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Content Analysis of the Nature of Science in the Thematic Learning Book for Lower Grade Elementary School 2013 Curriculum

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Abstract. The main book used in learning in elementary schools from upper to lower grades is currently the 2013 Curriculum thematic learning book. This study aims to describe the level of Nature of Science (NOS) content in the lower grade thematic curriculum books. This research is a descriptive research with the object of research being a thematic learning book for elementary school students in the lower grades of the 2013 curriculum, namely grades 1-3. Data was collected through observation techniques using research instruments that included an analysis of NOS aspects. After collecting the data, it was analyzed by grouping and scoring, as well as being tested for validity and reliability, before being described and drawing conclusions. The results showed that the level of NOS content in the thematic learning materials for lower grade elementary school students in the 2013 curriculum was very low, namely 3.7%. So it can be said that the NOS aspect in the lower grade 2013 curriculum books has not appeared.

Keywords: Difficulty, Start Reading, Students.

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INTRODUCTION ~ The nature of science (NOS) is a very important basis in teaching science to all educational students in schools. Because science education aims to equip students with the ability to apply scientific skills to understand various types of natural phenomena, and to develop students' awareness of scientific literacy through their understanding of science (Lederman et al., 2014). However, achieving these goals remains a major challenge for the education process in Indonesia.

Based on the results of the International Student Assessment Program (PISA) survey report, the Organization for Economic Co-operation and Development (OECD) revealed that, in recent years, Indonesia is still one of the countries with low scientific capabilities.

Previous research shows that students' understanding of NOS has different criteria than the understanding of the nature of science (NOS) teacher (Adi & Widodo, 2018). Students' NOS Comprehension Condition is in a low position (Widodo et al., 2019). Several studies that have examined the understanding of the nature of science in elementary schools (SD) explain that the understanding of the nature of science, especially for students, has not achieved the desired understanding (Adi & Widodo, 2018). Likewise, for teachers in the sufficient category (Adi & Widodo, 2018), whereas the nature of science (NOS) for prospective teachers is already in the good category (Rahayu & Widodo, 2019). The results showed that both teachers and students had an understanding of the nature of science in the "enough" category. Therefore, an

understanding of the nature of science in science subjects is very important (Adi & Widodo, 2018). This condition certainly illustrates that the level of understanding of the nature of science students has not been as expected. In line with previous research, it is stated that learning in schools regarding the nature of science for teachers and students has not achieved the desired understanding. One of the factors that causes the students' low understanding of the nature of science is the lack of content regarding the nature of science (NOS) in the textbooks used by teachers in every school (Rusilowati et al., 2016). So, up to now, the deepening of the concept of the nature of science in the digital era should be a priority in science learning in universities (Tursinawati & Widodo, 2019). And knowledge of aspects of the nature of science (NOS) should begin to be considered and studied by all the education community so that students and teachers understand the nature of science (NOS) very well. (Widodo et al., 2019). That's why it's so important to understand the nature of science (NOS) in learning in the digital age (Rahayu & Widodo, 2019). Apart from the above, understanding the nature of science (NOS) in the era of the industrial revolution (4.0) is very important where teachers who have an undergraduate educational background all have a higher percentage and are in the high category (Anggraeni & Widodo, 2019). From other studies, it is stated that there is a significant difference between understanding the nature of science (NOS) for students before and after learning using understanding the nature of science (NOS) (Yuniasih & Widodo, 2021)

While the results of other studies show the learning model's understanding of nature of science (NOS) has a significant effect on the level of understanding the nature of science (NOS) students (Lestari et al., 2021) The results of the further test with the LSD method showed that the model-based learning model's understanding of the nature of science (NOS) is superior to the direct learning model (Sudirgayasa et al., 2014).

A teacher's understanding of science is a prerequisite for teaching science. Therefore, future professional development programs for elementary school teachers must be designed in the field of subject matter and subject matter pedagogy.

