

Analysis of The Nature of Science in The Prototype Curriculum Based on Social and Science Students' Book for Fourth Grade Phase B

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Abstract: The Nature of Science or NOS is knowledge that explains how science works and how scientists conduct research. NOS has aspects of form, namely products, processes and properties. The preparation stage, such as reviewing the literature on the NOS aspect and determining the NOS aspect used, namely from the form aspect, including products, processes, attitudes, and from the nature aspect, in the form of empirical, tentative methods, subjective, creative, theoretical and legal, socio-cultural, and scientific; The analysis stage, by analyzing the basic competencies and content in the curriculum and its embodiment in student books. This research was carried out with the following steps: Based on the results of the researchers' agreement, the minimum value limit in the data analysis process is 80%. Based on the results of the analysis, it is shown that the aspects and embodiments of the nature of science and the nature of the science books for fourth grade students are not explicitly explained. The excellent category is in the product aspect with an average percentage of >80%. While other aspects have a very less category with a percentage of <80%, even some aspects have an average percentage of <1%.

Keywords: Analysis; Social and Science; Nature of Science; Prototype Curriculum

Introduction

The Nature of Science (NOS) is knowledge that explains how science works and how scientists conduct research (Listiani & Kusuma, 2017). NOS can also be interpreted as the epistemology of science, where science is a way to acquire knowledge or values and beliefs inherent in scientific knowledge or the development of science (Tursinawati & Widodo, 2019). However, NOS has not been widely involved in learning in schools, Jumanto & Widodo (2018) found that some teachers still feel unfamiliar with the term NOS. Olson (2018) stated that understanding NOS has long been a desired outcome of science education, despite ongoing disagreements regarding content, structure, and goal focus. When the COVID-19 outbreak occurred in 2022, the Indonesian national curriculum has three curriculum options that can be chosen by the education unit for recovery learning during the Covid-19 pandemic, one of

them is prototype curriculum. NOS has aspects include form and nature. In accordance with the practice of implementing learning using this prototype curriculum, it provides extraordinary benefits. Each educational unit can establish cooperation with various parties implementing education. The interests of educational units can be fulfilled by facilitating communication between one another (Oksari, A. A., Nurhayati, L., Susanty, D., Paramita, G. A., & Wardhani, K., 2022). The nature of science, consisting of (a) Products, phenomena, behaviors, characteristics packaged in a theory, concept, law, and principle, (b) The process of acquiring knowledge which is none other than the scientific method, (c) Scientific Attitude, the cultivation of attitudes in scientists when carrying out the scientific method process and the science learning process (Tursinawati, 2016). While the nature of science consists of (a) Empirical Based, scientific knowledge based on observations through five senses or experiments, (b)

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Tentative, scientific knowledge is something that can be refined through new observations and with existing reinterpretations because it is not an absolute truth represent relationships, observations, perceptions of natural phenomena accompanied by mathematical formulas. While the theory explains natural phenomena and the mechanism of relations between natural phenomena. Furthermore (d) Socio-Cultural, the science which is the result of human effort, so that the process is influenced by society and culture, (e) Creativity, scientific knowledge created from human imagination, creativity, and reason so that the knowledge continues to develop. In addition to which creative planning, observation, and conclusions are made, (f) The Scientific Method, it is explained that there is no definite and universal scientific method, every scientist who will conduct research given the freedom to determine the method to be used., as long as it can be accounted for the answer, (g) Subjective, Science is inevitable in science that can be influenced by factors such as personal values, beliefs, self-agenda, and previous experiences. In addition, research will also be influenced by how a scientist does his job (Adi & Widodo, 2018).

