

# Students' Pedagogic Literacy Skills Based on Textbook Development Teaching Strategies in Biology

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Received: December 21, 2023

Revised: February 27, 2024

Accepted: March 25, 2024

Published: March 31, 2024

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DOI: [10.29303/jppipa.v10i3.7168](https://doi.org/10.29303/jppipa.v10i3.7168)

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**Abstract:** The purpose of this study was to evaluate the pedagogical literacy skills of biology education students after studying lecture material from textbooks on biology teaching and learning strategies that have been developed based on the ADDIE model. This development research used 92 students of the Biology Education Study Program, FMIPA, State University of Medan as subjects, who were determined by random sampling technique. Pedagogic literacy is measured using an essay test to determine the ability of prospective teacher students according to developments in technology and communication. The data were analyzed by percentage technique. The results of the study found that students' pedagogic literacy abilities in preparing themselves for e-learning were included in the good category (82.45%), the use of digital learning in the very good category (91.84%), the learning components involved in online learning is included in the very good category (92.67%), and the use of authentic assessment is included in the good category (84.78%).

**Keywords:** ADDIE Models; Pedagogic Literacy; Teaching and Learning Strategies in Biology.

## Introduction

Pedagogical literacy competencies are currently increasingly being discussed among educators, along with developments in technology and communication in the world. Takda, et al (2022) stated that prospective biology teacher students need to prepare themselves with various abilities related to pedagogical competence, including preparing themselves to become future biology teachers. Nuruzzakiah, et al (2022) also stated that competitiveness creates an atmosphere and conditions for prospective biology teachers who need to equip themselves to be more professional. According to Suharyati, et al (2019) that the nation's competitiveness is in line with the need to increase teacher capabilities through digital literacy competencies. Krumsvik (2008) said that pedagogical literacy skills are really needed in the current digital era.

Digital skills are very important to be mastered by teachers in the future. Kunchayono & Putri (2020) stated that in addition to pedagogic competencies such as professional, personality and social skills, it is very

necessary to develop literacy skills for prospective biology teachers at this time. Haryati (2020) added that the literacy skills that are urgently needed today to respond to the development of the industrial revolution 4.0 are digital pedagogic literacy skills. Zakaria (2021) states that the literacy learning paradigm must be able to direct students to understand the values of pedagogical literacy.

Why do biology teacher candidates need digital pedagogical literacy skills? This is in line with Sulistryarini's opinion (2022) that the digital era is an era in which all aspects of life, including the learning process, make more use of digital media. Nugraha (2016) states that the success of teachers in organizing education is influenced by their pedagogic literacy competencies.

The pedagogical literacy skills of current students as future biology teacher candidates are faced with a learning process that uses the internet network. The learning process is known as an online learning system, and therefore the contents of the Biology Teaching and Learning Strategies lecture material need to be updated

## How to Cite:

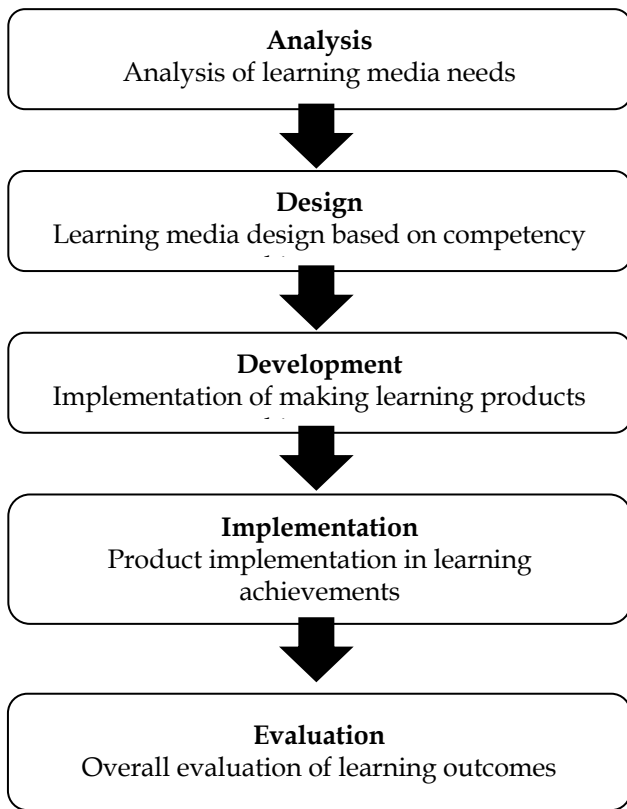
Hasruddin, H., Aryeni, A., Rezeqi, S., & Hartono, A. (2024). Students' Pedagogic Literacy Skills Based on Textbook Development Teaching Strategies in Biology. *Jurnal Penelitian Pendidikan IPA*, 10(3), 1056-1062. <https://doi.org/10.29303/jppipa.v10i3.7168>

