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Developing Context-Based Teaching Materials and their Effects on Students' Scientific Literacy Skills

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Abstract

This study aims to develop context-based teaching materials and examine their effects on students' scientific literacy skills. This study adopted the developmental research model by Borg & Gall (1983), which was modified into four stages: needs analysis, model development, model validation and implementation. Experts validated the draft of the developed teaching materials, and their practicality was tested prior to their implementation in the experimental class. The implementation of the teaching materials to determine its effectiveness on scientific literacy skills applied a quasi-experimental one-shot case study design. Descriptive and inferential statistics with the analysis of covariance (ANCOVA) test were used. It shows that the context-based teaching materials met the validity and practicality criteria. The results of the analysis of the student's scientific literacy skills in control and experimental classes show a significant difference in ability ($p<.01$). The implementation of the teaching materials revealed that the context-based teaching material could improve students' scientific literacy skills ($p<.01$). Furthermore, post hoc analysis shows that the students' scientific literacy skills in interpreting data and evidence scientifically is higher than the other two aspects, namely in evaluating and designing scientific enquiry, as well as in explaining phenomena scientifically.

Keywords: Teaching materials, contextual, scientific literacy

Introduction

The issue of scientific literacy attracts significant attention, especially in Indonesia. The results of scientific literacy measurement by PISA (The Programme for International Student Assessment) in 2015 showed that Indonesian rank is 64th out of 72 countries scoring below the OECD average (OECD, 2016). According to the results of PISA measurements from 2000 to 2015, Indonesian students' scientific literacy skills tend to increase; but the average Score is below the OECD average score (Tohir, 2016). The latest measurement resulted in 2018 shows that Indonesia ranks 74th out of 79 countries, with a score of 396 points (OECD, 2019a). This rank indicates that the scientific literacy of students in Indonesia is still low (Ramli et al., 2022). Scientific literacy is the ability to use knowledge to identify problems and draw conclusions based on the evidence in order to understand and make decisions about nature and the actions taken on nature through human activities. In facing the challenges of The Fourth Industrial Revolution era as it is today, Indonesia must set an orientation towards the main goal of science education by creating students who are scientifically literate or who possess scientific skills in preparing superior resources in terms of both soft skills and hard skills (OECD, 2019b; Fensham, 2008; Ariningtyas et al., 2017).

The students' low level of scientific literacy skills based on the results of the PISA measurement is in line with the research results conducted in several schools in Indonesia, which show that, in general, Indonesian students have low scientific literacy skills (Sujudi et al., 2020; Rahmadani et al., 2018; Arohman & Priyandoko, 2016; Kulsum et al., 2017). The low level of scientific literacy skills is assumed to be due to: the students' lack of readiness to take scientific literacy assessment tests, learning outcomes that are emphasized only on the cognitive aspects, and the lack of teachers' roles in encouraging students to have scientific literacy skills (Sujudi et al., 2020). Various studies have been conducted in order to find the right combination of learning to improve students' scientific literacy and higher-order thinking skills. One of the methods used is by implementing a learning model (Salim et al., 2020; Ita, 2018). In addition to the use of learning models, learning media development is also believed to be able to improve students' scientific literacy. Previous research conducted by Irmita & Atun (2017) has developed learning media through the TPACK approach to improve students' scientific literacy. However, it is unclear how these media can influence and improve students' scientific literacy skills. One way to overcome this problem is by developing contextual learning media that are oriented towards improving students' scientific literacy skills.

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The development of context-based learning media is believed to be able to improve students' scienti c literacy skills. Scienti c literacy is the knowledge used by individuals in everyday life (Carreira et al., 2011). erefore, the presentation of learning materials related to contextual problems in students' daily lives is believed to trigger students' scienti c literacy. To date, Science lesson is conducted only by referring to textbooks, making learning less meaningful for students. is is con rmed by the results of Hadipraytino et al. (2019), which revealed that 54.77% of high school students on the island of Lombok, Indonesia had di culty with the material taught at school. In addition, Firmanshah et al. (2020) also revealed that 85.64% of students could not connect the concepts they received with phenomena in everyday life. is research becomes essential because it can be a reference in improving students' scienti c literacy, especially in Indonesia and in other countries with relatively the same conditions as Indonesia. is study aims to develop context-based teaching material and examine its e ects on students' scienti c literacy skills.