On the other hand, textbooks used today are more dominant in presenting scientific content than ever before, while the path to obtaining scientific knowledge does not exist at all. On the other hand, schoolbooks are very important media because of their role in conveying information from teachers to students (Books et al., 2015). Another opinion states that, based on an analysis of the understanding of nature of science (NOS) in the curriculum and thematic books for elementary school students, only the product aspect has a percentage value of > 80%. Meanwhile, other aspects have low percentage values (Princess et al., 2021). that science teaching materials by explicitly understanding the nature of science (NOS) and critical thinking on the topic of temperature and heat are needed as a solution to help students improve scientific literacy skills (Amilia et al., 2017)

Considering the use of textbooks is one of the important learning tools to improve

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students' scientific skills, this study aims to analyze the existence of the nature of science presented in the thematic books for the lower grades of the elementary school curriculum 2013 as the main book in learning in elementary school.

The Nature of Science

The term "nature of science" is more oriented towards the characteristics of scientific knowledge, which is essentially obtained through the process of scientific investigation (Lederman et al., 2014). So, in essence, the nature of science (NOS) is an epistemology of science that looks at how knowledge is obtained and can be proven true.

Based on its constituent components, there are seven main aspects in the construction of the nature of science. The seven aspects consist of: (1) empirical basis, (2) tentative, (3) theories and law, (4) socio-cultural embeddedness, (5) creativity, (6) scientific method, and (7) subjective (Widodo et al., 2019).

Empirical baseIt means that knowledge is obtained based on empirical evidence or real events that occur and can be felt through the five senses. Scientific knowledge is based on observational and/or experimental evidence.

tentativehas an uncertain meaning or is still subject to change. This means that the truth of scientific knowledge obtained is not absolute and final; it can always be changed or refined based on existing situations and conditions and is supported by new observational evidence.

Theorists and laws are the products of scientific knowledge. In science, a theory is a descriptive explanation of an observed phenomenon. While the law is an explanation of the relationship between observed phenomena, As a result, scientific knowledge can take the form of a theory that explains the mechanism of an observed phenomenon, or it can take the form of a law that explains the relationship between observed phenomena.

Socio-cultural embeddedness means that scientific knowledge cannot be separated from or influenced by the prevailing social and cultural components and has been embedded in an environment where such knowledge is practiced, understood, and accepted by society.

CreativityIt is understood as an aspect of the nature of science that although scientific knowledge is empirical based on observations of nature, scientific knowledge is also produced through the imagination and creativity of humans or scientists themselves. The production of scientific knowledge involves an activity of discovery that requires a level of creativity from a scientist to logically, systematically, and continuously develop.

Scientific knowledge is obtained through the method or process of scientific discovery, as an aspect of the nature of science. There are many methods or ways that can be used to acquire scientific knowledge. There is no set of scientific methods that are singular and universally applicable, but every scientist is free to use various methods that can be justified.

Subjective means that scientific knowledge is subjective or based on the individual point of view of the scientist himself. This point of view is motivated by experience, commitment, mindset, and idealism that affect how a scientist works,

investigates, observes, understands, and interprets data.

Thematic Learning Book

Textbooks can be defined as standard textbooks containing a particular study of science, compiled by experts based on the aims and objectives of learning, which are equipped with various teaching elements that can make it easier for readers to understand the contents of the reading in order to support teaching and learning activities that are carried out effectively. on-going (Books et al., 2015). Textbooks are expected to make a positive contribution (Rahmawati, 2016). At the elementary level, thematic books are a very important part and are one of the characteristics of the implementation of the 2013 curriculum, which has been applied by the government to all schools in the national scope. The presence of thematic learning textbooks in elementary schools is represented in the form of books for students and books for teachers. This book is used as the main handbook for implementing thematic learning in accordance with the standard process of the 2013 curriculum that is being implemented.

