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Impact of Science Process Skills on Scientific Literacy

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Abstract: The purpose of this study was to determine the difference in the increase in scientific literacy skills of students who were taught with a science process skills approach with those taught using a direct learning model in physics learning. This study uses a quantitative approach to the Non-Equivalent Control Group Design experiment. The population used in this study were students of class XI MIA with a sample of 60 people taken by random sampling. The instrument used in this study was a test question in the form of an essay. The data of this study were analyzed using the average test, N-gain and independent sample t-test. The results showed that the average value of scientific literacy in the experimental class was in the high category and the control class in the medium category. In addition, based on the independent sample t-test, it was found that there was a significant difference in the increase in students' scientific literacy skills. So, it can be concluded that there is a difference in the improvement of students' scientific literacy skills in learning Physics taught with a science process skills approach with those taught using a direct learning model.

Keywords: Science process skills; Science literacy ability; Physics learning

Introduction

Scientific literacy comes from the Latin words, literatus and scientia, literatus means marked with letters, literate or educated, while scientia means knowledge (Maknun, 2014, Chenchung, 2022). Scientific literacy is a knowledge and understanding of scientific concepts and processes that enable a person to make a decision with the knowledge he has, and to be involved in matters of state, culture and economic growth. In other words, someone who is literate in science will be able to play an active role in all aspects of life, especially in the field of science they are involved in.

According to Winata et al (2018), scientific literacy is knowledge and understanding of scientific concepts and processes needed in making personal decisions, contributing to cultural and social activities, and economic productivity. In line with the previous opinion, Gormally et al. (2012), defines scientific literacy as a person's ability to distinguish scientific facts from a variety of information, recognize and analyze the use of scientific inquiry methods and the ability to organize, analyze, interpret quantitative data and scientific information. Based on these several definitions of scientific literacy, scientific literacy is seen as multidimensional which is not only an understanding of scientific knowledge.

Scientific literacy plays an important role in catalyzing science learning in the 21st century. Students must be prepared for scientific literacy to be able to solve scientific problems. scientific literacy has been established as the main goal of the science education curriculum, in 2015. Indonesia is ranked below in terms of scientific literacy ability compared to other Asian countries. The results of a survey conducted by the Program for International Student Assessment (PISA) showed that the scientific literacy scores of Indonesian students were 393, 395, 395 for 2000, 2003, and 2006 (OECD, 2013). The results of the 2009 PISA survey showed that Indonesia's scientific literacy score reached 383 and ranked 57 out of 65 countries (Winata et al, 2018). The results of the 2012 PISA survey showed that Indonesia's scientific literacy score was 382 and ranked 63 out of 64 countries (OECD, 2013). In line with the results of a survey conducted by PISA, based on a survey conducted by Trends in International Mathematics and Science Study (TIMSS) which is conducted every four years, in 2007 Indonesia was ranked 35th out of 49 countries and in 2011 Indonesia was ranked 40th. from 42 countries (NCES, 2012). The latest developments in

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the 2018 PISA results, especially in scientific literacy, Indonesia ranks 70th out of 78 countries (OECD, 2018). These results indicate that the average score of Indonesian scientific literacy is below the international average score. based on a survey conducted by Trends in International Mathematics and Science Study (TIMSS) which is conducted every four years, in 2007 Indonesia was ranked 35th out of 49 countries and in 2011 Indonesia was ranked 40th out of 42 countries (NCES, 2012).

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One of the important dimensions in scientific literacy is science process skills. Science process skills are skills needed to acquire, develop, and apply scientific concepts, principles, laws, and theories, both in the form of mental skills, physical skills (manual), and social skills (Zamista, 2015). Science process skills are skills needed in conducting research and solving problems (Maknum 2012). The development of process skills students will be able to find and develop their own facts and concepts as well as grow the required value attitudes (Hasbullah 2016).