METHOD

Research Design

This study adopted the development research model by Borg & Gall (1983), which was modified into four stages, i.e., needs analysis, model development, model validation, and implementation. e following describes the activities at each stage of the research.

Needs Analysis

The needs analysis stage aims to identify needs and collect information from various relevant sources when planning the development of the teaching material. e needs analysis stage was intended to map the school's capacity to support (supportability) the development of the teaching material (Sukri et al., 2018). Data collection in the needs analysis stage adopted the shbone diagram model (Ishikawa, 1976) through deep interviews with teachers and school principals and observation of various main and supporting factors for product implementation in the eld.

Model Development

The development stage was conducted to design the teaching material's contents, including subject matter, lesson plans, and syllabus (Sukri et al., 2018). In addition, at this stage, an instrument was designed to measure students' scienti c literacy skills based on the scienti c literacy competency indicators set by PISA (OECD, 2019b).

Model Validation

At this stage, the draft of the teaching material developed was then validated by experts. e content validation adopts Yaghmaei (2003), which was actualized in the form of three assessments: content, presentation and language use. ree validators conducted expert validation from lecturers and education practitioners who are experts in their respective elds. e validation sheet consists of four ratings, namely 1 = not suitable, 2 = slightly suitable, 3 = quite suitable, and 4 = very suitable (Sukri et al., 2022). Next, the validator is asked to ll out a validation sheet with the four predetermined ratings. To measure the criteria for expert validation results, the average Score of the validator is calculated and then converted into four criteria, namely 3<Score 4 (Very good), 2<Score 3 (Good), 3<Score 2 (Pretty good), and Score 1 (Not good) (Sukri et al., 2018).

Implementation

The implementation stage aimed at implementing the teaching material that had been validated to measure the practicality and e ectiveness of the model. Practicality was measured based on 20 assessment items with an assessment score of 1 to 4 adopting the assessment score by O anto et al. (2022) with the categories as follows: Score = 3.26-4.00 (Very practical), Score = 2.51-3.25 (Practical), Score = 1.76-2.50 (Slightly Practical), and Score = 1.00-1.75 (Not Practical). Implementation was conducted by adapting a quasi-experimental method with a one-shot case study design (Flannelly et al., 2018). e activity was conducted at three schools in West Nusa Tenggara, i.e., SMPN (State Junior High School) 2 Mataram, SMPN 13 Mataram and SMPN 15 Mataram, with a total of 110 students. e e ectiveness of the teaching material was measured based on students' scienti c literacy skills. e student's scienti c literacy skill instrument adapted PISA 2018's scienti c literacy skill indicators (OECD, 2019b).

Data Analysis

Data analysis used descriptive and inferential statistics. Descriptive statistics were used to describe students' scienti c literacy skills, including the pretest and posttest scores. To determine the scientific literacy skills of students in the control and experimental groups, the analysis of covariance (ANCOVA) test was conducted (Leppink, 2018), followed by post hoc analysis (Pereira et al., 2015) to determine the differences in students' scientific literacy skills for each scienti c literacy indicator.

FINDINGS

Needs Analysis

Needs analysis that was conducted with teachers and education practitioners through FGD activities revealed that the teaching materials used by the teachers in lessons have not fully facilitated students to develop scienti c literacy skills. In addition, teachers were not very interested in implementing learning methods that could improve students' scientific literacy skills. As a result, teaching material preparation and design conducted by teachers was only limited to meeting the standardization of student learning and curriculum needs. On the other hand, the teacher is aware of the lack of attention to contextual learning resources in accordance with the students' daily lives and the inconsistency between the concept of the material and examples of problems in the surrounding environment. This is even though its implementation is highly possible due to the environment's supportability. e results of the FGD recommend that it is necessary to develop context-based teaching material to improve students' scienti c literacy skills.

