View of teachers and students understanding’ of the nature of science at elementary schools in Padang city Indonesia

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Abstract. This research aims to determine the level of understanding of teachers and elementary students about the nature of science (NOS) in the city of Padang. The type of research conducted is descriptive qualitative by survey method. The sample of this research are 1 teacher and 28 students of grade 5 SD N 08 Padang Besi at Lubuk Kilangan District Padang City, 1 teacher and 28 students of grade V Elementary School Kampung Baru at Lubuk Begalung District Padang City, 3 teachers and 29 students of grade V and VI Elementary School Koto Tuo at Koto Tangah District Padang City, and 3 teachers from Elementary School Lubuk Minturun at Koto Tangah District Padang City. The instrument used in the research is a questionnaire containing 30 statements prepared by researchers, consulting with supervisor, elementary teachers and compiled based on theories from related literature. The result of the research showed that the level of understanding of teacher science in three sub-districts are in Good criteria with average score of 71.58% and the level of science understanding of elementary students in three sub-districts of Padang City is on the criteria Enough with an average value of 64.05%. The Scientific Method aspect of the nature of science is more widely understood by teachers and the Theories and Law aspects of the nature of science are more widely understood by students. In conclusion, the level of understanding of the nature of science of the teachers is higher than the level of understanding of the nature of science of the students and no relationship significant between the two. The implication of this research is the knowledge about the nature of science should begin to be considered and understood by all elements of education so that teachers and students can understand the nature of science very well.

1. Introduction
The term science or The Nature of Science (NOS) is defined as the nature of knowledge which is a complex concept involving philosophy, sociology, and historical knowledge. The nature of science / NOS refers to the main principles and ideas that provide a description of science as a way of knowing, as well as the characteristics of scientific knowledge [1-3]. The nature of science usually refers to “the values and assumptions that are inherent in science, scientific knowledge, and / or the development of scientific knowledge” [4]. The NOS is a part that deals with the understanding of the nature of
scientific science as a whole. This understanding includes the empirical nature of science, creative and imaginative nature, instilling social and culture, and tentative nature [5]. The existence of NOS in education is not to indoctrinate, but to show reasons for accepting certain circumstances [6]. The nature of science (NOS) is an epistemology of science, science as a way to acquire knowledge, or values and beliefs that are inherent in scientific knowledge or in the development of science [7].

Major reform documents and current science education literature emphasize students’ understanding of the disciplinary norms of science: an understanding of how scientific knowledge is constructed, evaluated, validated, and communicated [8]. An understanding of the nature of science is very important in education. An understanding of NOS is considered very necessary for graduation standards from science education before entering lectures so that they can have scientific literacy [8]. Even Mullis and Jenkins state that understanding the nature of a good science can provide the intellectual abilities needed by someone to develop science and technology [9]. However, understanding of the nature of science is now lacking in the attention and seriousness of the education community. Especially with growing rapidly development of Technology nowadays that has an important role and effect in many ways and in all areas of life including science [10]. The development of science and technology also increasingly encourages renewal efforts in the teaching and learning process [11], including teaching and learning of the nature of science.

The nature of science (NOS) is an often neglected part of science teaching, yet it provides a vital background for students, detailing how science and scientists work and how scientific knowledge is created, validated, and influenced [12]. The nature of science is a part of science that must be taught by the teacher but often neglected or lacking attention. NOS can provide an important background for students about how science and scientists work and how scientific knowledge is created, validated, and influenced.

Given the importance of understanding the nature of science, there needs to be a study that reveals how the level of understanding of science by teachers and students in elementary school through measurement instruments. NRC recommends that students' knowledge content must be tracked from time to time during their learning process, the instrument used can be a valuation methodology that can provide educators with scores in various aspects of their students' science knowledge content. The aim is to provide teachers with the data needed to inform their instructional practices so that they can help their students build scientific content and epistemic knowledge [13].

Many experts divide NOS into several aspects [5][14][15][16][17][18][19]. From various opinions of these experts, the researchers concluded that at least the nature of science had 7 aspects that needed to exist. The seven aspect are: (1) Empirical Base (2) Tentative (3) Theories and Law (4) Socio Cultural embeddednes (5) Creativity (6) Scientific Method and (7) Subjective.

This study intends to determine the level of understanding of the nature of Science by teachers and students in the area of Padang City. The purpose of this study was to investigate the relationship of students’ and teachers’ understanding of the nature of science and classroom practice and to delineate factors that cause a relationship. The formulation of the research is; How the level of understanding of the nature of Science by teachers and students in the area of Padang City?.