Based on the author's observations and interviews with physics teachers at SMAN 1 Peukan Baro, the physics learning process has been introduced to scientific literacy. The scientific literacy of students at the school is still low. The scientific literacy at the school is categorized as low based on the Assasment test that was tested on students, where students obtained scores at the minimum threshold. Students are not able to answer questions related to scientific concepts of physics and science knowledge proposed by the teacher, this is also reinforced by the results of daily tests of students related to scientific concepts of physics and scientific knowledge which are below the passing grade, the average value of students is below 65 which is far from the limit. Passing Grade is 70.

Based on a review of data on computer-based national exam, the paper-based test and the end-semester exam scores, SMA Negeri 1 Peukan Baro in the last 3 years has a low average national exam score for students in physics. The average computer-based national exam score for physics lessons obtained in 2017 was 26.25, in 2018 it was 31.79 and in 2019 it was 32.82. This is far from the national category of 46.47, so it can be concluded that the scientific literacy ability of SMA Negeri 1 Peukan Baro students is still low. is low.

Based on these problems, teachers need to innovate in the teaching and learning process. Where for a more effective and efficient learning process to take place, it is necessary to apply a learning model, method or approach that can improve student literacy which encourages students to solve a problem (Amar et al., 2020; Fitriyanti et al., 2021). Science process skills approach is one of the most important science learning approaches for scientific inquiry (Kruea-In & Thongperm, 2015; Juhji, 2016; Alatas & Fachrunisa, 2018; Setiawan. A.M & Sugiyanto, 2020). The science process skills approach is an approach in science learning that involves mental and physical skills which include three aspects of psychomotor, affective, and cognitive skills that can be applied in scientific activities. In learning, the science process skills approach provides opportunities for students to be actively involved so that interactions can form between process skills and scientific facts, concepts, and principles that can foster students' scientific attitudes (Juhji, 2016; Hernawati, 2018). In this process skills approach, students are invited to learn to observe, classify, measure, use numbers, guess, conclude and communicate the object being studied. In addition, students are also invited to be able to identify variables, form hypotheses (Kizilaslan, 2019) In this process skills approach, students are invited to learn to observe, classify, measure, use numbers, guess, conclude and communicate the object being studied. In addition, students are also invited to be able to identify variables, form hypotheses (Kruea-In, 2015) In this process skills approach, students are invited to learn to observe, classify, measure, use numbers, guess, conclude and communicate the object being studied. In addition, students are also invited to be able to identify variables, form hypotheses (Kruea-In, 2015)

Based on the above background, the authors want to study further about whether the application of Science Process Skills can improve students' scientific literacy skills in learning physics? Therefore, the author raised a research title "Application of Science Process Skills to Improve Students' Scientific Literacy Ability in Learning Physics".

Method

In this study, the researchers used a quantitative approach with a quasi-experimental type of research (quasi-experimental). The research design used in this study is the Non-Equivalent Control Group Design. This study used two classes, namely the experimental class and the control class. The experimental class is the class that gets treatment by applying Science Process Skills with steps, while the control class is the comparison class that only uses direct learning models in its learning such as lectures and also explanations explained on the blackboard. The experimental class and the control class in this study were given a pretest and also a posttest to be able to see the differences in problem solving skills and motivation of the two classes.

Table 1 Research Design Nonequivalent Control Group Design

Experimental class	O1	X	O2
Control class	O1	-	O2

(Source: Sugiyono, 2014)

Results and Discussion

The scientific literacy ability of students in this study was measured using 7 questions that had passed the feasibility test in the form of descriptions, where the questions used were analyzed using Microsoft Excel to see the average value obtained regarding the pretest and posttest data and N- gain on students' scientific literacy skills. Questions related to scientific literacy skills were given to students twice, where the first was at the pretest and the second was at the posttest.