with e-learning biology learning. Biology learning by e-learning is in line with the opinion of Kaharuddin (2021) that learning with an e-learning system allows for the need for learning resources that refer to developments in information and communication technology.

To acquire pedagogical literacy skills, prospective biology teacher students are equipped with learning resources in the form of Biology Teaching and Learning Strategies textbooks. This development research uses the ADDIE Model in the evaluation section related to how the abilities of biology education as future biology teacher candidates have their pedagogical literacy skills. This is what will be discussed in this article.

**Method**

The research steps were carried out based on the following workflow.



**Figure 1.** Stage of Research

This development research was carried out in five stages, namely analysis, design, development, implementation, and evaluation. This article presents the results of the evaluation that was carried out in the learning process of the Biology Teaching and Learning Strategies course for 92 students of the Biology Education Study Program. The research sample was determined by random sampling technique. Data analysis was carried out qualitatively using the Miles and Huberman technique including three main steps,

namely data collection, data reduction, and data presentation. This data analysis technique was chosen because it is able to accurately analyze research results to obtain accurate generalizations of the data.

At this evaluation stage, a questionnaire was administered to obtain data about students' views of the contents of the book related to pedagogical literacy skills. The questionnaire contains 30 questions in which there are 18 positive statements and 12 negative statements. Before being used, the questionnaire was validated by construction and content validation to four experts in the field of biology education. To obtain data on students' pedagogical literacy abilities obtained by using a test, by giving essay questions as many as 7 questions. The questions presented are in the form of students' analytical ability levels.

The data from the questionnaire given to the respondents was analyzed to see the tendency of students' attitudes towards the developed textbooks. Furthermore, the scores obtained are averaged and given meaning to the categorization. While the test results were analyzed per item and determined the level of student ability from 0-100. Next, the data were analyzed using the percentage technique, and given the meaning of the categories.

**Result and Discussion**

The results of the analysis of the questionnaire distributed to respondents to obtain responses to the contents of the textbooks that have been developed and implemented are presented below. In connection with the responses of respondents about the teacher's pedagogical competence as shown in Table 1 below.

**Table 1.** Textbook Contents Regarding Aspects of Teacher Pedagogical Competence

Rated Aspect	Score (%)	Category
Mastery of student characteristics and physical, moral, social, cultural, emotional, and intellectual aspects	3.84	Very good
Mastery of learning theory and principles of educational learning	3.22	Good
Able to develop a curriculum related to the field that is mastered	2.88	Pretty good
Organizing educational development activities	2.96	Pretty good
Utilizing information and communication technology for the benefit of organizing educational development activities	3.16	Good
Facilitating the development of the potential of students to actualize their various potentials.	3.28	Good
Communicate effectively, empathetically, and politely with students.	3.55	Very good

Students' views on the contents of the Biology Teaching and Learning Strategy textbook related to the pedagogic literacy skills of prospective teacher students are shown in Table 2.