As the thematic book functions as one of the main tools that support the implementation of the learning process, the quality of the thematic learning books used affects the quality of the learning it supports. In line with the role and function of thematic textbooks, as well as the implementation of the objectives of the 2013 curriculum, which emphasizes the mastery of attitudes, knowledge, and skills, the content of the 2013 curriculum thematic textbooks, which are designed based on scientific approaches and authentic assessments, must not only focus on presenting knowledge, or cognitive aspects, but also process skills and student attitudes. In particular, the 2013 curriculum thematic books are books that integrate several subjects into one theme, including science learning. Therefore, the book is deemed necessary to explicitly present the elements of the nature of science or NOS in the content of the 2013 curriculum textbooks. How teachers teach teachers to present integrated teaching and how to choose content to be delivered to students (Adi Putra et al., 2017).

Basically, constructivism emerged as a learning theory that is widely used in several studies and contains five principles about teaching and learning, namely: first, learning has prior knowledge; second, learning is a process of constructing knowledge based on prior knowledge that has been possessed; third, learning is a change in the conception of learning; fourth, the construction process takes place in a certain context; and fifth, learn to be responsible for the learning process (Widodo, 2005)

Teachers need to develop their own scientific-based thematic teaching material products that integrate local potential for elementary school students (Susilawati et al., 2020).

From the results of the research analysis of 20 relevant journals, it shows that the scientific approach is effectively applied in integrated thematic learning in elementary schools (Astimar, 2020).

Students' scientific literacy ability shows that the mastery of scientific literacy is still low, which is below 60% (Arista et al., 2019).

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One solution to applying scientific knowledge is to provide teaching materials that express the nature of science (Subaeri et al., nd).

METHOD

This study uses a descriptive research design and aims to describe the level of content of the nature of science in thematic learning books for elementary school students for the lower grades of the 2013 curriculum. The object of this research is textbooks for elementary school students, with a population of all elementary thematic books from grades 1-3 and a sample of several book pages. The learning theme that includes the Basic Competencies (KD) of Science in each theme and sub-theme.

RESEARCH INSTRUMENTS

The data collection instrument used in this study was a document observation sheet, which was developed based on seven aspects of the nature of science, consisting of: (1) empirical basis, (2) tentative, (3) theories and law, (4) socio-cultural embeddedness, (5) creativity, (6) scientific method, and (7) subjective. The indicators used in each aspect are adopted from previous research on understanding the nature of science (NOS) by elementary school students and teachers (Widodo et al., 2019).

RESEARCH PROCEDURE

The research was started by conducting a literature review from various primary sources, then an observation sheet instrument was developed, which contained aspects of the nature of science being analyzed along with its indicators. The next step is the data collection stage. Data collection is done by reading and recording carefully each paragraph on each page, which is analyzed and matched with the indicators on the observation sheet. Then, the occurrence of aspects of the nature of science in each paragraph is counted and documented. This reading and recording are carried out by researchers with the knowledge, thoroughness, and criticality needed to find and collect the data needed in accordance with the research problem being studied.

DATA ANALYSIS

Data analysis in this study was carried out through several stages. The first is grouping and scoring data. The results of recording findings in books are grouped based on each aspect of the nature of the observed science. Then, the emergence of aspects of the nature of science in each class is converted into scores and added up. The results of the total scores are converted into percentages. The second is the determination of the validity and reliability of the data. The validity of the data in this study was carried out by means of semantic validity, namely data validity techniques that were carried out by looking at the suitability of the data and interpreting it according to the context or concept that had been chosen. on thematic books.

The higher the coefficient of agreement (KK) level, the better the reliability of a data analysis result will be. The observers' coefficient of agreement was categorized into the following categories: 0.40 is considered very bad, 0.40–0.75 is considered good, and > 0.75 is considered very good (Books et al., 2015). The results of the agreement coefficient of the observers in this study were classified in the very good category, with the following results:

Table 1. Shows the recapitulation coefficient of agreement.