Model Development

Needs analysis results served as a reference in developing the context-based teaching material. e teaching material development activities were con ned to a design that included the selection of the material formats, determining learning strategies, organizing learning materials and activities, and developing assessment instruments and resources. e context-based teaching materials were developed to adopt the topic of additives and addictive substances in food. e teaching materials integrated contextual problems faced by the students, combined with pictures and comprehensive explanations. e presentation of teaching material developed is presented in Figure 1.

Model Validation

At this stage, the draft of the teaching material, the final product of the development stage, was validated by experts. Model validation consisted of three assessments: content, presentation, and language use. Table 1 shows the results of the validation conducted by three experts. e nal product of this stage was a dra of a teaching material model that was validated and ready to be implemented

Fig. 1: Learning Materials Organization

Implementation

The teaching materials that had been validated were then implemented in the experimental class to determine the model's feasibility and e ect on students' scienti c literacy skills. e feasibility of the model was measured based on the teachers' responses. e results of the practicality test of the teaching materials are shown in Table 2.

e ANCOVA was conducted to determine the e ect of teaching material implementation on each aspect of scienti c literacy skills, with the pretest value as a covariate. e results of the Anacova analysis are shown in Table 3.

e results in Table 3 show that the pretest as a covariate a ects students' scienti c literacy skills (p<.01). erefore, ANCOVA analysis is appropriate because it can control the pretest statistically. Furthermore, Table 3 reveals that the teaching material a ects students' scienti c literacy skills in the control and experimental classes. is can be observed based on the results of descriptive statistic analysis of the student's literacy skills presented in Figure 2.

e results in Figure 2 are strengthened by the analysis of variance, which revealed that the scienti c literacy skills of students in the experimental and control classes were signi cantly di erent (p<.01). e results of the analysis also show that the scienti c literacy skills of the students in experimental class is higher than those of the students in the

Table 1.:Teaching Materials Validation Result

No	Assessment Aspect	Mean
1	Content Feasibility Aspect	
	Learning Indicators and Objectives	3.8
	Accuracy of materials	3.9
	Supporting elements	3.7
2	Presentation Feasibility Aspect	
	Presentation Technique	4.0
	Coloring and Drawing	3.6
	Graphic and Design	3.6
3	Language Feasibility Aspect	
	Straightforward	3.9
	Communicative	3.8
	Compliance to Indonesian Spelling System General Guidelines	3.8
Total		34.2
Mean		3.8
Category		Very good

Table 2:Teaching Materials Practicality Test Results

No	Assessment Criteria	Mean
1	Ease of learning	3.0
2	Encourage curiosity	2.9
3	Clarity of learning objectives to be attained	3.2
4	Systematicity of learning materials presentation	3.1
5	In-teaching material problems' linearity with students' everyday problems	3.0
6	Pictures or other illustrations help me understand the concept of the materials	2.9
7	Pictures displayed are relatively interesting and support the objects described	3.0
8	Teaching materials appeal and learning interest	2.9
9	Tasks and evaluation questions	3.2
10	Supporting information in the Teaching Materials can construct scienti c concepts related to additives and addictive substances	3.1
11	Daily life examples	3.2
12	Ease of learning through the use of examples	3.2
13	Information in the worksheet	3.1
14	Language use in the worksheet	3.1
15	Systematicity in the worksheet	3.1
16	Worksheet e ciency	2.8
17	Bene ts of assignments for students in exploring scienti c concepts	3.2
18	Ease of association between concepts learned	3.0
19	Measurement of students' abilities through questions about additives and addictive substances	3.4
20	Students' activeness through assignments	3.3
Mean		3.1
Category		Practical

Table 3: *The results of the ANCOVA test for students' Scientific Literacy Skills*

Tests of Between-Subjects E ects					
Dependent Variable: Postest					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	20169.644[a]	2	10084.822	99.851	.000
Intercept	18821.632	1	18821.632	186.355	.000
Pretest	14643.093	1	14643.093	144.983	.000
Teaching Material	4300.333	1	4300.333	42.578	.000
Error	19997.752	198	100.999		
Total	488483.531	201			
Corrected Total	40167.396	200			

a. R Squared = .502 (Adjusted R Squared = .497)

control class. A post hoc test was conducted to strengthen the results obtained to test the di erences in students' scienti c literacy skills in each aspect of scienti c literacy. e results of the post hoc analysis are shown in Table 4. Table 4 shows that students' scientific literacy skills for the aspects of evaluating and designing scienti c inquiries and explaining phenomena scientifically are not significantly different. In addition, Table 4 also reveals that the students' highest scienti c literacy skills are in the aspect of interpreting data and evidence scienti cally.