2. Methods

This research used descriptive method through which the researcher tried to describe the Nature of Science from the teachers and students of elementary school in Padang city West Sumatera Indonesia. This descriptive design was used to describe the understanding of the teacher and elementary school students on the seven aspects of the nature of science. The population of this study were teachers and elementary students in three sub-districts in Padang City, West Sumatera. The sampling technique used is area probability sampling technique. The sample was 1 teacher and 28 students in grade V Elementary School Padang Besi in Lubuk Kilangan Sub district Padang City, 1 teacher and 28 students in grade V Elementary School Kampung Baru District Lubuk Begalung Padang City, and 3 teachers and 29 students in grades V and VI Elementary School Koto Tuo and 3 teachers at Elementary School Lubuk Minturun, Koto Tangah District, Padang City.
This research begins with examining the opinions of experts on the nature of Science or nature of science (NOS). From various opinions of these experts, the researchers concluded that at least the nature of science had 7 aspects that needed to exist. Furthermore, from the seven aspects, the understanding is understood in depth by comparing the opinions of experts. Armed with the opinions of experts, the researchers then made their own definitions of these seven aspects. Furthermore, these seven aspects were used as the basis for the preparation of science comprehension questionnaires by teachers and elementary school students. Presently the most popular pencil and paper tool is the Views of the Nature of Science Questionnaire (VNOS), developed by Lederman et al. [5]. This research was conducted by giving the instrument the nature of science/ NOS in the form of a questionnaire to each sample and filled in when the sample was in the classroom. The instrument used in the study contained 30 statement items compiled by researchers in consultation with supervisors and elementary school teachers and based on the literature related to the nature of science. Creswell [20] has suggested diversifying the data resources and investigators for triangulations to enhance the internal validity of qualitative research.

Analysis of statements from questionnaires is done by utilizing the correct percentage of answers for each aspect and then described. The description is done by comparing the percentage of the results of the correct answer with the existing criteria. The next analysis is to compare the score of the acquisition of understanding the nature of science by teachers and elementary students in three districts of Padang city qualitatively. The research conducted began from mid 2017 to early 2018. The data were collected through questionnaires sheets and documentation.

3. Result and Discussion

Based on the data collection process, the questionnaire is filled directly by the teacher and students without being taken home. So it is expected that the statements contained in the questionnaire really represent an understanding of the nature of science by the subject of research without the help of others and without looking at book sources or the internet.

3.1 Understanding of the Nature of Science by Students in Three Districts of Padang City

The results of data analysis on understanding the nature of science / NOS of students taken from three elementary schools in three sub-districts in Padang city are illustrated in Table 1 and Table 2.

**Table 1.** Level of understanding of science by elementary students in the city of Padang.

| Subject (Name of School) | Empiris Base | Tentative | Theories and Law | Socio, Cultural embedded -ness | Creativity | Scientific Method | Subjective Total Score | Percentage | Criteria |
|-------------------------|--------------|------------|------------------|--------------------------------|------------|-------------------|------------------------|------------|---------|
| SD N Koto Tuo           | 350          | 377        | 395              | 363                            | 579        | 349               | 356                    | 2768       | 63.63   | Enough  |
| SD N Kampung Baru       | 376          | 300        | 391              | 389                            | 548        | 333               | 356                    | 2693       | 64.04   | Enough  |
| SD N Padang Besi        | 403          | 327        | 380              | 348                            | 569        | 337               | 344                    | 2708       | 64.48   | Enough  |
| Sum                     | 1129         | 1004       | 1166             | 1100                           | 1696       | 1019              | 1056                   | 8169       | 64.05   | **Enough** |
| Percentage              | 66.41        | 59.06      | 68.59            | 64.71                          | 66.51      | 59.94             | 62.12                  |            |         |         |

Criteria: Enough, Enough, **Good**, Enough, Enough, Enough, Enough
In Table 1, it can be seen that the level of understanding of the nature of science by students in the city of Padang, in general, gets a score of 64.05%. This means that with this score the understanding of the Nature of Science by students in the city of Padang is generally based on the criteria of Enough. It means that the instrument used to measure the nature of student science is quite reliable in measuring every aspect of the NOS that is measured. As stated by McFarland [21] and Schuman and Presser [22] pointed out that respondents might be affected by the order in which response options are presented. The order effect may depend on the knowledge level of respondents. Aspects of theories and law in the nature of science are more understood by students and tentative aspects are less understood by students. Students This because of questionnaire had overlapping meanings and were redundant. Likewise, Botton and Brown [23] found the “considerable difficulty students had when expected to differentiate between some of the statements” (p. 57). Elementary School Students Padang Besi sub district Lubuk Kilangan has a higher score on the understanding of the nature of science.