No	Class	Coefficient of deal	Category
1	Class 1	0.85	Very good
2	Grade 2	0.85	Very good
3	Grade 3	0.85	Very good

The last stage is a description and drawing conclusions. The percentage level of the content of the aspects of the nature of science in each class is described to understand the meaning of the existing data, and then conclusions are drawn from the results of the research. The description of the level of content of the nature of science in this thematic book is done by comparing the percentage of observations on each aspect observed based on the existing categories. This description process is also linked and strengthened by the results of research that has been carried out by previous researchers. The following categories of content level describe the nature of science used in this research:

Table.2 Content of the Nature of Science at the Category Level

Percentage Rate	Category
81 – 100	Very good
61 – 80	Well
41 – 60	Enough
21 – 40	Not enough
< 20	Very less

RESULTS

Based on the results of data analysis and processing that have been carried out in this study, it is known that the aspects of the nature of science in students' thematic books already exist, but the percentage level of content of the nature of science is still in the very poor category. The following is a table of the results of the analysis of the emergence of aspects of the nature of science in thematic books for students in grades 1-3 of the elementary school curriculum in 2013.

Table 3. Results of the Analysis of the Nature of Science

Aspect	Class			Average
	1	2	3	
Empirical based	0	17	17	11.3
Tentative	0	0	0	0
Theorists and law	0	8	11	6.3
Socio-cultural	0	0	0	0
Creativity	0	0	0	0
Science Method	0	8	17	8.3
Subjective	0	0	0	0
Book average (%)	0	4.7	6.4	3.7

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The percentages in the table indicate the level of content in the nature of science for each aspect analyzed. Based on the information in the table above, it can be seen that, overall, the thematic books for the elementary school curriculum in 2013 have not fully presented the content of aspects of the nature of science explicitly.

The average percentages for empirical basis, theories and law, science method, and subjective aspects are 11.3%, 6.3%, and 8.3%, respectively.As for the other four aspects, such as tentative, socio-cultural, creativity, and subjective, respectively, 0% or nothing appears.

The average percentage level of the content of the nature of science in each thematic book from grades 2 and 3 is 4.7% and 6.4%, respectively. Meanwhile, thematic books in grade 1 have a science content level of 0%, or nothing appears.

That way, the average percentage of books that present aspects of the nature of science for elementary school students in the 2013 curriculum from grades 1-3 is 3.7%, which can be categorized in the very poor category. This means that only 3.7% of the total number of pages analyzed shows that there is explicit content about the nature of science, while 96.3% of all thematic books do not fully contain aspects of the nature of science.

DISCUSSION

In general, the thematic books for elementary school students in the 2013 curriculum from grades 1-3 have not fully presented the content of the nature of science. This is indicated by the average percentage of occurrences of aspects of the nature of science being analyzed which are still in the very poor category. The condition of the lack of content on the nature of science presented in this thematic book will certainly affect the level of understanding of elementary students towards the nature of science which is low. This is in line with the results of previous studies which showed that one of the factors that led to the low level of understanding of the nature of science (NOS) of students was the lack of presentation of the content of the nature of science in the textbooks used by each school (Rusilowati et al., 2016).

The results of the analysis in this study indicate that the lower grade thematic books, especially grade 1, have no scientific content at all, so that science lessons tend not to be delivered in grade 1. Meanwhile, grades 2 and 3 have not fully presented the seven aspects of the nature of science that have been thoroughly observed. Aspects of the nature of science contained in the lower grade thematic books only gave rise to three aspects of the seven aspects analyzed, with an average percentage of occurrences that was still low or less. The empirical basis, the first aspect of the nature of science, is thought to have the highest percentage of occurrences, but it is still not optimal.This is because thematic books more directly present the concept of science, while facts or empirical evidence are less directly presented. The second aspect is tentative. This aspect has not yet appeared in the analyzed book. Books tend to directly discuss scientific concepts, but there are no explanatory sentences that build students' understanding of the openness of a theory that it will always evolve and can be retested based on facts or evidence of new findings. Third, theory and law are aspects that have appeared in the analyzed book but are not yet optimal.

