of Emergence of Process Aspect Science Literacy in Science E-Module

The results obtained in Figure 2 stated that the value of 74% was stated to be very clear, 78% was stated to be clear, 27% was stated to be sufficient while 19% was stated to be unclear. Supported by the research of Fathurrohman & Astuti (2017) concluded that the results of the research were the development of a Basic Physics I module based on scientific literacy on the subject of oscillations and waves which had high validity, readability levels were easy to understand and effective for increasing scientific literacy of students of the UPS Tegal Science Education Study Program. This research is relevant to Usmeldi's opinion (2016) that the use of research-based physics learning modules with a scientific approach is effective in increasing students' scientific literacy.

The results of the assessment by the validator on the scientific literacy-based science practicum module were analyzed descriptively quantitatively, the overall score obtained based on the assessment of the experts was converted into a range of values according to Darmayanti & Haifaturrahmah (2019) that practicality was 66.27 or very practical, and the acquisition of an effectiveness value was 0.72 with very effective criteria.

These results are supported by the research of Maturradiyah & Rusilowati (2015) which concluded that the application of integrated science learning can improve aspects of science as a way of thinking. The results of the assessment by the validator on the scientific literacy-based science practicum module were analyzed descriptively quantitatively, the overall score obtained based on the assessment of the experts was converted into a range of values according to Darmayanti & Haifaturrahmah (2019) that practicality was 66.27 or very practical, and the acquisition of an effectiveness value was 0.72 with very effective criteria.

These results are supported by the research of Maturradiyah & Rusilowati (2015) which concluded that the application of integrated science learning can improve aspects of science as a way of thinking. then the overall score obtained based on expert judgment is converted into a value range according to Darmayanti & Haifaturrahmah (2019) that practicality is 66.27 or very practical, and the acquisition of an effectiveness value is 0.72 with very effective criteria. These results are supported by the research of Maturradiyah & Rusilowati (2015) which concluded that the application of integrated science learning can improve aspects of science as a way of thinking.

Aspects of Context

The modern definition of scientific literacy according to PISA emphasizes the importance of knowing and understanding the context of science applications, as well as being able to apply science in solving real problems they face both related to the child's personality (for example eating), the local community where the child lives (for example water supply), as well as life on earth more globally (for example global warming). The percentage of the context aspect assessment is shown in the Figure 3.

Based on the graph above, it is explained that 78% is stated very very clearly, 81% is stated clearly, then 26% is stated as sufficient and 20% is stated not clear. The results obtained by the Science e-module are related to scientific literacy in the context aspect with clear category alternative answers, so it can be concluded that the material about everyday life in the e-module is declared good. The results of this study are in accordance with Yuyu's research (2017) explaining that scientific literacy skills are something that is very basic,

especially for all stakeholders involved in science education.

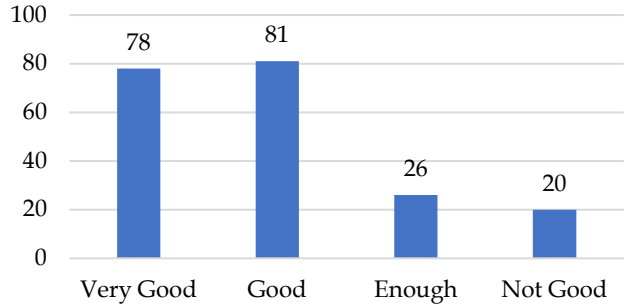

Figure 3. Percentage Percentage of Context Aspects of Science Literacy Emergence in Science E-Module

This research is also related to the research of Mufida and Teguh (2018) that the application of local excellence-based learning can improve the ability of content, context. After carrying out research on the Science e-module at the Muhammadiyah Middle School in Langsa City, teacher interviews were then conducted about the implementation of learning using the Science e-module learning tools related to material related to scientific literacy. Then the results obtained from the teacher's interview with the research team are as follows (Figure 4).

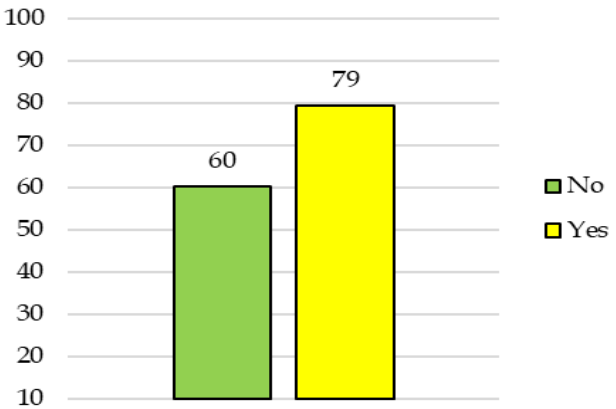

Figure 4. Science Teacher Interview Results Using Science E-Module Learning Devices Related to Science Literacy