**Table 2.** Student Views of Textbooks

Rated Aspect	Score (%)	Category
Can understand students more deeply	3.74	Very good
Doing lesson plans	3.62	Very good
Carry out learning	3.04	Good
Designing and evaluating learning	3.21	Good
Develop students as the actualization of the various potentials of students	2.88	Pretty Good

Student responses related to the evaluation of the contents of the Biology Teaching and Learning Strategies textbook as shown in Table 3 below.

**Table 3.** Student Responses

Rated Aspect	Score (%)	Category
Up-to-date content of textbooks	3.90	Very good
The depth and breadth of the content of the book	3.82	Very good
Textbooks accommodate pedagogic literacy	3.68	Very good
Ease of understanding the contents of textbooks	3.25	Good
Generate learning motivation	3.12	Good

Test results regarding students' abilities regarding pedagogic literacy are shown in Table 4 below.

**Table 4.** Student Pedagogic Literacy Ability

Rated Aspect	Score (%)	Category
E-Learning aspect	82.45	Good
Use of digital learning	91.84	Very Good
Learning components in online learning	92.67	Very Good
Use of authentic assessments	84.78	Good

The Biology Teaching and Learning Strategy textbook that was developed has the elements needed to prepare students to become future biology teacher candidates. Wahyu, et al (2023) also explained that it is very necessary to fulfill the components of mastering student characteristics from the physical, moral, social, cultural, emotional and intellectual aspects of students in textbooks. This is in line with the opinion of Sari, et al (2022) & Yamtinah, et al (2022) who state that pedagogical literacy abilities are in line with numerical literacy abilities and emotional abilities, this influences the formation of students' character at school.

The material compiled in the Biology Teaching and Learning Strategy textbook needs to accommodate

various aspects that can provide opportunities for students to be able to have pedagogic literacy skills. This is in line with the results of research conducted by Susanto, et al (2020) which stated that increasing pedagogic literacy skills would have an impact on improving the quality of learning. Cajkler (2016) adds that pedagogic literacy is an opportunity to improve the quality of the learning process.

Therefore, the explanation of the requirements for becoming a teacher is from an expert and in accordance with the provisions. Warlinda, et al (2022) also conveyed the same thing that from the applicable laws and regulations above, it can be understood that teachers' pedagogical competence has a very important position. Dibyantini, et al (2023) also reported that the position of a teacher's pedagogical competence is one part of the requirements for someone to become a teacher. Fauziah & Sukmawati (2023) added that teachers are appointed as teacher-educators in formal education institutions (madrasah-schools). Oktariana, et al (2023) also reported that teachers' mastery of pedagogical competence has a very important position in realizing the main duties and functions of madrasah school teachers. Sukmawati & Zulherman (2023) added that if one of these conditions, especially pedagogical competence, is not met, the learning and education process at the madrasah will not be able to run well, so that the educational goals there will definitely not be achieved optimally.

The students' views on the contents of the Biology Teaching and Learning Strategies textbook that have been developed are included in the positive category. Students can feel that the presence of these textbooks can improve pedagogic literacy skills. Shomedran (2020) states that in the learning process in the digital era, learning resources including textbooks need to contain expertise, skills related to the digital era, so that students are able to adapt to the times. Thus, the preparation of textbooks really needs to be adjusted to developments that occur, such as digitalization.

Student understanding There are at least four things that teachers must understand from their students, namely the level of intelligence, creativity, physical disabilities and cognitive development. Suryati, et al (2021) also emphasized that in this case there is only one thing that needs to be added, namely "student understanding is one of the competencies that teachers must have. Nurliana & Sukmawati (2023) emphasized that there are at least four things that teachers must understand about their students, namely the level of intelligence, creativity, physicality, and growth and development of students, as well as the potential that students have. Dewitasari & Rusmini (2023) also emphasized that teachers are required to truly understand their students, so they can adapt to what the students need, and can adapt the material to be taught to the students' needs.