This is due to the lack of presentation of facts or evidence from observations and experiments, so that the relationships and explanations of the natural phenomena studied are less visible. But there is no explanatory sentence that builds students' understanding of the openness of a theory so that it will always develop and can be retested based on facts or evidence of new findings. Third, theory and law are aspects that have appeared in the analyzed book but are not yet optimal. This is due to the lack of presentation of facts or evidence from observations and experiments, so that the relationships and explanations of the natural phenomena studied are less visible. But there is no explanatory sentence that builds students' understanding of the openness of a theory so that it will always develop and can be retested based on facts or evidence of new findings. Third, theory and law are aspects that have appeared in the analyzed book but are not yet optimal. This is due to the lack of presentation of facts or evidence from observations and experiments, so that the relationships and explanations of the natural phenomena studied are less visible.

The fourth aspect is socio-cultural. This aspect has not appeared in the analyzed book. The explanation of the concept in the book has not combined the socio-cultural conditions that exist in an environment with the socio-cultural background of scientists to show their influence on the process of finding the concept and the practice of applying the concept in the community. Fifth is the aspect of creativity. This aspect has not yet appeared in the analyzed book. This is because there are no written sentences in the book that encourage students to do a creative activity that makes them discover new knowledge or products. Books mostly contain activities for students to carry out the discovery process and make existing products, so students just have to re-practice.

The sixth is the aspect of the scientific method. This aspect has been found in many books, but it is not yet optimal. This is due to the lack of scientific methods such as direct and specific inquiry activities that are actually practiced by students. Nothing has appeared in the seventh place, which is subjective.Books do not involve students' personal diversity when carrying out the scientific method process of generating or discovering new knowledge for themselves.

Thematic books are more dominantly focused on presenting science products in the form of a collection of materials used by students to be able to practice their ability to remember and understand an object of knowledge only. This is in accordance with previous research which states that science textbooks used by teachers in every school emphasize more on aspects of knowledge presented in the form of facts, concepts, principles, laws, hypotheses, theories, models, and stimulate students to retain knowledge or information.

The results of the analysis of the thematic books on each learning theme from the lower grades showed an uneven distribution. The findings of aspects of the nature of science for lower grade thematic books from 1-3 are gathered into one theme and are not found in other themes. Moreover, for each of the themes in the first grade thematic books, there were no observable aspects of the nature of science. This is because, based on

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Permendikbud no. 37 of 2018, science learning in the 2013 curriculum for grades 1-3 is not oriented towards scientific inquiry and is only limited to introductions presented in the form of scientific knowledge. Therefore, in the 2013 curriculum, there are no science competencies that are explicitly taught to students in grades 1-3.

CONCLUSION

The results of this study indicate that the level of content on the nature of science in the thematic learning books for elementary school students for the lower grades of the 2013 curriculum is in the category of very poor. The thematic book is more dominant in presenting a collection of scientific knowledge compared to teaching aspects of the nature of science in the form of research activities, scientific thinking, and social aspects of science. This is evidenced by the results of the analysis of thematic books, which show that the average percentage of the content of the essence of science is 3.7%, with an average percentage level of the empirical basis, theories and law, science method, and subjective aspects in general of 11.3%, 6.3%, and 8.3%, respectively. As for the other four aspects, such as tentative, socio-cultural.

Based on the results of the research that has been carried out, this study only examines the level of existence of aspects of the nature of science (NOS) in the thematic learning books for elementary school students in the 2013 curriculum from grades 1-3. As for suggestions for further research opportunities, it would be better if there was an in-depth analysis of the thematic learning books for the 2013 curriculum and in-depth studies on the development of science-based textbooks, the development of science-based assessment questions, or the development of effective learning models to train the nature-based abilities of science students, especially at the elementary school level.