Table 4: Post hoc test for each aspect of scientific literacy

Methods and aspects of scientific literacy		N	Subset for alpha = 0.05	
			1	2
Tukey Ba	Evaluating and designing scienti c enquiry	109	14.7963	
	Explaining phenomena scienti cally	109	15.9569	
	Interpreting data and evidence scienti cally	109		21.4716

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 109.000.

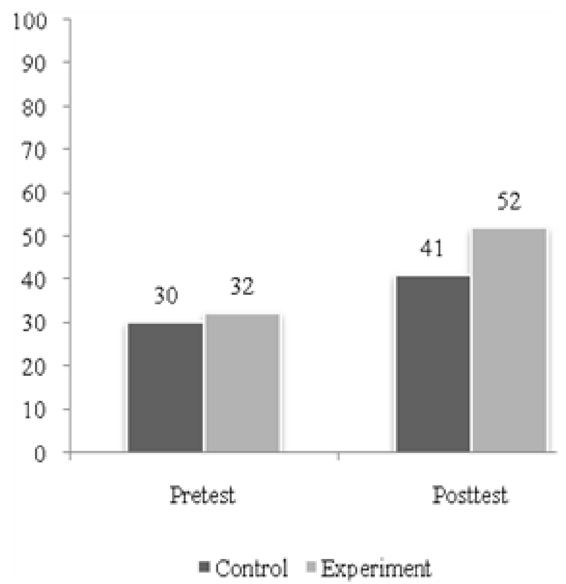

Fig. 2: Students' Scientific Literacy Score Mean for Control and Experimental Group

DISCUSSION

The results in Table 3 show that the context-based teaching material can improve students' scienti c literacy skills (p<.01). is increase indicates that context-based teaching materials can be a solution to improve students' scienti c literacy skills. ese results also serve as evidence that the integration of contextual aspects in learning activities is e ective in increasing scienti c literacy. It is believed that it can create a new learning atmosphere for students to obtain direct learning experiences and positively in uence learning attitudes, objectives, and outcomes (Khoiri, 2016; Hadisaputra et al., 2020; Setiawan, 2019; Hastuti et al., 2020). e environment also signi cantly affects the development of scientific literacy, sensitivity, and the formation of students' character (Nurkhalisa et al., 2017). e context-based teaching materials' e ectiveness in improving students' scienti c literacy can't be separated from the quality of the teaching material produced, which has met the criteria for validity, be it in terms of its content as well as other aspects such as appearance. is result is also supported by the results of the practicality test conducted by the teachers, which shows that the teaching materials have met the criteria for practicality. According to Boujaoude (2002), the quality of teaching materials also determines the students' scienti c literacy skills.

In addition to the quality of the teaching materials, improving the students' scienti c literacy skills might result from the learning process presented in the teaching materials. In addition to integrating contextual learning, the learning activities using the teaching materials allow the students to read critically by presenting problems that exist in everyday life. On the other hand, through the developed teaching materials, the students are directed to conduct scientific investigations in the form of observations and others so that the student's abilities can be improved. ese two things seem to impact the increase of students' scienti c literacy skills. According to Karademir & Ulucinar (2016), critical reading a ects students' scienti c literacy skills. In addition, results from other research reveal that scienti c investigations can a ect students' scienti c literacy achievement (Fang & Wei, 2010; Gormally et al., 2009).