Understanding the nature of science can provide detailed background on how science and scientists work, how scientific knowledge is created, validated, and influenced. Understanding the nature of science is important to understand. Here are five arguments about the importance of understanding the nature of science, namely: 1) Utilitarian, to understand science and manage technological objects and processes in everyday life, 2) Democratic, to inform that decides socio-scientific problems, 3) Culture, to appreciate the value of science as part of contemporary culture, 4) Moral, to help develop an understanding of community norms scientific that embodies moral commitments regarding common values for society, 5) Science learning, to facilitate the learning of science subject matter (Rahayu & Widodo, 2019). Textbooks are very important components of education in the learning process. The teacher uses at least one textbook in the learning process. The textbooks used must be in accordance with the demands and needs contained in the curriculum (Sesrita, 2020). Science textbooks used in the learning process must construct the concepts learned in accordance with the nature of existing science. In the implementation of learning, student books are widely used as a learning resource for students. Student books are expected to contain aspects of the nature of science so that the learning process can be carried out properly. Science learning has unique characteristics compared to other subject matters. Therefore, in learning science, it is necessary to meet the characteristics of science, namely the nature of science in the learning process activities

(Sayekti et al., 2019). However, based on TIMSS (2015) science education in Indonesia is still very far behind other countries with an average science score of 397 points and ranks 45th out of 48 who took the survey (Adi & Widodo, 2018). Learning activities, in addition to making students able to master the targeted competencies (material), are also designed to make students know, realize/care about, and internalize values and turn them into behaviors (Dirjen Dikdasmen, 2016). The learning activities are teacher activities programmed in design to make students learn actively (Dimiyati & Mudjiono, 2009). Teachers really need their role in efforts to shape national character that has identity and dignity. (Setyaningrum & Husamah, 2011). (Firman & Widodo, 2007) explain that a science teacher is required to have a clear picture of science. This is expected to improve student learning outcomes. Learning outcomes come from the words "results" and "learning" which means something that is held through effort (Alwi, 2000). (Mudavanhu & Zezekwa, 2017) states that science teachers need adequate understanding of the nature and processes of science as a basis for their pedagogical content knowledge in order to produce effective classes.

In the learning process the teacher uses at least one textbook as a support and reference in teaching and learning activities. Textbooks used in teaching and learning activities must comply with the demands and needs contained in the educational curriculum (Sesrita, 2020). Science learning is a learning activity that comes from experience Patta Bundu (2006), so based on these problems, analysis is carried out to determine the suitability of the nature of knowledge and its embodiment in Social and Science students' books for fourth grade as students' learning media in school.

Method

In this study, a document analysis method with a descriptive quantitative approach was used which aims to express something as it is. This study also conducted a comparison aimed at comparing the presence of one or more variables in two or more different samples or at different times (Satryawan, 2016). The steps taken in this study are as follows: (a) Preparatory stage, such as reviewing the literature on NOS aspects and determining the NOS aspects used, namely from the aspects of form, including products, processes, attitudes, and from the aspect of nature, in the form of empirical, tentative, subjective, creative, theoretical and legal, socio-cultural, and scientific; (b) The analysis stage, by analyzing the basic competencies and content in the curriculum and their embodiment in the student's book, is carried out by the researcher. Based on the results of

the researcher's agreement, the minimum value limit in the data analysis process is 80%. (c) The last stage, processing research data by calculating the percentage of each NOS and providing an explanation of the results of the analysis on each NOS.

Table 1. Data Analysis Assesment Categories

Data Analysis Assessment Categories	Criterion
Percentage of Correct Answer	
81-100	Excellent
61-80	Good
41-60	Enough
21-40	Less
≤ 20	Very Less

In the category of assessment of the nature of science data analysis based on the Social and Science book in the prototype curriculum for grade IV students, the category of data analysis assessment was determined to measure criteria based on the percentages obtained from each aspect studied. The percentage of correct answers ≤20 got very poor scoring criteria, the percentage of correct answers with a range of 21-40 got poor scoring criteria, the percentage of correct answer with a range 41-60 got enough criteria, the percentage of correct answers with a range of 61-80 got good assessment criteria, the percentage of correct answers with a range of 81-100 got excellent assessment criteria.