Based on the results of the study, it was obtained that the posttest mean of the experimental class was higher than the control class and there was an increase in the scientific literacy ability of students as seen from the N-gain value in the experimental class and control class. The value of the research analysis results obtained related to increasing students' scientific literacy skills can be seen briefly in Table 2

Table 2 Improving Science Literacy Ability in Experiment and Control Class

Class	The Average Value of Students' Science Literacy Ability		N-gain	Category
	Pretest	Posttest		
Experiment	34	85	0.78	Tall
Control	33	69	0.54	Currently

The results of the scientific literacy ability of students seen from the pretest and posttest scores and the N-gain value in Table 2 above show that the pretest scores of the two classes are relatively the same and are still very low, this shows students' understanding related to the material of traveling waves and waves. stationary is still very low, where for the experimental class the pretest value obtained is 34 and for the control class is 33, while the posttest mean value obtained in the experimental class is 85, which is greater than the control class which is only 69. This result indicates an increase students' scientific literacy skills on the material of traveling waves and stationary waves.

The average value obtained in the experimental class is due to the fact that in that class learning is carried out by applying science process skills as an alternative learning and using steps of science process skills in the learning process, while in the control class only uses conventional learning in accordance with the learning that is indeed used by the teacher. Physics subject at SMA Negeri 1 Peukan Baro, in the learning process the two classes both conduct experiments with different treatments in order to strengthen students' understanding related to the concepts of traveling waves and stationary waves, so that it will affect their learning outcomes.

The difference in the value of scientific literacy ability obtained by the control class at the time of the posttest with an average of 69 while the experimental class of 85, from this value it can be seen that there is a significant difference in the average value of the scientific literacy ability of students, so it can be concluded that there is a significant difference in literacy ability. students' science for the control class and experimental class, where for the experimental class the learning is done by applying the science process skills, although there are differences, but for increasing the value of students' scientific literacy abilities more clearly can be seen based on the N-gain value. Graph Figure 1.

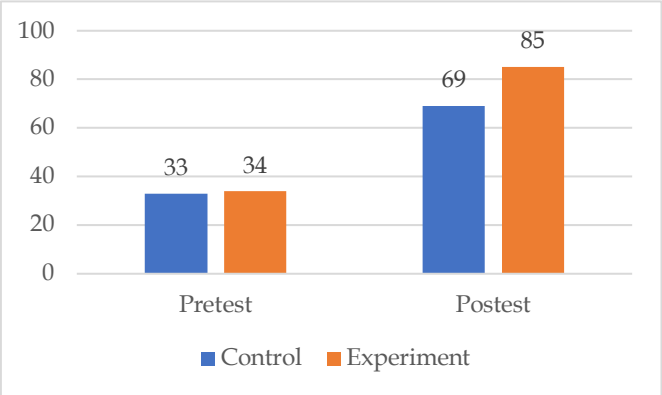

Figure 1. Diagram of increasing scientific literacy skills

Figure 1 shows the difference in the average pretest and posttest values of the experimental class and the control class with the N-gain value of each class, where in the control class the mean pretest value is 33 while for the posttest it is 69 with an increase in the value as illustrated by the N-gain value. of 0.54 in the medium

category, while for the experimental class the mean value of the pretest was 34 and for the posttest it was 85 with an N-gain value of 0.78 in the high category. Based on the N-gain value, it can be concluded that there was an increase in the scientific literacy ability of the experimental class and control class students, but in the experimental class the increase was greater than the control class.

A more specific explanation related to the analysis of the results of increasing the average value of the pretest and posttest data for the control and experimental classes can also be seen based on the N-gain value of each scientific literacy ability indicator which is the reference value to determine the overall mean value of the pretest and posttest of the control class and the experimental class, where N-gain values for each indicator of scientific literacy ability can be seen in Table 3.