Based on Figure 4 regarding the results of interviews with four science teachers who were given by the research team with an average percentage score of 79%, it was stated that the Science e-module used by the teacher was related to the scientific literacy component, while those who answered no were 60% who did not have a scientific literacy component. So it can be concluded that the science e-module used by the teacher has a scientific literacy component in every science learning material. This statement goes hand-in-hand with Yuliati's opinion (2016) stating that the most important things in developing students' scientific literacy include knowledge of science, scientific processes, development of scientific attitudes, and students' understanding of science so that students not only know science concepts but can also apply scientific abilities in solving various problems and can make decisions based on scientific considerations. Teaching materials can provide space for acquiring knowledge and skills, developing self-confidence and self-actualization of students.

These results explain that the average scientific literacy ability of Indonesian students is only able to recognize basic facts, they have not been able to relate this ability to various science topics, issues in society, let alone to apply concepts (Toharudin et al., (2011) in Retno et al., 2017). The application of PBL can increase students' scientific literacy because in essence PBL is a constructivist-based learning model so that it can assist students in maturing their abilities. Thus, PBL can train and help students' scientific literacy skills (Imaningtyas et al., 2017).

The product that has been developed in the form of problem-based learning science e-modules after being implemented on a large scale is expected to increase students' scientific literacy, as previous research conducted by Wulandari & Sholihin (2015) stated that the implementation of the problem-based learning model can significantly improve scientific literacy skills.

The results of the research can be concluded that the scientific literacy categories that appear in each chapter have various numbers and percentages (Hamidah et al., 2021). This is in accordance with research (Ginting, 2018) which analyzed the level of scientific literacy of class XI biology textbooks on nervous system material in high schools in Pancurbatu District for the 2016/2017 academic year.

The results of his research show that the theme of scientific literacy that appears the most in the teaching materials analyzed is science as a way of investigating with an average percentage occurrence of 11.22%. (Ariningrum, 2016) states that the dimension of scientific literacy that appears the most is the dimension of science as a process of investigating with a percentage of 35%. This is in line with (Pratama et al.,

Conclusion

Based on the results of an analysis of the scientific literacy indicator categories in the Science e-module as a teacher learning tool, from the content aspect that the Science e-module made by a Science teacher with a percentage of 84% was stated to contain elements of scientific literacy. While the process aspect with a percentage of 78% is stated to contain good scientific

literacy, then the context aspect with a percentage of 81% is stated to contain elements of scientific literacy. As for the results of the interview assessment of the Science e-module learning tool used by the Science teacher for learning activities with a percentage of 79% it was stated that there was something related to Science material with scientific literacy

Acknowledgements
The Research Team would like to thank LPPM and PM of Samudra University for providing research funding from the DIPA of Samudra University for the 2023 Fiscal Year which can be completed as promised. Do not forget also to the Principal of SMP Muhammadiyah Langsa City who has granted research permission as a place to carry out research.

Author Contributions
Rizky Nafaida: Designing Learning Tools, Ekariana S Pandia: Making Instruments, Dini Fitria: Creating an E-Module Application, Nursamsu: Collecting outcome data study, Nurhasnah Manurung: Validating Products

Funding
Universitas Samudra DIPA Funds for Fiscal Year 2023

Conflicts of interest
No Problem in Research

References

Anggun. (2018). Kemampuan Awal Literasi Sains Peserta Didik Kelas V SDN Sidorejo I Tuban Pada Materi Daur Air. JTIEE, 2(1). 58-64. http://dx.doi.org/10.30587/jtiee.v2i1.356.

Ariningrum, T. R. (2016). *Analisis Literasi Ilmiah Buku Teks Pelajaran Biologi SMA*. Skripsi. Universitas Negeri Semarang. Retrieved from http://lib.unnes.ac.id/18664/

Akmal, M, F. Anwar M, & Eriyani, R. (2022). Literasi Digital Pada Pembelajaran Jerman. *Jurnal Ilmiah Pendidikan Bahasa, Sastra Indonesia dan Daerah*, 12(2). 116-12. https://doi.org/10.23969/literasi.v12i2.4926

Darmayanti & Haifaturrahmah. (2019). Analisis kelayakan buku panduan praktikum ipa terpadu smp berpendekatan saintifik dengan berorientasi lingkungan sekitar. *Jurnal Hasil Kajian, Inovasi, & Aplikasi Pendidikan Fisika,* 5(1):45-47. https://doi.org/10.31764/orbita.v5i1.1021