Result and Discussion

Based on the results of the analysis of the nature of science in the Social and Science book of grade IV students in Table 2 above about the existence of The Essence of Science or the nature of science, the product aspect has the highest average percentage, namely about

100%. Meanwhile, the attitude and process aspects have a low percentage value of 18.02% and 3.16%, which is still far from the minimum value of 80%. In the student's book, each material to be studied must contain products in the form of theories and concepts to be studied. For example, pages 56-57 describe sublimating and depositioning matter by making crystals. It reveals new knowledge for students that is a product of project-based learning.

Based on the table of the results of the analysis of the Nature of Science in the Social and Science Book in class IV, aspects of attitudes and processes have an average percentage that is categorized as low based on the minimum standards determined, namely <80%. As on pages 56-57 above, there is no activity that demands the attitude and learning process of students scientifically according to the nature of science so that it cannot produce new knowledge that matches the demands and needs of the students themselves.

Table 2. Percentage of the Nature of Science in the Social and Science Students' Book for Fourth Grade Phase B

Chapter	Percentage of NOS in the Social and Sciensi Students' Book for Fourth Grade Phase B		
	Science Facts		
	Products (%)	Attitude (%)	Process (%)
I	100.00	16.66	8.3
II	100.00	12.90	16.12
III	100.00	23.58	19.35
IV	100.00	25.00	14.28
V	100.00	16.00	36.00
VI	100.00	13.63	18.18
VII	100.00	18.18	50.00
VIII	100.00	18.18	40.00
Average	100.00	18.02	3.16

Table 3. Percentage of Traits in the Social and Science Students' Book for Fourth Grade Phase B

Chapter	Percentage of Traits in the Social and Science Students' Book for Fourth Grade Phase B								
	Tentative	Subjective	Empirical	Scientific Method	Limitations	Knowledge influenced socio cultural	Science developed through the scientific method	The Scientific method has limitations	The scientific process demands a scientific attitude
I	0.04	0.46	16.66	12.5	0	0	11.53	0	4.16
II	0.03	0.32	25.81	19.35	3.22	0	16.12	0	3.22
III	0	0.18	25.58	22.5	0	0	19.35	0	16.12
IV	0.03	0.4	25	17.85	3.58	14.28	0	3.57	7.14
V	0.16	0.10	0.12	0	0	87.5	0	0	0
VI	0	0.24	0	0	0	91.6	0	0	13.63
VII	0.05	0.38	0	0	0	54.52	0	0	18.18
VIII	0	0.52	0	0	0	45.45	0	0	4.54
Average	0.04	0.44	13.13	9.04	0.85	36.66	5.87	0.44	8.38

Based on the results of the analysis of Social and Science book documents for grade IV students in Table 2 above regarding nature, aspects of knowledge influenced by socio-culture have an average percentage value of 36.66% the highest compared to Another aspect. However, still this aspect is below the minimum standard specified, which is <80%. This also applies to other aspects because it has an average below the specified standard such as the tentative aspect 0.04%, the subjective aspect 0.44, the empirical 13.3%, the scientific method 9.04%, the limited 0.85%, the science developed through the scientific method 5.87%, the scientific method has limitations 0.44%, and the scientific process demands a scientific attitude of 8.38% is still classified as very low. These aspects of the trait even have a percentage value of <1%, this is because the material in the student's book has not fully strengthened the nature of science.