Table 3. N-gain Value of Scientific Literacy Ability based on Indicator

Indicator	Science Literacy Ability					
	Control class			Experiment class		
	Pre test	Post test	N-gain	Pre test	Post test	N-gain
Explaining Phenomena scientific	30	70	0.56	32	84	0.76
Evaluating and designing Scientific Investigations	29	64	0.49	29	89	0.84
Interpret data and evidence scientifically	39	73	0.54	40	83	0.71

Based on the N-gain values in Table 4.3 for the control class and the experimental class, it shows that overall, there is an increase in scientific literacy ability in the high category in the experimental class, where the overall N-gain value in the experimental class is in the high category. The highest N-gain value from other indicators lies in the indicators of data investigation and scientific evidence.

The increase in scientific literacy skills occurs when the learning process is carried out by applying the science process skills which can be seen from the N-gain value of the experimental class of 0.78.

The magnitude of this increase shows that students begin to understand related to the situation described in the problem, because students' understanding of concepts is getting better related to the material of traveling waves and stationary waves when learning by applying science process skills, where for students' scientific literacy abilities are assessed based on their ability to solve problems. questions based on indicators of scientific literacy ability with learning to apply science process skills. A more detailed explanation regarding the increase that occurs in each indicator of scientific literacy ability based on the N-gain value obtained by students can be seen in the following discussion.

Explaining Scientific Phenomena

The first indicator is to explain the phenomenon scientifically, where the N-gain value for the experimental class is 0.76 and the control class is 0.56. it means increasing scientific literacy skills on indicators explaining scientific phenomena for the two different classes. The difference in the N-gain value between the experimental class and the control class is influenced by different learning processes, where in the experimental class the learning process uses science process skills and the control class uses conventional learning. If students are able to explain natural phenomena scientifically, it can be said that students have been able to apply scientific literacy skills. Students' scientific literacy skills are more visible when students are able to explain natural phenomena, draw conclusions and use theories, ideas, information, as well as facts that occur in everyday life. This is also in line with (Nurfaidah, 2017; Kurniawan, 2019), stating that students' scientific literacy skills when explaining natural phenomena and drawing conclusions based on scientific evidence will make these students have the ability to recognize, remember, explain, describe and apply the knowledge they have acquired. get in everyday life.

Evaluating and designing scientific investigations

The second indicator of scientific literacy ability is evaluating and designing scientific investigations, where based on the N-gain value of the experimental class and control class it is obtained that the experimental class value is 0.84 greater than the control class is only 0.49, this shows that in the experimental class an increase occurs in the high category. while in the control class in the medium category.

The increase that occurred in the experimental class was due to the fact that in the learning process students were invited to be able to evaluate and design practicum processes related to traveling waves and stationary waves.

Interpret data and evidence scientifically

The third indicator of scientific literacy ability is to interpret data and evidence scientifically. Based on the results of the N-gain value obtained on this indicator for the experimental class and control class, it can be seen

that the increase in the experimental class is greater than the control class, where for the experimental class the increase is 0.71, while for the control class it is only 0.54, this is occurring because in the experimental class students get learning by applying science process skills, while in the control class applying conventional learning. Hypothesis testing can be known by doing a t-test so that it can be seen whether the results of the hypothesis testing are true or not.

Based on the normality and homogeneity test, it is known that the student learning outcomes data on the normality test in the control class are 0.263 and 0.284. While the experimental class 0.115 and 0.165. The homogeneity test of both classes is 0.831. The value obtained from the two tests in each class is sig.> 0.05, so it can be concluded that the two data are normally distributed and homogeneous. Hypothesis testing was measured using an independent sample test through SPSS version 25 software with a significant value > 0.05. The test results show that the posttest scores in both classes obtained tcount (5.786) > t table (2.042), it can be concluded that there are significant differences between the two classes, namely the control and experimental classes. The difference is seen in the experimental class that applies the science process skills while the control class applies the direct learning model.