Dewi, P.Y.A., &Primayana, K.H. (2019). Effect of learning module with setting contextual teaching and learning to increase the understanding of concepts. *International Journal of Education and Learning,* 1(1). 19–26. https://doi.org/10.31763/ijele.v1i1.26

Fausih, M. (2015). Pengembangan Media e-Modul Mata Pelajaran Produktif Pokok Bahasan "Instalasi Jaringan LAN (Local Area Network) untuk Siswa Kelas XI Jurusan Teknik Komputer Jaringan di SMK Negeri 1 Labang Bangkalan Madura. *Jurnal Mahasiswa Teknologi Pendidikan Unesa,* 01(01). 1-9. Etrieved from https://ejournal.unesa.ac.id/index.php/jmtp/article/view/10375

Fathurrohman, M. A., & Astuti, R. K. (2017). Pengembangan Modul Fisika Dasar I Berbasis Literasi Sains. *PSEJ (Pancasakti Science Education Journal)*, *2*(2), 163-171. Retrieved from https://scienceedujournal.org/index.php/PSEJ/article/view/89

Gamaliel, S.A. (2014). *Pengembangan Modul Pembelajaran Berbasis Home Science Process Skill Dipadu dengan Blended Learning untuk Meningkatkan Keterampilan Proses Sains Siswa Kelas XI IPA SMA Kristen Petra Malang*. Tesis Pascasarjana. Universitas Negeri Malang.

Ginting, V. E. (2018). Analisis Tingkat Literasi Sains Buku Teks Biologi Kelas XI Pada Materi Sistem Saraf Di SMA Se- Kecamatan Pancurbatu Tahun Pembelajaran 2016/2017. Jurnal Pelita Pendidikan, 6(1). https://doi.org/10.24114/jpp.v6i1.8900

Hendri S, Ridha, T.M.A., Mustika, D. (2017). Pembelajaran Inkuiri Berbasis Virtual Laboratory Untuk Meningkatkan Kemampuan Literasi Sains Mahasiswa Calon Guru Pendidikan Fisika. Universitas Samudra. *Jurnal IPA dan Pembelajaran IPA,* 1(2). 143-148. https://doi.org/10.24815/jipi.v1i2.9688.

Hidayati, Putri W.N., & Afrizon, R. (2020) Analisis Validasi Modul Fisika Bermuatan Literasi Saintifik pada Materi Gerak Lurus dan Gerak Parabola. *Pillar of Education*, 13(1). 185-192. http://dx.doi.org/10.24036/818917107.

Hamidah, I., Ratnasari, A., & Suparjo, J. (2021). Analisis Kategori Literasi Sains pada Bahan Ajar Ilmu Pengetahuan Alam SMP/MTs Kelas VII Kurikulum 2013. *Jurnal Kulidawa*, 2(2):52-58. https://dx.doi.org/10.31332/kd.v2i2.3094

Imaningtyas, C. D., Karyanto, P., Nurmiyati, & Asriani, L. 2017. Penerapan E-Module Berbasis Problem Based Learning untuk Meningkatkan Literasi Sains dan Mengurangi Miskonsepsi pada Materi Ekologi Siswa Kelas X MIA 6 SMAN 1 Karanganom Tahun Pelajaran 2014/2015. *Bioedukasi: Jurnal Pendidikan Biologi,* 9(1), 4. DOI: https://doi.org/10.20961/bioeduka si-uns.v9i1.2004

Lestari R., Faelasofi., dan Suminto. 2021. Efektivitas Penggunaan Modul Numerasi Pada Pembelajaran Jarak Jauh. *Jurnal e-DuMath,* 7(2):42-50. https://doi.org/10.52657/je.v7i2.1543.

Laili I., Ganeferi., dan Usmeldi. 2019. Eefektivitas Pengembangan E-Modul Project Based Learning Pada Mata Pelajaran Numerasi. *Jurnal Pendidikan dan Pembelajaran,* 3(3):306-315. https://doi.org/10.23887/jipp.v3i3.21840.

Maturradiyah, N. & Rusilowati, A. (2015). Analisis buku ajar fisika SMA Kelas XII di Kabupaten Pati berdasarkan muatan literasi sains. *Unnes Physics Education Journal*, 4(1). 17-20. https://doi.org/10.15294/upej.v4i1.4731

Mufida, N & Teguh, J. (2018). Upaya Peningkatan Literasi Sains Siswa Melalui Pembelajaran Berbasis Keunggulan Lokal. BIOSFER Jurnal Tadris Pendidikan Biologi, 9 (1): 24-35. https://doi.org/10.24042/biosf.v9i1.2876.