Based on the figure 1 of the results of analysis Social and Science students' book for class IV in figure 1 regarding the nature of science and properties, the product aspect has the highest percentage, which is

100% with very criteria well. In learning this Social and Science students' book, there are aspects of knowledge in each chapter. While the low aspect is found in an attitude aspect with a percentage of 18.02%, because it is more expressed implicitly, although in this book there is an aspect of attitude but not clearly demonstrated in his learning activities. Just like the attitude aspect, the process aspect in the analysis of the student's Social and Science book is not shown explicitly even though in the learning implicitly there is a process aspect, so it has an average percentage of 3.16% falls into the category of severely lacking. The percentage of product aspect is higher than the process aspect and the attitude aspect is supported by the statement contained in the *prototype* curriculum that in the profile Pancasila students, it is stated that Indonesian students who have critical reasoning are able to process information both qualitatively and quantitatively objectively, building relationships between various information, analyze the information, evaluate and infer it. By having good process skills, the profile can be achieved.

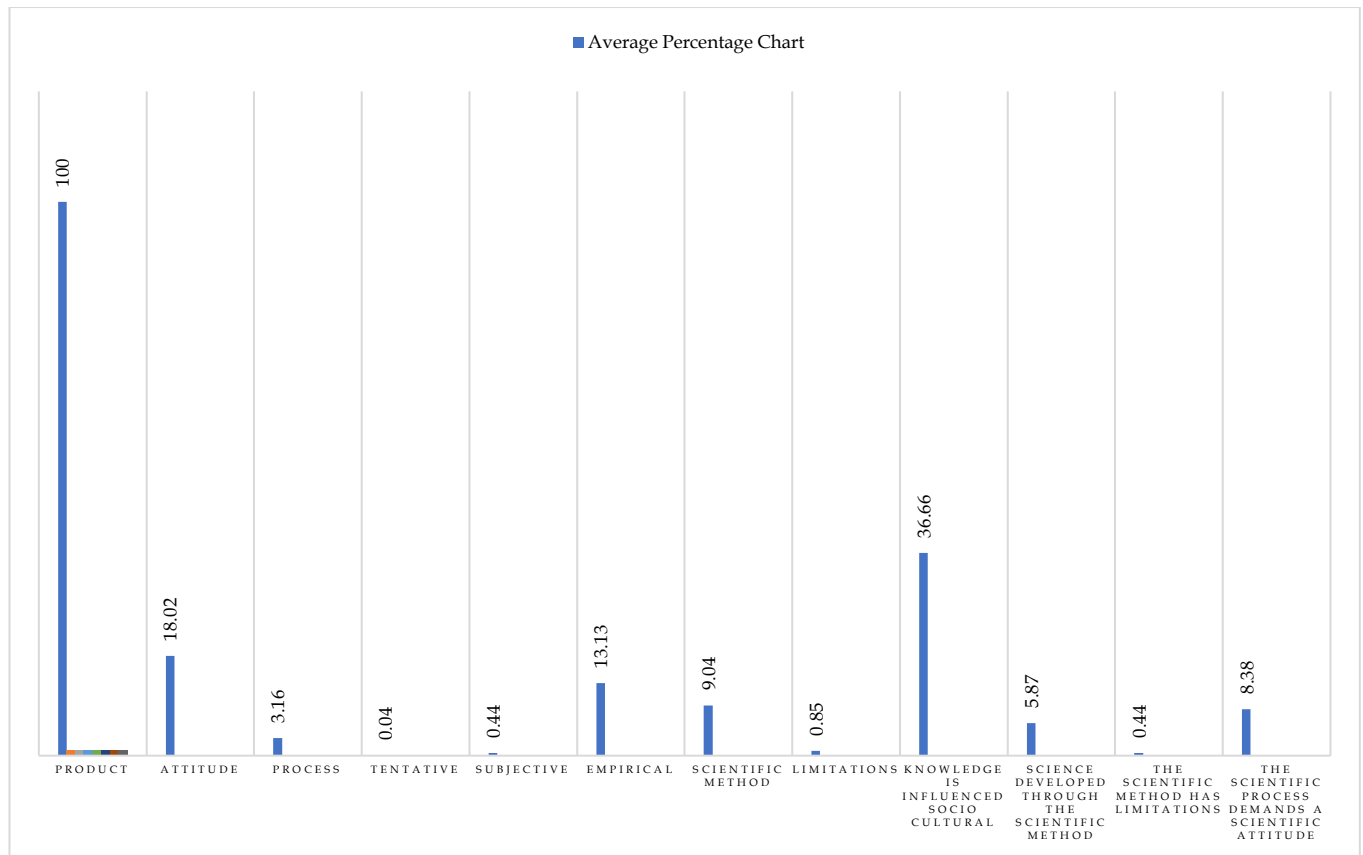


Figure 1. Diagram of Analysis of the Nature of Science and Nature in the Prototype Curriculum Based on Social and Science Students' Book for Fourth Grade Phase B

Based on the results of the analysis of knowledge and tentative aspect in the Social and Science book class IV chapters I-VIII is in the category of very less with the overall percentage of chapters I-VIII is 0.04%. The learning activities in the Social and Science class IV book do not explicitly and do not implicitly explain that students are asked to open students' understanding of openness a theory to always be developed and can be retested through new facts or evidence of findings.

Aspects of knowledge are subjective in the Social and Science book Grade IV students are only found in learning activities, which indicates that this aspect of subjective knowledge cannot be said to be optimal in the content of science book learning materials for Grade IV students with a *prototype* curriculum because the percentage of subjective knowledge in chapters I-VIII with an average of 0.44% in the category very lacking. Activities in the Social and Science book Grade IV students with a *prototype* curriculum do not involve student diversity when carrying out the scientific method process in producing or discovering new knowledge for themselves.