The difference in increasing scientific literacy skills taught by applying science process skills in the experimental class can be seen in the scores obtained by students, where the pretest got an average of 34 and the posttest got an average of 85, with a large increase of 0.78. This is in accordance with Beyyer (2019) which states that science process skills-based learning which emphasizes the process of seeking knowledge has a positive influence on increasing students' scientific literacy skills. While in the control class at the time of the pretest, the average was 33 and the posttest obtained an average of 69 with a large increase of 0.54. This is in the learning control class which takes place by applying the direct learning model so that the amount of improvement obtained is lower than the experimental class. Science process skills have a relationship with indicators of scientific literacy ability, as shown in Table 4.

Table 4. The relationship between science process skills and scientific literacy

Science Process Skills Syntax	Scientific Literacy Indicator		
	Explaining Phenomena Scientifically	Evaluating and Designing Scientific Investigations	Interpreting Data and Evidence Scientifically
Basic Skills	0.43	0.13	0.35
Processing Skills	0.15	0.35	0.12
Investigating Skills	0.38	0.55	0.68

The correlation between Science Process skills Syntax and Scientific Literacy Indicators means that in Science Process Skills syntax, basic skills consist of observing skills, recording data and information, following orders, taking measurements, manipulating movements and implementing procedures, and using equipment techniques. In the basic skills science process skills syntax, it can be seen that it has a correlation of 0.43 with scientific literacy indicators, namely explaining scientific phenomena in the medium category because in this syntax students are required to observe a video displayed by the teacher about traveling waves and stationary waves, and students are required to make a summary based on the observed video and formulate an initial hypothesis about the traveling wave, this is in accordance with scientific literacy indicators explaining scientific phenomena, because in this indicator students are required to remember appropriate scientific knowledge, identify, make and justify appropriate predictions and provide a hypothesis. Meanwhile, the indicators of evaluating and designing scientific investigations have a correlation of 0.13 which is in the very low category, while the indicator of interpreting data and evidence scientifically has a correlation of 0.35 which is in the low category, this is due to the basic skills syntax of students' science process skills have not been required to transform data from one representation to another, and analyze and interpret the data and draw the right conclusions, because in this syntax new students are required to observe, record data and information and follow the instructions given.

The second skill in the science process skills is processing skills which consist of predicting inference skills and procedure selection skills, based on table 4. it can be seen that processing skills have a relationship with explaining scientific phenomena with a large correlation of 0.15 with a very low category, while with indicators evaluating and designing investigations large scientific correlation 0.35 with a low category this is because the syntax of processing skills students are required to make predictions, Differentiating and selecting this procedure is in accordance with the indicators of evaluating and designing scientific investigations because in this process students conduct experiments according to the experimental procedures on the student worksheet and implement and predict the possibilities that will occur if using different practicum materials, and for indicators interpreting data and evidence. Scientific research has a correlation of 0.12 with a very low category because of this syntax, students have not been required to interpret the data and draw the right conclusions so that the indicator is in the very

low category.12 with a very low category because of this syntax, students have not been required to interpret the data and draw the right conclusions so that the indicator is in the very low category 12 with a very low category because of this syntax, students have not been required to interpret the data and draw the right conclusions so that the indicator is in the very low category.

The third skill in science process skills is the investigative skill which includes the skills to design research and carry out research. The investigative skill has a correlation with the scientific literacy indicator explaining scientific phenomena of 0.38 with a low category, while the indicator of designing scientific investigations has a correlation of 0.55 with a medium category, while for the indicator of interpreting data and scientific evidence has a correlation of 0.68 with high category.

Science process skills has a relationship with scientific literacy so Komikesari (2016) states that science process skills are the foundation for the formation of a logical thinking foundation so it is important for students to have. Likewise, Nugraha's (2019) statement which describes science process skills as procedural, experimental skills and investigates the habit of carrying out scientific work processes from the ability to think or scientific investigations in accordance with scientific literacy indicators evaluating and designing scientific investigations. Then related to this Pratono (2018) and Andriyawati, (2020) concluded that science process skills are one of the most important things to be improved in the teaching and learning process because it can make students have the ability or proficiency to take an action in science learning to produce concepts, theories, principles,

Conclusion

Based on the results of research and data analysis, it was found that the scientific literacy ability of students in the control class taught by the direct model was 0.54 in the medium category and in the experimental class taught by applying the science process skills was 0.78 with the high category so that it can be concluded that there is a difference increasing the scientific literacy ability of students who are taught with a science process skills approach to those taught using a direct learning model in physics learning.