e post hoc analysis results (Table 4) show that one aspect of scienti c literacy, namely interpreting data and proving data scienti cally, is higher than the other two aspects of scientific literacy competence, namely evaluating and designing scienti c investigations and explaining phenomena scienti cally. e student's skills in these two aspects were not signi cantly di erent. e ability to evaluate and design scienti c investigations is the ability to describe and evaluate scienti c investigations and answer questions scienti cally (Jaerani et al., 2020)mengevaluasi desain penyelidikan ilmiahÃ,Â dan menginterpretasi dan membuktikan data secara ilmiah. Salah satu model yang bisa mendukung pencapaian kompetensi tersebut adalah pembelajaran Inkuiri Bebas. Tujuan penelitian ini adalah untuk mengetahui pengaruh model inkuiri bebas terhadap kemampuan literasi sains siswa kelas XI SMAN 2 Labuapi. Jenis penelitian yang digunakan adalah eksperimen semu (Quasi Experiment. It was assumed that the low scienti c literacy competence at this level is due to the student's lack of ability to draw conclusions and interpret scienti c evidence obtained during the learning process. According to Sukowati et al. (2016)included in the poor category. In terms of distribution of score points ability of scientific literacy acquired under the target distribution points Organisation for Economic Co-operation and Development (OECD, the lack of ability to evaluate and design scientific investigation factors is caused by the students' lack of mastery because they rarely conduct practicum activities and do not master competence in scientific investigations (Sumarra et al., 2020).

The ability to explain a phenomenon scientifically is an ability that requires students to develop their curiosity in answering all the questions given (Haerani et al., 2020)mengevaluasi desain penyelidikan ilmiahÃ'Â dan menginterpretasi dan membuktikan data secara ilmiah. Salah satu model yang bisa mendukung mencapaian kompetensi tersebut adalah pembelajaran Inkuiri Bebas. Tujuan penelitian ini adalah untuk mengetahui pengaruh model inkuiri bebas terhadap kemampuan literasi sains siswa kelas XI SMAN 2 Labuapi. Jenis penelitian yang digunakan adalah eksperimen semu (Quasi Experiment. In addition, this ability is also related to the ability to apply scientific knowledge in any given situation (Asyhari, 2015). The lack of ability to explain phenomena scientifically, according to Wulandari (2016)China, was caused by a novel betacoronavirus, the 2019 novel coronavirus (2019-nCoV is caused by the inaccurate selection of methods and approaches for building the concept of knowledge and the student's curiosity. The ability to interpret data and create graphs is one of the many competencies of scientific literacy (OECD, 2016)Sweden is now showing first improvements. Student performance has improved significantly in mathematics and reading, and a declining trend has been reversed in science. The results are now at or above the OECD average in all three subjects. • It is particularly encouraging that Sweden has been able to reduce the share of low performers in mathematics, while at the same time raise excellence with an increased number of top performers. • Sweden shows one of the highest levels of efficiency in education with strong academic results compared to the number of hours students receive instruction or do homework. Only five other school systems have a more positive ratio between learning time and academic outcomes. • Students in Sweden have positive attitudes towards science. They agree with current views about the nature of science and scientific methods. They also believe that science is important for their own future career-more so today than around a decade ago. However, when asked about their own career expectations, few students in Sweden expect to be working in a science-related occupation. • There are signs of growing inequalities in the distribution of learning outcomes in Sweden. The gap between the highest-and lowest-performing students has increased over the last decade and is now wider than the OECD average. The performance gap between socioeconomically advantaged and disadvantaged students is also increasing. • Sweden is facing a difficult challenge with immigrant students. The share of immigrant students in Sweden (first-and second-generation. This competency has the highest Score among the other two scientific literacy competencies. It requires students to analyze and evaluate data and provide responses and arguments to reach the right conclusions and communicate results (Yuliati, 2016). The high level of attainment for this competency is due to the learning process in the classroom that facilitates analytical skills through group discussions and repetitive training (Mijaya et al., 2019; Haerani et al., 2020)mengevaluasi desain penyelidikan ilmiahÃ'Â dan menginterpretasi dan membuktikan data secara ilmiah. Salah satu model yang bisa mendukung mencapaian kompetensi tersebut adalah pembelajaran Inkuiri Bebas. Tujuan penelitian ini adalah untuk mengetahui pengaruh model inkuiri bebas terhadap kemampuan literasi sains siswa kelas XI SMAN 2 Labuapi. Jenis penelitian yang digunakan adalah eksperimen semu (Quasi Experiment. This is reflected in the group discussion activities during the investigation to prove the content of additives in food. During the process, problems are presented on the worksheets to encourage the students to be active in finding solutions based on the data from the investigation. Usually, the data are presented in the form of a graph. If students can interpret the data well, it means that this ability is supported by their ability to connect the meaning of graphs with scientific concepts (Fadilah et al., 2020)the ability of disaster context science literacy (LSKB. This is in line with Abidin's statement that data interpretation is an activity that prioritizes the ability to remember and makes use of theories, ideas, and information. Thus, this statement supports the research results that the third scientific literacy competence is the aspect the students mastered the most—hence, it got the highest Score.