Nurmayanti, F, Bakri, F, & Budi, E. (2015). Pengembangan Modul Elektronik Fisika dengan Strategi PDEODE pada Pokok Bahasan Teori Kinetik Gas untuk Siswa Kelas XI SMA. *Prosiding Simposium Nasional Inovasi dan Pembelajaran Sains 2015 (SNIPS 2015)*. 337-340.

Nursamsu, Mustika, D., Nafaida, R., & Manurung, N. (2020). Analisis Kelayakan Dan Kepraktisan Modul Praktikum Berbasis Literasi Sains Untuk Pembelajaran IPA. *JIPI (Jurnal IPA dan Pembelajaran IPA),* 4(1). 29-40. https://doi.org/10.24815/jipi.v4i1.15546.

OCED. (2012). *United States Country Note*. PISA 2012

Phearson, P.T., Pollack, G.R., & Sable, J.E. (2008). *Increasing scientific literacy in undergraduate education*: Acase study from.

Pratama, W. A., Hartini, S., & Misbah. (2019). Analisis Literasi Digital Siswa Melalui Penerapan E-Learning Berbasis Schoology. *Jurnal Inovasi Dan Pembelajaran Fisika*, 06(1). https://doi.org/10.36706/jipf.v6i1.10398

Pramono, R. (2021). The Feasibility Study of Moodle-Based E-Module to increase the Numeration Literacy of Elementary School Students. Jurnal Pendidikan Sekolah Dasar, 4(2). 73-78. https://doi.org/10.21831/didaktika.v4i2.41034

Rakhmawan, A. (2015). Perancangan Pembelajaran Literasi Sains Berbasis Inkuiri pada Kegiatan Laboratorium. Jurnal Penelitian dan Pembelajaran IPA, 1(1). 143-152. http://dx.doi.org/10.30870/jppi.v1i1.331.

Retno, A. T. P., Saputro, S., & Ulfa, M. (2017). Kajian aspek literasi sains pada buku ajar kimia SMA kelas XI di Kabupaten Brebes. *Seminar Nasional Pendidika Sains,* 21(2013), 112–123.

Setyoko. (2014). *Struktur Komunitas Makrozoobenthos di Area Mangrove Pantai Bukit Barisan Kabupaten Bengkalis sebagai Modul Ekologi Hewan di Perguruan Tinggi. Malang*. Tesis Pascasarjana. Universitas Negeri Malang.

Usmeldi. (2016). Pengembangan modul pembelajaran fisika berbasisriset dengan pendekatan scientific untuk meningkatkan literasi sains peserta didik. *Jurnal Penelitian & Pengembangan Pendidikan Fisika*, 2(1). 1-8. https://doi.org/10.21009/1.02101

Yuliati, Y. (2016). Peningkatan Keterampilan Proses Sains Siswa Sekolah Dasar Melalui Model Pembelajaran Berbasis Masalah. *Jurnal Cakrawala Pendas,* 2(2). https://doi.org/10.31949/jcp.v2i2.335

Yuyu, Y. (2017). Literasi Sains Dalam Pembelajaran IPA. *Jurnal Cakrawala Pendas*. 3 (2): 21-28. http://dx.doi.org/10.31949/jcp.v3i2.592

Yosef, F.N., & Supardi, K. (2019). Literasi Sains Peserta Didik Dalam Pembelajaran IPA Di Indonesia. *JIPD (Jurnal Inovasi Pendidikan Dasar*), 3(1), 61-69. Retrieved from https://jurnal.unikastpaulus.ac.id/index.php/jipd/article/view/214.

Winata, A., Cacik, S., Rakhma, I.S., & Widiyanti. (2017). Pengembangan Petunjuk Praktikum IPA Berbasis Literasi Sains Program Studi PGSD Unirow Tuban. *Prosiding Seminar Nasional Hasil Penelitian dan Pengabdian kepada Masyarakat II.* Tuban, 23 September 2017. ISSN: 2580-3921.

Wulandari., Yogica, R., & Darussyamsu. (2021). Analisis Manfaat Penggunaan EModul Interaktif Sebagai Media Pembelajaran Jarak Jauh di Masa Pandemi Covid 19. *Jurnal Ilmiah Kependidikan*, 15(2):139-144. http://dx.doi.org/10.30595/jkp.v15i2.10809.

Wulandari, N., & Sholihin, H. 2015. Penerapan Model Problem Based Learning (PBL) Pada Pembelajaran IPA Terpadu Untuk Meningkatkan Aspek Sikap Literasi Sains Siswa SMP. *Prosiding Simposium Nasional Inovasi Dan Pembelajaran Sains 2015*, 2015 (Snips), 437–440.