REFERENCE

Adi Putra, MJ, Widodo, A., & Sopandi, W. (2017). Science Teachers' Pedagogical Content Knowledge and Integrated Approach. Journal of Physics: Conference Series, 895(1). https://doi.org/10.1088/1742-6596/895/1/012144

Adi, YK, & Widodo, A. (2018). Understanding the Nature of Science in Elementary School Teachers and Students. Journal of Education, 10(1), 55–72. https://doi.org/10.31603/edukasi.v10i1.1831

Amilia, R., Rahayu, S., & Yulianti, E. (2017). The Importance of Explicit Nature Of Science (NOS) and Critical Thinking in Science Teaching Materials on the Topic of Temperature and Heat for Junior High School Students. Proceedings of the 2nd National Science Learning Seminar 2017 "Integration of Character Education in Science Learning to Realize Intelligent and Virtuous Generations," February 2020, 219–223. https://www.researchgate.net/publication/335929629_Importance_Mengeksplisitkan_Nature_Of_Science_NOS_dan_Berikir_Kritis_pada_Ajar_Material_IPA_Topik_Suhu_dan_Kalor_Untuk_Student_SMP

Anggraeni, P., & Widodo, A. (2019). Understanding NOS in the Industrial Revolution 4.0 Era in PGSD Students and Elementary School Teachers.

ELSE (Elementary School Education Journal): Journal of Primary School Education and Learning, 3(2), 67–86. https://doi.org/10.30651/else.v3i2.3293

Arista, E., Khabibah, N., Rusilowati, A., & Supriyadi, S. (2019). Development of a Science Literacy-Based Evaluation Tool to Measure Science Literacy Ability of SMP/MTs Students with the Theme of Natural Symptoms. UPEJ Unnes Physics Education Journal, 8(2), 141–151. https://doi.org/10.15294/upej.v8i2.33321

Astimar, N. (2020). Implementation of the Scientific Approach in Integrated Thematic Learning in Elementary Schools (Literature Studies). Tambusai Journal of Education, 3(1), 114–128. https://www.jptam.org/index.php/jptam/article/view/669

Books, A., Physics, A., Class, SMA, Di, XII, Pati, K., Muatan, B., & Science, L. (2015). Analysis of Physics Textbooks for Class Xii in Pati Regency Based on Science Literacy Content. UPEJ Unnes Physics Education Journal, 4(1). https://doi.org/10.15294/upej.v4i1.4731

Lederman, NG, Antink, A., & Bartos, S. (2014). Nature of Science, Scientific Inquiry, and Socio-Scientific Issues Arising from Genetics: A Pathway to Developing a Scientifically Literate Citizenry. Science and Education, 23(2), 285–302. https://doi.org/10.1007/s11191-012-9503-3

Lestari, H., Widodo, A., & Indonesia, UP (2021). Journal of Cakrawala Pendas THE ROLE OF THE NATURE OF SCIENCE LEARNING MODEL FOR. 7(1), 1–9.

Putri, DS, Pramswari, LP, Suryana, SI, & Widodo, A. (2021). Analysis of the Nature of Science in Elementary School Science Curriculum and Its Empowerment in Student Book. Journal of Science Education Research, 7(3), 488–495. https://doi.org/10.29303/jppipa.v7i3.763

Rahayu, AH, & Widodo, A. (2019). Understanding of the Nature of Science Pre-Service Students and Elementary School Teachers in the Digital Age. Formative: Scientific Journal of Mathematics and Natural Sciences Education, 9(2), 161–172. https://doi.org/10.30998/formatif.v9i2.3251

Rahmawati, G. (2016). Lesson Textbooks As A Source Of Student Learning In The School Library At Sman 3 Bandung. Edulib, 5(1), 102–113. https://doi.org/10.17509/edulib.v5i1.2307

Rusilowati, A., Nugroho, SE, & Susilowati, SM (2016). Development of Science Textbook Based on Scientific Literacy for Secondary School. Indonesian Journal of Physical Education, 12(2), 98–105. https://doi.org/10.15294/jpfi.v12i2.4252

Subaeri, Rahayu, S., & Marfuah, S. (nd). NoS Ari Widodo et al.pdf.