Conclusion

The context-based teaching material developed met the criteria of being valid and practical. The analysis of students' scientific literacy skills in the control and experimental classes shows a significant difference in ability ($p<.01$). The implementation of the teaching materials to determine their effectiveness in improving students' scientific literacy skills revealed that the context-based teaching materials could improve students' scientific literacy skills ($p<.01$). Furthermore, post hoc analysis shows that students' scientific literacy skills for the aspect of interpreting data and evidence scientifically are higher than those for the other two aspects, evaluating and designing scientific investigations, as well as explaining phenomena scientifically. The results of this study can be used as a reference for improving students' scientific literacy skills.

Suggestion

Other researchers can adopt this developed model by implementing it on the subject of high school students to reveal students' literacy skills.

Limitation

This research is limited to one material. Researchers can arrange more complete teaching materials by adding other materials to reveal students' scientific literacy skills comprehensively.

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References

Ariningtyas, A., Wardani, S., & Mahatmanti, W. (2017). Efektivitas Lembar Kerja Siswa Bermuatan Etnosains Materi Hidrolisis Garam untuk Meningkatkan Literasi Sains Siswa SMA. *JISE*, *6*(2).

Arohman, M., & Priyandoko, D. (2016). Kemampuan Literasi Sains Siswa pada Pembelajaran Ekosistem. *Jurnal.Uns.Ac.Id*, *13*(1).

Asyhari, A. (2015). Profil Peningkatan Kemampuan Literasi Sains Siswa Melalui Pembelajaran Saintifik. *Jurnal Ilmiah Pendidikan Fisika Al-Biruni*, *4*(2). https://doi.org/10.24042/jpifalbiruni.v4i2.91

Borg, W. ., & Gall, M. . (1983). Educational Research an Introduction fourth edition. *Longman Inc*, *1*(1).

BouJaoude, S. (2002). Balance of scientific literacy themes in science curricula: The case of Lebanon. *International Journal of Science Education*, *24*(2). https://doi.org/10.1080/09500690110066494

Carreira, S., Amado, N., & Lecoq, F. (2011). Mathematical Modelling of Daily Life in Adult Education: Focusing on the Notion of Knowledge. In *International Perspectives on the Teaching and Learning of Mathematical Modelling* (Vol. 1). https://doi.org/10.1007/978-94-007-0910-2_21

Fadilah, M., Permanasari, A., Riandi, R., & Maryani, E. (2020). Analisis Karakteristik Kemampuan Literasi Sains Konteks Bencana Gempa Bumi Mahasiswa Pendidikan IPA pada Domain Pengetahuan Prosedural dan Epistemik. *Jurnal IPA & Pembelajaran IPA*, *4*(1). https://doi.org/10.24815/jipi.v4i1.16651

Fang, Z., & Wei, Y. (2010). Improving middle school students' science literacy through reading infusion. *Journal of Educational Research*, *103*(4). https://doi.org/10.1080/00220670903383051

Fensham, P. J. (2008). Science education policy-making: eleven emerging issues. *Unesco*.