Student responses to the contents of the Biology Teaching and Learning Strategy textbook that were developed were very positive. The same thing was also stated by Setiawan, et al (2023) that textbooks need to accommodate various components that make textbooks suitable for consumption by students. Wumu & Buhungo (2023) reported the suitability of textbooks in terms of various aspects as an indicator of the success of this research and can be recommended as reading material for students. Anggraeni (2018) stated that having adequate learning resources will be able to improve students' pedagogical and literacy competencies to understand the material presented, especially now that textbooks are needed that can motivate and improve students' literacy skills.

The professionalism of prospective biology teachers is faced with changes in advances in information technology and the development of students in the digital era. The results of this study indicate that the literacy skills of students in the Stregati Teaching and Learning Biology course are in the very good category. This really allows students to adapt towards digital changes in the learning process. This is in line with Suciati's opinion (2018) which states that the development of creativity and innovation in the learning process is in accordance with the demands of the digital era. Likewise, Jayawardana's opinion, (2017) which states that the era of digital biology learning requires material concepts that are also digital in innovating and creating students.

One effort to understand the concept of curriculum and learning for prospective teachers is to use concept maps. The same thing was also stated by Kharolinasari, et al (2023) that concept maps were developed as a strategy to describe the position of curriculum and learning in increasing pedagogical literacy in the education system, so that the concepts of curriculum and learning are clearly illustrated for prospective teachers. Lestari, et al (2021) also emphasized that in carrying out learning activities the concept discovery process is very important, being able to master all the concepts that have been studied without a certain method is not an easy thing. One method that can be used to facilitate the discovery and rediscovery of concepts is to create links between one concept and another. Soraya, et al (2023) also report that the relationship between one concept and another is called a concept map. A concept map is a simple network of related elements regarding learning material. This network is formed based on concepts related to the material in question.

The curriculum is a very important tool in ensuring the success of the educational process, especially increasing students' pedagogical literacy. This means that without a good and appropriate curriculum it will be difficult to achieve the desired educational goals and objectives. A similar thing was also stated by Fakhriyah,

et al (2022) that the existence of the curriculum as a component of education is in a strategic position where its main role is as a guide in learning activities. Educational activities that are expected to run well must pay attention to the conditions of the curriculum, because the experience that will be given in class during the implementation of education will refer to the curriculum. Suhirman & Prayogi (2023) also report that the curriculum occupies a central position in the educational process. It seems that it is not an exaggeration to say that the educational process is controlled, regulated and assessed based on the criteria contained in the curriculum. Dewi, et al (2019) also emphasized that from several concepts stated above it can be concluded that the curriculum concept consists of three, namely curriculum as substance, curriculum as system, and curriculum as field of study.

The first concept, curriculum as substance. Society views the curriculum as a plan of learning activities for students at school, or as a set of goals to be achieved. Imaduddin (2023) emphasized that the curriculum can also refer to a document that contains a formulation of objectives, teaching materials, teaching and learning activities, schedules and evaluations. Bahtiar, et al (2023) also emphasize that the curriculum can also be interpreted as a written document resulting from a joint agreement between curriculum makers, education policy holders and the community. Jufri, et al (2019) also report that the curriculum can also cover certain regions, schools, districts, provinces, or entire countries.

Improving students' pedagogic literacy skills is closely related to learning resources as obtained in this study which shows that the use of Biology Teaching and Learning Strategies textbooks as a development result can improve students' pedagogic literacy skills. This is in line with Susanto's opinion (2018) which states that increasing pedagogic literacy skills is also influenced by interactions in the field of education. Likewise the opinion of Cremin, et al. (2021) which states that the view of pedagogic literacy skills is closely related to the existence of training and opportunities to use various learning resources.

The current pedagogic literacy skills of prospective biology teacher students are very relevant to be strengthened when students are attending lectures. This is of course very good for producing qualified teacher candidates. In the future the profile of a competent biology teacher will not only master the subject matter, but also need to have skills in using online learning. Bernhardt, (2020) states that with this online learning system, teacher skills are needed in using devices that can be used to support the online learning process. Likewise Ucu's opinion (2018) that the existence of technology today strongly supports the e-learning process. Likewise the opinion of McDougal, et al (2019) which states that pedagogic literacy skills are currently

more emphasized on digital abilities. Simpson (2014) added that pedagogic literacy with e-learning uses digital platforms.