Based on the table of the results of the analysis of science book learning activities, Grade IV students with a *prototype* curriculum of empirical knowledge aspects as a whole in chapters I-VIII have a percentage of 13.13% with categories very lacking. In learning, the empirical knowledge aspect is more abundant in the material of chapters I-IV, because in the content or material of the chapter there is more deep science material its implementation contains observations and experiments although many activities in which there are observations but are not accompanied by experiments, different with the material of chapters V-VIII which is more many contain social or social media material content in the implementation of learning. Jadi, it can be said that the empirical aspect of thinking is still very weak.

Based on the results of the analysis of the Social and Science book for Grade IV students with a *prototype* curriculum, aspects of the scientific method have a percentage of 9.04% with a very less category. In the implementation of learning, aspects of the scientific method are more abundant in the content of learning materials in chapters I-IV regarding the process of observation, discussion and learning about the surrounding environment such as nature and the proof of experiments related to the material to be studied. Meanwhile, in chapters V-VIII, it is dominant with socio-cultural aspects covering activities, norms, regulations in students' daily lives as well as the implementation of community activities around students.

Based on the results of the analysis of documents in the Social and Science book, grade IV students in chapters I-VIII are in the very lacking category, there is

a limitation aspect with an average percentage of 0.85%. Some learning activities generally have limitations, but only according to what is stated in each learning activity. Some learning activities contain aspects of the learning activity but these limitations are not explicitly spelled out in the points of learning activities or the truth can still be proven scientific so it does not meet the criteria in the category of aspects of limitations.

Based on the table of the results of the analysis of socio-cultural influenced knowledge aspects in chapters I-VIII is in the less category with an overall percentage of 36.66%. Basically, student learning is influenced by socio-cultural aspects, but in some learning activities there are only a few points that contain material with aspects in influence socio-cultural aspects. The aspect of knowledge is influenced socio-culturally which is only found in social knowledge learning activities in chapters V-VIII, proving that socio-cultural influenced knowledge is still limited.

Based on the results of the analysis of the Social and Science book for Grade IV students with a *prototype* curriculum, the science aspect developed through the scientific method has a percentage of 5.87% with a very less category. In the implementation of learning, aspects of the scientific method are more abundant in the content of learning materials in chapters I-IV regarding the process of observation, discussion and learning about the surrounding environment such as nature as well as the proof of experiments related to the material will be studied by students.