Firmanshah, M. I., Jamaluddin, J., & Hadiprayitno, G. (2020). Learning difficulties in comprehending virus and bacteria material for senior high schools. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, *6*(1). https://doi.org/10.22219/jpbi.v6i1.10981

Flannelly, K. J., Flannelly, L. T., & Jankowski, K. R. B. (2018). Threats to the internal validity of experimental and quasi-experimental research in healthcare. *Journal of Health Care Chaplaincy*, *24*(3). https://doi.org/10.1080/08854726.2017.1421019

Gormally, C., Brickman, P., Hallar, B., & Armstrong, N. (2009). Effects of Inquiry-based Learning on Students' Science Literacy Skills and Confidence. *International Journal for the Scholarship of Teaching and Learning*, *3*(2). https://doi.org/10.20429/ijsotl.2009.030216

Hadisaputra, S., Savalas, L. R. T., Makhrus, M., Purwoko, A. A., & Andayani, Y. (2020). *Effects of Local Wisdom-Based Practicum on Learners' Attitudes, Science Literacy, and Learning Outcome*. https://doi.org/10.2991/assehr.k.200827.029

Haerani, S. A. S., Setiadi, D., & Rasmi, D. A. C. (2020). Pengaruh Model Inkuiri Bebas Terhadap Kemampuan Literasi Sains. *Jurnal Pijar Mipa*, *15*(2). https://doi.org/10.29303/jpm.v15i2.1682

Hastuti, P. W., Setianingsih, W., & Anjarsari, P. (2020). How to develop students' scientific literacy through integration of local wisdom in Yogyakarta on science learning? *Journal of Physics: Conference Series*, *1440*(1). https://doi.org/10.1088/1742-6596/1440/1/012108

Irmita, L. U., & Atun, S. (2017). Pengembangan perangkat pembelajaran menggunakan pendekatan TPACK untuk meningkatkan literasi sains. *JTK (Jurnal Tadris Kimiya)*, *2*(1). https://doi.org/10.15575/jta.v2i1.1363

Ishikawa, K. (1976). Guide to quality control, asian productivity organization. In *Nordica International*.

Ita. (2018). Keterampilan Berpikir Tingkat Tinggi dan Hasil Belajar Kognitif Siswa melalui Pembelajaran Kooperatif Berbasis Inkuiri. *BIODEKSI: Jurnal Pendidikan Biologi*, *11*(1).

Karademir, E., & Ulucinar, U. (2016). Examining the Relationship between Middle School Students' Critical Reading Skills, Science Literacy Skills and Attitudes: A Structural Equation Modeling. *Journal of Education in Science, Environment and Health*, *3*(1). https://doi.org/10.21891/jeseh.275669

Khoiri, A. (2016). Local Wisdom PAUD to Grow Student's Soft Skills (Study Cash: Development RKH On Science Learning). *Indonesian Journal of Early Childhood Education Studies*, *5*(1).

Kulsum, F., Rochman, C., & Nasrudin, D. (2017). Profil literasi sains peserta didik pada konsep pembangkit listrik tenaga air (PLTA) Cirata di Kabupaten Cianjur Jawa Barat. *WaPFi (Wahana Pendidikan Fisika)*, *2*(1). https://doi.org/10.17509/wapfi.v2i1.4866

Leppink, J. (2018). Analysis of Covariance (ANCOVA) vs. Moderated Regression (MODREG): Why the Interaction Matters. *Health Professions Education*, *4*(3). https://doi.org/10.1016/j.hpe.2018.04.001

Mijaya, N. P. A. P., Sudiatmika, A. A. I. A. R., & Selamet, K. (2019). Profil literasi sains siswa SMP melalui model pembelajaran levels of inquiry. *Jurnal Pendidikan Dan Pembelajaran Sains Indonesia (JPPSI)*, *2*(2). https://doi.org/10.23887/jppsi.v2i2.19385

Nurkhalisa, S., Fari, F., & Ummayah, D. (2017). Etse-Module "The Benefits of Acidic Bases in Life" Ethnoscience Based Demak Society in the Utilisation of Lime. *International Journal of Science and Research (IJSR)*, *6*(7), 1396–1400. https://doi.org/10.21275/art20175389

OECD. (2016). Country Note – Results from PISA 2015: Indonesia. *Oecd*.

OECD. (2019a). Country Note–Result from PISA 2018 Indonesia. In *Oecd*.

OECD. (2019b). PISA 2018 Assessment and Analytical Framework, PISA. In *OECD Publishing*.