## Conclusion

Based on the research that has been conducted, it can be concluded that students' pedagogic literacy abilities in preparing themselves for e-learning were included in the good category (82.45%), the use of digital learning in the very good category (91.84%), the learning components involved in online learning is included in the very good category (92.67%), and the use of authentic assessment is included in the good category (84.78%). These pedagogical literacy skills can support the adaptive and up-to-date skills of prospective Biology teacher students

## Acknowledgements

Researchers would like to thank all parties who have helped with the research mechanism, especially the Department of Biology Education in supporting research data.

## Author Contributions

The research team contributed to improving the quality of Biology learning, providing pedagogical competencies for prospective Biology teacher students as well as procedures for writing scientific papers.

## Funding

Funding for this research comes from the researcher's independent funds.

## Conflicts of Interest

The author declares that there is no conflict of interest in publishing this article.

## References

- Anggraeni, A.D. (2018). Kegiatan Literasi melalui Pembuatan Bahan Ajar Calistung (Membaca, Menulis, Berhitung) di dalam Upaya Meningkatkan Kompetensi Pedagogik Guru TK di Kecamatan Limo dan Cinere. *J- Dinamika : Jurnal Pengabdian Masyarakat*, 2(2): 21-28. <https://doi.org/10.32486/dikemas.v7i2>
- Bahtiar, B., Yusuf, Y., Doyan, A., & Ibrahim, I. (2023). The Trend of Technology Pedagogical Content Knowledge (TPACK) Research in 2012-2022: Contribution to Science Learning of 21st Century. *Jurnal Penelitian Pendidikan IPA*, 9(5), 39-47. <https://doi.org/10.29303/jppipa.v9i5.3685>
- Bernhardin, D. & Rizkia, R.A. (2020). Pembelajaran On-Line : Penggunaan Media Pembelajaran Audio Visual Berbasis Digital Terhadap Penguasaan Gerak Dasar Lay Up. *JPOE*, 2(2): 260-266. <https://doi.org/10.37742/jpoe.v2i2.119>
- Cajkler, W.W. (2016). Lesson Study and Pedagogic Literacy in Initial Teacher Education: Challenging Reductive Models. *British Journal of Educational Studies*, 64(4): 503-521. <https://doi.org/10.1080/00071005.2016.1164295>
- Cremin, T., Mottram, M., Collins, F.M., Powell, S., & Drury, R. (2021). Changing Views of Literacy and Pedagogic Practice. *Researching Literacy Lives*, 2(1): 96-119. <https://www.taylorfrancis.com/chapters/edit/10.4324/9781315772820>
- Dewi, C. A., Khery, Y., & Erna, M. (2019). An ethnoscience study in chemistry learning to develop scientific literacy. *Jurnal Pendidikan IPA Indonesia*, 8(2), 279-287. <https://doi.org/10.15294/jpii.v8i2.19261>
- Fakhriyah, F., Masfuah, S., Hilyana, F. S., & Mamat, N. (2022). Analysis of technological pedagogical content knowledge (TPACK) ability based on science literacy for pre-service primary school teachers in learning science concepts. *Jurnal Pendidikan IPA Indonesia*, 11(3). <https://doi.org/10.15294/jpii.v11i3.37305>
- Hariyani, S. (2020). Peningkatan Kompetensi Pedagogik Guru dalam Melaksanakan Literasi pada Pembelajaran Melalui Lesson Study di SDN Lemahputro 1 Sidoarjo. *Jurnal of Indonesian Education*, 3(1): 39-47. <https://journal.unusida.ac.id/index.php/jie/issue/view/40>
- Imaduddin, M. (2023). A Systematic Review on Pedagogical Content Knowledge in Utilizing Science Learning Technology at the Indonesian Junior High School Level. *Thabiea: Journal Of Natural Science Teaching*, 5(2), 174-192. <http://dx.doi.org/10.21043/thabiea.v5i2.19324>
- Jayawardana, H.B.A. (2017). Paradigma Pembelajaran Biologi di Era Digital. *Jurnal Bioedukatika*, 5(1): 12-19.
- Kaharudin, (2021). Paparan Best Practice Implementasi Pemanfaatan TIK dan Teknologi Terkini untuk Pembelajaran Daring di Masa Pandemi Covid-19. *Jira: Jurnal Inovasi dan Riset Akademik*, 2(8): 1282-1297. <https://pbio.uad.ac.id/publikasi/jurnal-bioedukatika-3/>
- Jufri, A. W., Ramdani, A., Jamaluddin, J., & Azizah, A. (2019). Development of Scientific Literacy and Pedagogical Content Knowledge (PCK) of Prospective Science Teachers through Lesson Study-Based Courses. *Jurnal Penelitian Pendidikan IPA*, 5(2), 179-184. <https://doi.org/10.29303/jppipa.v5i2.235>
- Kharolinasari, R., Mulyani, S., VH, E. S., & Indriyanti, N. Y. (2023). Teachers and Students Needs Analysis for the Development of Subject Specific Pedagogy (SSP) Blended Learning Based on Multiple