Sudirgayasa, I., Suastra, M., & Ristiati, M. (2014). The Influence of Nature of

e-ISSN: 2808-8263
p-ISSN: 2829-0976

Science (NOS) Based Learning Model on the Ability to Apply Biology Concepts and Students' Understanding of Nos in Biology Learning at Sma Negeri 1 Marga. Indonesian Journal of Science Education and Learning, 4(1).

Susilawati, F., Gunarhadi, G., & Hartono, H. (2020). The Importance of Developing Thematic Teaching Materials in Improving Students' Environmental Care Character. EduHumanities | Cibiru Campus Basic Education Journal, 12(1), 62–68. https://doi.org/10.17509/eh.v12i1.15068

Tursinawati, T., & Widodo, A. (2019). Understanding Nature of Science (NoS) in the Digital Age: Perspectives From PGSD Students. Journal of Science & Science Learning, 3(1), 1–9. https://doi.org/10.24815/jipi.v3i1.13294

Widodo, A. (2005). Constructivism and Science learning. In Journal of Education and Teaching IKIP Negeri Singaraja: Vol. No. 2 (Issues 0215–8250, pp. 159–171). https://www.academia.edu/9340611/EFEKTIVITAS_KEGIATAN_LABORATORIUM_KONSTRUKTIVIS_DALAM_MENINGKATKAN_PENGUASAAN_KONSEP-KONSEP_ARUS_SEARAH_MAHASISWA_CALON_GURU

Widodo, A., Jumanto, J., Adi, YK, & Imran, ME (2019). Understanding the nature of science (NOS) by elementary school students and teachers. Journal of Science Education Innovation, 5(2), 237–247. https://doi.org/10.21831/jipi.v5i2.27294

Yuniasih, N., & Widodo, A. (2021). Nature of Science learning design for elementary school students. IOP Conference Series: Materials Science and Engineering, 1098(6), 062075. https://doi.org/10.1088/1757-899x/1098/6/062075 Adi Putra, MJ, Widodo, A., & Sopandi, W. (2017). Science Teachers' Pedagogical Content Knowledge and Integrated Approach. Journal of Physics: Conference Series, 895(1). https://doi.org/10.1088/1742-6596/895/1/012144

Adi, YK, & Widodo, A. (2018). Understanding the Nature of Science in Elementary School Teachers and Students. Journal of Education, 10(1), 55–72. https://doi.org/10.31603/edukasi.v10i1.1831

Amilia, R., Rahayu, S., & Yulianti, E. (2017). The Importance of Explicit Nature Of Science (NOS) and Critical Thinking in Science Teaching Materials on the Topic of Temperature and Heat for Junior High School Students. Proceedings of the 2nd National Science Learning Seminar 2017 "Integration of Character Education in Science Learning to Realize Intelligent and Virtuous Generations," February 2020, 219–223. https://www.researchgate.net/publication/335929629_Importance_Mengeksplisitkan_Nature_Of_Science_NOS_dan_Berikir_Kritis_pada_Ajar_Material_IPA_Topik_Suhu_dan_Kalo

r_Untuk_Student_SMP

Anggraeni, P., & Widodo, A. (2019). Understanding NOS in the Industrial Revolution 4.0 Era in PGSD Students and Elementary School Teachers. ELSE (Elementary School Education Journal): Journal of Primary School Education and Learning, 3(2), 67–86. https://doi.org/10.30651/else.v3i2.3293

Arista, E., Khabibah, N., Rusilowati, A., & Supriyadi, S. (2019). Development of a Science Literacy-Based Evaluation Tool to Measure Science Literacy Ability of SMP/MTs Students with the Theme of Natural Symptoms. UPEJ Unnes Physics Education Journal, 8(2), 141–151. https://doi.org/10.15294/upej.v8i2.33321

Astimar, N. (2020). Implementation of the Scientific Approach in Integrated Thematic Learning in Elementary Schools (Literature Studies). Tambusai Journal of Education, 3(1), 114–128. https://www.jptam.org/index.php/jptam/article/view/669