Ofianto, Aman, Ningsih, T. Z., & Abidin, N. F. (2022). The Development of Historical Thinking Assessment to Examine

Students' Skills in Analyzing the Causality of Historical Events. *European Journal of Educational Research*, *11*(2). https://doi.org/10.12973/eu-jer.11.2.609

Pereira, D. G., Afonso, A., & Medeiros, F. M. (2015). Overview of Friedmans Test and Post-hoc Analysis. *Communications in Statistics: Simulation and Computation*, *44*(10), 2636–2653. https://doi.org/10.1080/03610918.2014.931971

Rahmadani, Y., Fitakurahmah, N., Fungky, N., Prihatin, R., Majid, Q., & Prayitno, B. A. (2018). Profil Keterampilan Literasi Sains Siswa di Salah Satu Sekolah Swasta di Karanganyar. *Jurnal Pendidikan Biologi*, *7*(3). https://doi.org/10.24114/jpb.v7i3.10123

Ramli, M., Susanti, B. H., & Yohana, M. P. (2022). Indonesian Students' Scientific Literacy in Islamic Junior High School. *International Journal of STEM Education for Sustainability*, *2*(1). https://doi.org/10.53889/ijses.v2i1.33

Salim, S., Basri, A. M., Husain, D. L., Hidayah, A. N., & Nurhayati, N. (2020). the Use of Digital Literacy in Higher Education. *AL-ISHLAH: Jurnal Pendidikan*, *12*(1), 52–66. https://doi.org/10.35445/alishlah.v12i1.197

Setiawan, A. R. (2019). Literasi Saintifik Berdasarkan Kecerdasan Majemuk dan Motivasi Belajar. *Media Penelitian Pendidikan : Jurnal Penelitian Dalam Bidang Pendidikan Dan Pengajaran*, *13*(2). https://doi.org/10.26877/mpp.v13i2.4913

Sujudi, M. S., Idris, T., S, S., & Handayani, P. H. (2020). Profil Kemampuan Literasi Sains Siswa SMP Islam As-Shofa Kota Pekanbaru Berdasarkan PISA. *Journal of Natural Science and Integration*, *3*(1). https://doi.org/10.24014/jnsi.v3i1.9023

Sukowati, D., & Rusilowati, A. (2016). Analisis Kemampuan Literasi Sains Dan Metakogntif Peserta Didik. *Physics Communication*, *1*(1).

Sukri, A., Rizka, M. ., Lukitasari, M., Ramdiah, S., & Purwanti, E. (2022). Validating student's green character instrument using factor and Rasch model. *European Journal of Educational Research*, *11*(2), 859–872. https://doi.org/https://doi.org/10.12973/eu-jer.11.2.859

Sukri, A., Rizka, M. A., Sakti, H. G., Maududy, K. U., & Hadiprayitno, G. (2018). Designing an integrated curriculum based on local primacy and social reconstruction perspectives of West Nusa Tenggara, Indonesia. *Jurnal Pendidikan IPA Indonesia*, *7*(4), 467–475. https://doi.org/10.15294/jpii.v7i4.15272

Sumarra, M. Y., Wulan, A. R., & Nuraeni, E. (2020). Analisis Penggunaan Tes Tertulis tentang Keterampilan Mengevaluasi dan Merancang Penyelidikan Ilmiah pada Matapelajaran IPA-Biologi SMP. *Jurnal Penelitian Pendidikan*, *20*(2). https://doi.org/10.17509/jpp.v20i2.24477

Tohir, M. (2016). Hasil PISA Indonesia tahun 2015 mengalami peningkatan. *Tersedia Online: Https://Matematohir.Wordpress.Com/2016/12/08/Hasil-Pisa-Indonesiatahun-2015-Mengalami-Peningkatan/ [08 Desember 2016]*, *1*(1).

Wulandari, N., & Wulandari, N. (2016). Analisis kemampuan literasi sains pada aspek pengetahuan dan kompetensi sains siswa SMP pada materi kalor. *EDUSAINS*, *8*(1). https://doi.org/10.15408/es.v8i1.1762

Yaghmaei, F. (2003). Content validity and its estimation. *Journal of Medical Education*, *3*(1), 25–27. https://brief.land/jme/articles/105015.html

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