- Representations. *Jurnal Penelitian Pendidikan IPA*, 9(7), 5322-5328. <https://doi.org/10.29303/jppipa.v9i7.3600>
- Krumsvik, R.J. (2008). Situated Learning and Teachers' Digital Competence. *Education and Information Technologies*, 13(4): 279-290. <https://doi.org/10.1007/s10639-008-9069-5>
- Kuncahyono, K. & Maharani, P. (2020). Digital Skill Guru melalui E -Modul sebagai Inovasi Bahan Ajar di EraDisrupsi 4.0. *Jurnal Pendidikan Dasar*. 1(1): 5-12. <https://doi.org/10.22219/jp2sd.v1i1i2.23049>
- Lestari, H., Rahmawati, I., Siskandar, R., & Dafenta, H. (2021). Implementation of blended learning with a stem approach to improve student scientific literacy skills during the covid-19 pandemic. *Jurnal Penelitian Pendidikan IPA*, 7(2), 224-231. <https://doi.org/10.29303/jppipa.v7i2.654>
- McDougall, J., Brites, M.J., Couto, M.J., & Lucas, C. (2019). Digital Literacy, Fake News and Education. *Cultura y Educacion*. 31(2): 203-212. <https://doi.org/10.1016/B978-0-12-822144-0.00003-3>
- Nugraha, A. & Bhakti, C.P.. (2016). Membangun Kompetensi Pedagogik Calon Guru Melalui Hidden Curriculum di Lembaga Pendidikan Tenaga Kependidikan (LPTK). *Prosiding FKIP*. 1(1): 1-9. <http://seminar.fkip.uad.ac.id/wp-content/uploads/2017/06/ARIADI-1-p01.pdf>
- Nuruzzakiah, N., Hasanuddin, H., Artika, W., Supriatno, S., & Rahmatan, H. (2022). Competency analysis of technological pedagogical and content knowledge (TPACK) biology teachers. *Jurnal Penelitian Pendidikan IPA*, 8(1), 325-335. <https://doi.org/10.29303/jppipa.v8i1.1166>
- Sari, S.P., Natuna, D.A., & Afrianto. (2022). Pengaruh Kecerdasan Emosional dan Literasi Numerasi Terhadap Kompetensi Pedagogik Guru Matematika Sekolah Menengah Pertama (SMP) Negeri Kota Pekanbaru. *Jurnal Pajar (Pendidikan dan Pengajaran)*. 6(1): 290-297. <http://dx.doi.org/10.33578/pjr.v6i1.8379>
- Simpson, A. & Walsh, M. (2014). Please Note: Pedagogic Conceptualisations for Touch Pad Technologies. *Australian Journal of Language and Literacy*. 37(02): 128-138. <https://doi.org/10.1007/BF03651940>
- Soraya, Y., Nurmaliah, C., Khairil, K., Muhibbuddin, M., & Safrida, S. (2023). The Relationship between Technological Pedagogical and Content Knowledge (TPACK) and Technology Integration Self Efficacy (TISE) of Biology Teachers. *Jurnal Penelitian Pendidikan IPA*, 9(8), 6688-6693. <https://doi.org/10.29303/jppipa.v9i8.4027>
- Suharyati, H., Elizabeth, P., & Yuyunmulyati. (2019). Peningkatan Kemampuan Pedagogik Tenaga Pengajar PAUD dalam Upaya Pemberdayaan melalui Keterampilan Literasi Digital di Wilayah Kota Bogor. *Jurnal Difusi*. 2(2): 11-17. <https://doi.org/10.35313/difusi.v2i2.1663>