Books, A., Physics, A., Class, SMA, Di, XII, Pati, K., Muatan, B., & Science, L. (2015). Analysis of Physics Textbooks for Class Xii in Pati Regency Based on Science Literacy Content. UPEJ Unnes Physics Education Journal, 4(1). https://doi.org/10.15294/upej.v4i1.4731

Lederman, NG, Antink, A., & Bartos, S. (2014). Nature of Science, Scientific Inquiry, and Socio-Scientific Issues Arising from Genetics: A Pathway to Developing a Scientifically Literate Citizenry. Science and Education, 23(2), 285–302. https://doi.org/10.1007/s11191-012-9503-3

Lestari, H., Widodo, A., & Indonesia, UP (2021). Journal of Cakrawala Pendas THE ROLE OF THE NATURE OF SCIENCE LEARNING MODEL FOR. 7(1), 1–9.

Putri, DS, Pramswari, LP, Suryana, SI, & Widodo, A. (2021). Analysis of the Nature of Science in Elementary School Science Curriculum and Its Empowerment in Student Book. Journal of Science Education Research, 7(3), 488–495. https://doi.org/10.29303/jppipa.v7i3.763

Rahayu, AH, & Widodo, A. (2019). Understanding of the Nature of Science Pre-Service Students and Elementary School Teachers in the Digital Age. Formative: Scientific Journal of Mathematics and Natural Sciences Education, 9(2), 161–172. https://doi.org/10.30998/formatif.v9i2.3251

Rahmawati, G. (2016). Lesson Textbooks As A Source Of Student Learning In The School Library At Sman 3 Bandung. Edulib, 5(1), 102–113. https://doi.org/10.17509/edulib.v5i1.2307

Rusilowati, A., Nugroho, SE, & Susilowati, SM (2016). Development of Science Textbook Based on Scientific Literacy for Secondary School. Indonesian Journal of Physical Education, 12(2), 98–105. https://doi.org/10.15294/jpfi.v12i2.4252

e-ISSN: 2808-8263
p-ISSN: 2829-0976

Subaeri, Rahayu, S., & Marfuah, S. (nd). NoS Ari Widodo et al.pdf.

Sudirgayasa, I., Suastra, M., & Ristiati, M. (2014). The Influence of Nature of Science (NOS) Based Learning Model on the Ability to Apply Biology Concepts and Students' Understanding of Nos in Biology Learning at Sma Negeri 1 Marga. Indonesian Journal of Science Education and Learning, 4(1).

Susilawati, F., Gunarhadi, G., & Hartono, H. (2020). The Importance of Developing Thematic Teaching Materials in Improving Students' Environmental Care Character. EduHumanities | Cibiru Campus Basic Education Journal, 12(1), 62–68. https://doi.org/10.17509/eh.v12i1.15068

Tursinawati, T., & Widodo, A. (2019). Understanding Nature of Science (NoS) in the Digital Age: Perspectives From PGSD Students. Journal of Science & Science Learning, 3(1), 1–9. https://doi.org/10.24815/jipi.v3i1.13294

Widodo, A. (2005). Constructivism and Science learning. In Journal of Education and Teaching IKIP Negeri Singaraja: Vol. No. 2 (Issues 0215–8250, pp. 159–171). https://www.academia.edu/9340611/EFEKTIVITAS_KEGIATAN_LABORATORIUM_KONSTRUKTIVIS_DALAM_MENINGKATKAN_PENGUASAAN_KONSEP-KONSEP_ARUS_SEARAH_MAHASISWA_CALON_GURU

Widodo, A., Jumanto, J., Adi, YK, & Imran, ME (2019). Understanding the nature of science (NOS) by elementary school students and teachers. Journal of Science Education Innovation, 5(2), 237–247. https://doi.org/10.21831/jipi.v5i2.27294

Yuniasih, N., & Widodo, A. (2021). Nature of Science learning design for elementary school students. IOP Conference Series: Materials Science and Engineering, 1098(6), 062075. https://doi.org/10.1088/1757-899x/1098/6/062075