In the aspect of the scientific method has limitations, the total percentage as a whole is 0.44% with the category very less. Actually, aspects of the scientific method have limitations already seen in the material of chapters I-IV in the Social and Science book Grade IV in the Social and Science students' book for Grade Fourth with a *prototype* curriculum, containing science material with the scientific method, but in this aspect has not been explicitly proven because the truth in the limitations of the scientific method can still be proven logically or scientifically through experiments and observations.

Then the aspects of the scientific process demanding scientific attitudes in the Social and Science students' book for Fourth Grade are found only a few in learning activities, which indicates that aspects of the scientific process demand attitudes Scientific is not optimal, with a percentage of 8.38% so, it can be concluded by the category is very lacking. Science learning students' book Grade Fourth do not carry out the process of learning activities in producing or leading to scientific attitudes.

Teaching materials are systematically arranged materials or subject matter, which are used by teachers and students in the learning process (Pannen, 1996). In

1994, Rowntree grouped four teaching materials by their nature, including printed teaching materials. Printed teaching materials are a number of materials arranged on paper, which can serve for the purpose of learning or conveying information (Nasution et al., 2017). One example of printed teaching materials is student books.

Student books are references that can be used to explore knowledge so that students have a broad understanding to optimize their abilities (Sriwindayani et al., 2016). Student books as teaching materials are very important for teachers and students in the learning process. With student books, teachers can save time in teaching, change the role of teachers from teachers to facilitators, improve the learning process, become more effective and efficient. Similarly, the role of student books for students is very important because it can help students learn independently (Nasution et al., 2017). By knowing the importance of the role of student books as teaching materials, we conduct an analysis of the nature of knowledge in student books to evaluate student books to match education goals and applicable curriculum (Jannah et al., 2019).

Conclusion

Based on the results of research from the analysis of the Social and Science Book for Grade IV Students in the prototype curriculum, the average of each aspect studied gets an assessment with a percentage that can be said to be very low, meaning that the average of the Each of these aspects has a percentage of <80% as the minimum limit. From the results of the research analysis of the Social and Science Book for Grade IV Students in the *prototype* curriculum, it can be concluded that only in the nature of science, especially the product aspect, obtains an average percentage of 100% meaning that this product aspect Classified as the category with the highest score when compared to other aspects. The assessment of product aspects in the nature of this science is included in the excellent category above the minimum limit set by the specified researcher, which is 80%. Whereas in other aspects the nature of science and nature has a very less category because the average percentage is as follows: in the attitude aspect, an average percentage of 18.02% is obtained, in the process aspect an average of 3.16% is obtained, in the tentat if aspect, an average of 3.16% is obtained, in the if aspect , an average of 0.04%, in the subjective aspect obtained an average of 0.44%, in the empirical aspect obtained an average percentage of 13.13%, in the scientific method aspect obtained an average of 9.04%, in the aspect of limitations obtained an average of 0.85%, in the aspect of limitations obtained an average of 0.85%, in the socio-cultural influenced aspects obtained an average of

36.66%, in the science aspect developed through the scientific method obtained an average of 5.87%, in the scientific method aspect has limitations obtained on average by 0.44%, and in the scientific process aspect demanding scientific attitudes obtained an average of 8.38%.

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Author Contributions

The author's contribution to this study is as follows. Dini Aulia Pratiwi led in the manuscript, conceptualization. Methodological data, visualization, writing, reviewing, editing, which was revised by all authors. Wahyu Sopandi supervised the research process and provided input regarding obstacles during the research. Desy Ayu Pangesty provided revisions and suggestions. Finally. All authors provided corrections and approved the final version version of the manuscript.

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Conflicts of Interest

The authors state that they have no financial or personal stake in the outcomes of this research. No authors have any financial, personal, or professional ties that could be construed as a conflict of interest or that could affect how the result are presented or discussed. This protects the realibility of the research and the findings presented here.

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