References

Amar, G. I., Suranto, S., & Sajidan, S. (2020). The Use of a Creative Problem Solving Based Genetic Mutation Module in Higher Education. *International Journal of Higher Education*, *10*(3), 33. https://doi.org/10.5430/ijhe.v10n3p33

Adriyawati, U., Rahmawati, Y., & Mardiah, A. (2020). STEAM-project-based learning Integration to Improve elementary school students' scientific literacy on alternative energy learning. *Universal Journal of Educational Research*, 8(5), 1863–1873. https://doi.org/10.13189/ujer.2020.080523

Alatas, F., & Fachrunisa, Z. (2018). Keefektifan Pogil dengan Laboratorium Virtual di Meningkatkan Keterampilan dan Sikap Proses Sains: Konsep Gerak Harmonik Sederhana. *EDUSAIN*,10(2), 327–334. https://doi.org/10.15408/es.v10i2.10239

Chen-Chung Liu,Cai-Ting Wen,&Shih-Hsun Fan Chiag Hsin-Yi Chang. (2022) Augmenting the efect of virtual labs with "teacher demonstration" and "student critique" instructional designs to scafold the development of scientiic literacy, *Instructional Science*. 50:303–333 https://doi.org/10.1007/s11251-021-09571-4

Gormally, C., Brickman, P., & Lutz, M. (2012). Developing a test of scientific literacy skills (TOSLS): Measuring undergraduates' evaluation of scientific information and arguments. *CBE Life Sci Educ*. *11*(4): 364–377. https://doi.org/10.1187/cbe.12-03-0026

Hasbullah. (2016). Pengembangan Lembar Kerja Siswa BerorientasiKeterampilan Proses Dalam Pembelajaran Saintifik Terhadap Hasil Belajar Siswa Pada Pokok Bahasan Sistem Pencernaan Manusia, *jurnal Pendidikan Biologi*, 7(2): 123-124. http://dx.doi.org/10.24127/bioedukasi.v7i2.613

Hernawati, D., Amin, M., Irawati, M. H., Indriwati, S. E., & Omar, N. (2018). The effectiveness of scientific approach using encyclopedia as learning materials in improving students' science process skills in science. *Jurnal Pendidikan IPA Indonesia*, 7(3), 266–272. https://doi.org/10.15294/jpii.v7i3.14459

Inayah, A. D., Ristanto, R. H., Sigit, D. V., & Miarsyah, M. (2020). Analysis of science process skills in senior high school students. Universal Journal of Educational Research, 8(4 A), 15–22. https://doi.org/10.13189/ujer.2020.081803

Juhji, J. 2016. Keterampilan Proses Sains Siswa melalui Pendekatan Peningkatan Inkuiri Terbimbing.*Jurnal Penelitian dan Pembelajaran IPA*,2(1), 58–70. http://dx.doi.org/10.30870/jppi.v2i1.419

Komikesari, H. 2016. Peningkatan keterampilan proses sains dan hasil belajar fisika siswa pada model pembelajaran kooperatif tipe *student team achievement division*. *Tadris: Jurnal Keguruan dan Ilmu Tarbiyah*, 1(1):15-22. https://doi.org/10.24042/tadris.v1i1.886

Kurniawan, W., Darmaji, D., Astalini, A., Kurniawan, D. A., Hidayat, M., Kurniawan, N., & Farida, L. Z. N. (2019). Multimedia physics practicum reflective material based on problem solving for science process skills. International Journal of Evaluation

and Research in Education, 8(4), 590–595. https://doi.org/10.11591/ijere.v8i4.20258