- Suhirman, S., & Prayogi, S. (2023). Overcoming challenges in STEM education: A literature review that leads to effective pedagogy in STEM learning. *Jurnal Penelitian Pendidikan IPA*, 9(8), 432-443. <https://doi.org/10.29303/jppipa.v9i8.4715>
- Sulistiyarini, W. & Fatonah, S.. (2022). Pengaruh Pemahaman Literasi Digital dan Pemanfaatan Media Pembelajaran Terhadap Kompetensi Pedagogik Guru Era Digital Learning. *Journal of Educational Learning and Innovation*. 2(1): 42-72. <https://doi.org/10.35445/alishlah.v14i1.1151>
- Susanti. (2018). Pengembangan Kreativitas Inovatif melalui Pembelajaran Digital. *Jurnal Pendidikan*. 19(2): 145-152. <https://doi.org/10.33830/jp.v19i2.181.2018>
- Susanto, R., Febrianti N., Husna N.I., & Anggita, P.A.. (2018). Gerakan Literasi Pedagogik bagi Guru untuk Peningkatan Mutu Pembelajaran di SDN Duru Kepa 17 Pagi dan SDN Jelambar Baru 01 Pagi. *Jurnal Abdimas*. 5(1): 33-38. <https://doi.org/10.35445/alishlah.v14i1.935>
- Susanto, R., Sofyan, H., Rozali, Y.A., Nisa, M.A., Umri, C.A., Nurlinda, B.D., Oktafiani, H., & Lestari, H.A.. (2020). Menakar Kompetensi dan Profesi Lulusan Pendidikan Luar Sekolah di Era Digital. *Jurnal Pendidikan dan Pemberdayaan Masyarakat (JPPM)*. 7(1): 82-92. <https://doi.org/10.35445/alishlah.v14i1.1605>
- Takda, A., Jadmiko, B., & Erman, E. (2022). Development of INoSIT (Integration Nature of Science in Inquiry with Technology) Learning Models to Improve Science Literacy: A Preliminary studies. *Jurnal Penelitian Pendidikan IPA*, 8(1), 18-31. <https://doi.org/10.29303/jppipa.v8i1.957>
- Ucu, N.L., Paturusi, S., Sompie, S., & Sherwin, R.U.A. (2018). Analisa Pemanfaatan E-Learning untuk Proses Pembelajaran. *Jurnal Teknik Informatika*. 13(1): 41-48. <https://doi.org/10.35793/jti.13.1.2018.20196>
- Wahyu, Y., Edu, A. L., & Helmon, A. (2023). STEM-based PjBL Learning Model with Manggaraians Indigenous Science Content to Improve Science Literacy: is it Effective?. *Jurnal Penelitian Pendidikan IPA*, 9(10), 8263-8273. <https://doi.org/10.29303/jppipa.v9i10.4963>
- Yamtinah, S., Utami, B., Masykuri, M., Mulyani, B., Ulfa, M., & Shidiq, A. S. (2022). Secondary School Science Teacher Response to Minimum Competency Assessment: Challenges and Opportunities. *Jurnal Penelitian Pendidikan IPA*, 8(1), 124-131. <https://doi.org/10.29303/jppipa.v8i1.1075>
- Zakaria & Mahfud, I. (2021). Literature Based Model as an Effort to Build Pedagogic Literacy Ability of Students Elementary School. *International Journal on*



- Advanced Science, Education, and Religion*. 4(1): 1-8.  
<https://doi.org/10.33648/ijoaser.v4i1.98>
- Warlinda, Y. A., Yerimadesi, Y., Hardeli, H., & Andromeda, A. (2022). Implementation of Guided Discovery Learning Model with SETS Approach Assisted by E-Modul Chemistry on Scientific Literacy of Students. *Jurnal Penelitian Pendidikan IPA*, 8(2), 507-514.  
<https://doi.org/10.29303/jppipa.v8i2.1264>
- Setiawan, D., Ashari, R. B., Ansori, I., Fathurrahman, M., Kiptiyah, S. M., & Tyas, D. N. (2023). Actualization of Science Literacy in the Freedom Era of Studying in the City of Semarang. *Jurnal Penelitian Pendidikan IPA*, 9(9), 7238-7248.  
<https://doi.org/10.29303/jppipa.v9i9.4219>
- Wumu, A., & Buhungo, T. J. (2023). The effectiveness of problem-based learning model assisted by canva-oriented pancasila student profiles to improve scientific literacy. *Jurnal Penelitian Pendidikan IPA*, 9(8), 5892-5898.  
<https://doi.org/10.29303/jppipa.v9i8.4022>
- Suryati, N., Riadina, F. U., Istiqomah, R., Kusumawati, A., & Febryan, H. I. (2021). The Implementation of Reading to Learn Pedagogy in Indonesian Junior Schools: Impact on Students' Writing Skills and Students' Perceptions. *Jurnal Pendidikan: Teori, Penelitian, dan Pengembangan*, 6(11), 1743-1752.  
<http://dx.doi.org/10.17977/jptpp.v6i11.15137>
- Nurliana, N., & Sukmawati, W. (2023). Stacking Analysis on the Application of the RADEC Model to the Creativity of Fifth Grade Elementary School Students on Water Cycle Material. *Jurnal Penelitian Pendidikan IPA*, 9(8), 5964-5970.  
<https://doi.org/10.29303/jppipa.v9i8.3951>
- Dewitasari, A. P., & Rusmini, R. (2023). Feasibility of Interactive E-LKPD Based on Nature of Science (NoS) to Train Students' Critical Thinking Skills on Chemical Bonding Material. *Jurnal Penelitian Pendidikan IPA*, 9(9), 7122-7131.  
<https://doi.org/10.29303/jppipa.v9i9.4436>
- Dibyantini, R. E., Amdayani, S., Siregar, M. I., & Syafriani, D. (2023). Application of STEM-PjBL Based Chemistry Module to Improve Science Literacy and Student Learning Motivation. *Jurnal Penelitian Pendidikan IPA*, 9(SpecialIssue), 95-102.  
<https://doi.org/10.29303/jppipa.v9iSpecialIssue.5872>
- Fauziah, N., & Sukmawati, W. (2023). Stacking Analysis of Higher Thinking Skills of Class V Elementary School Students on the Material of Movement Organs Using the RADEC Model. *Jurnal Penelitian Pendidikan IPA*, 9(7), 5263-5270.  
<https://doi.org/10.29303/jppipa.v9i7.3926>
- Oktarina, R., Fitria, Y., Ahmad, S., & Zen, Z. (2023). Development of STEM-Oriented E-Modules to Improve Science Literacy Ability of Elementary School Students. *Jurnal Penelitian Pendidikan IPA*, 9(7), 5460-5465.  
<https://doi.org/10.29303/jppipa.v9i7.4503>
- Sukmawati, W., & Zulherman, Z. (2023). Analysis of Changes in Students' Scientific Literacy Ability After Attending Lectures Using the RADEC Model. *Jurnal Penelitian Pendidikan Ipa*, 9(3), 1039-1044.  
<https://doi.org/10.29303/jppipa.v9i3.2846>