Kızılaslan, A. (2019). The development of science process skills in visually impaired students: Analysis of the activities. International Journal of Evaluation and Research in Education, 8(1), 90–96. https://doi.org/10.11591/ijere.v8i1.17427

Kruea-In, C., Kruea-In, N., & Fakcharoenphol, W. (2015). A Study of Thai In-Service and Pre-Service Science Teachers' Understanding of Science Process Skills. *Procedia – Social and Behavioral Sciences*, *197*, 993–997. https://doi.org/10.1016/j.sbspro.2015.07.291

Maknun.D.(2014).Penerapan Pembelajaran Kontekstual Untuk Meningkatkan Literasi Sains dan Kualitas Argumentasi Siswa Pondok Pesantren Daarul Uluum PUI Majalengka pada diskusi Sosiaintifik IPA, *JURNAL TARBIYAH*, 21(1). http://dx.doi.org/10.30829/tar.v21i1.221

Nugraha, E.S., Hartono. dan Nuswowati, M. (2019). Improving science process skills through the socio-cultural inquiry model. *Journal of Primary Education,* 8(2):192– 199. Retrieved from https://journal.unnes.ac.id/sju/index.php/jpe/article/view/25990

Nurfaidah, S.S. (2017). Analisis Aspek Literasi Sains pada Buku Teks Pelajaran IPA. *Mimbar Sekolah Dasar*, 4(1), 56-66. https://doi.org/10.53400/mimbar-sd.v4i1.5585

NCES. 2012. *Table S1. Percentage Distribution of 15-Year-Old Students on PISA Science Literacy Scale, by Proficiency Level and Education System:2012*. Retrieved from https://nces.ed.gov/pubs2014/2014024_tables.pdf

OECD. (2013). *PISA 2018 Result (Volume 1): What students Know and Can Do,* PISA, OECD Publishing, Paris. Retrieved from https://www.oecd.org/publications/pisa-2018-results-volume-i-5f07c754-en.htm

OECD. (2018). PISA 2015 Results (Volume II): Excellence and Equity in Education, PISA. Paris: OECD Publishing. Retrieved from https://www.oecd.org/pisa/Combined_Executive_Summaries_PISA_2018.pdf

Pratono, A., Sumarti, S.S. dan Wijayati, N. 2018. Contribution of assisted inquiry model of e-module to student science process skill. *Journal of Innovative Science Education,* 7(1):62-68. Retrieved from https://journal.unnes.ac.id/sju/index.php/jise/article/view/20633

Setiawan, A. M., & Sugiyanto. (2020). Science process skills analysis of science teacher on professional teacher program in Indonesia. Jurnal Pendidikan IPA Indonesia, 9(2), 241–247. https://doi.org/10.15294/jpii.v9i2.23817

Sugiyono. (2014). *Metode Penelitian Pendidikan: Pendekatan Kuantitatif, Kualitatif, dan R&D*. Bandung: Alfabeta

Winata, A., Cacik, S., Seftia, I. (2018) Kemampuan Awal Literasi Sains Peserta Didik Kelas V SDN Sidoerejo I Tuban Pada Materi Daur Air. *Journal Of Teaching Elementary Education*, 2(1). http://dx.doi.org/10.30587/jtiee.v2i1.356

Widodo, W., Sudibyo, E., Suryanti, S., Sari, D., Inzanah, I., & Setiawan, B. (2020). The Effectiveness of Gadget-Based Interactive Multimedia in Improving Generation Zâ€™s Scientific Literacy. *Jurnal Pendidikan IPA Indonesia, 9*(2), 248-256. https://doi.org/10.15294/jpii.v9i2.23208

Zamista, A. (2015). *Pengembangan Tes Keterampilan Proses Sains Materi Fluida Statis Kelas X SMA/MA (Pdf Online)*. Retrieved from http://journal.unj.ac.id/unj/index.php/prosidingsnf/article/view/5012