### Table 2. Level of understanding of science by elementary students in the city of padang.

| Subject (Name of School) | Score of NOS |   |   |   |   |   |
|-------------------------|--------------|---|---|---|---|---|
|                         | Average of Male Students | Average of Female Students | High Score of Male Student | High Score of Female Student | Positive Statement | Negative Statement |
| SD N Koto Tuo           | 98.75        | 93.1 | 112 | 110 | 1701 | 1067 | 73.32 | 52.56 |
| SD N Kampung Baru       | 95.7         | 96.7 | 115 | 110 | 1675 | 1018 | 74.77 | 51.94 |
| SD N Padang Besi        | 97.3         | 95.6 | 109 | 104 | 1643 | 1065 | 73.35 | 54.34 |
| Criteria                |              |     |     |     |     |     | Good | Enough |

From the data collected after analysis, the conclusions of negative statements are obtained which have lower scores than positive statements, this means that negative statements regarding aspects of the nature of science are better understood by students than positive statements, boys better understand the nature of science than girls are seen from the average total value and the highest score of students’ science understanding by male students as shown in Table 2. The wealth of data regarding boys’ and girls’ interests in science suggests that boys, in general, are more interested in science than girls [24] [25].

### 3.2 Understanding of the Nature of Science by Teachers in Three Districts of Padang City

The results of data analysis on understanding the nature of science / NOS teachers taken from four elementary schools in three sub-districts in Padang city are illustrated in Table 3.

### Table 3. Level of understanding of science by elementary teachers in padang city.

| Subject (Name of School) | Aspect of NOS | Total Score | Percentage | Criteria |
|-------------------------|---------------|-------------|------------|----------|
|                         | Empiris Base  | Tentative   | Theories and Law | Socio, Cultural Embeddedness | Creativity | Scientific Method | Subjective |         |
| SD N Koto Tuo           | 44            | 37          | 43          | 43       | 72        | 49           | 43         | 331      | 73.55   | Good     |
Based on the questionnaire filled in by the teacher, it is known that in general the understanding of the Nature of Science / NOS by teachers in the city of Padang has an average score of 71.58%. With this score, it means that the teacher has an understanding of the nature of science in the criteria of good. The Scientific Method aspect of the nature of science is better understood by the teacher and the Socio-Cultural Embeddedness aspect that is not understood by the teacher. Elementary School Kampung Baru teachers in Lubuk Begalung Sub district, Padang City have the highest score on the understanding of the nature of science and the teachers of Elementary School Padang Besi, Lubuk Kilangan District, Padang city have the lowest comprehension score. To find out the level of understanding of the nature of teacher science based on age for the three sub-districts in the city of Padang can be seen in Table 4.

Table 4. Level of understanding of the nature of science by teachers of SD padang city by age.

| No. | Teacher’s Name | Name of School          | Gender | Class | Age | Score | Average |
|-----|----------------|-------------------------|--------|-------|-----|-------|---------|
| 1   | SD             | SD N Padang Besi        | P      | V     | 45  | 97    |         |
| 2   | A              | SD N Koto Tuo           | P      | VI    | 50  | 103   |         |
| 3   | T              | SD N Koto Tuo           | P      | V     | 52  | 121   | 106     |
| 4   | S              | SD N Lubuk Minturun     | P      | VI    | 50  | 102   |         |
| 5   | J              | SD N Lubuk Minturun     | P      | V     | 52  | 107   |         |
| 6   | RS             | SDN Kp Baru             | P      | V     | 33  | 118   |         |
| 7   | ROF            | SD N Lubuk Minturun     | P      | III   | 29  | 104   | 109,6667|
| 8   | COG            | SD N Koto Tuo           | P      | IV    | 26  | 107   |         |
|     | Sum            |                         |        |       |     | 859   | 71.58  |

From Table 4, it can be seen that there are more teachers under the age of 40 who understand the nature of science when viewed from the average score. The previous research has consistently shown that students, preservice teachers, and in-service teachers do not possess adequate conceptions of the NOS, especially with respect to tentativeness, subjectivity, creativity, social and cultural embeddedness, and the relations among observation, inference, theory, and law [26-28]. Consistent with previous research, it seems clear that teachers’ conceptions of the NOS do not necessarily influence their long of their classroom practice [29-31].
3.3 Understanding the Nature of Science by Teachers and Students in Three Districts of Padang City

From the data on the results of the understanding of the nature of natural science questionnaires filled by elementary school students and teachers in three sub-districts of Padang city, it can be summarized into one, it can be seen the differences from the seven aspects of NOS as in Table 5.

Table 5. Level of understanding nature of science by elementary school students and teachers in padang city.

| Subject | Aspect of NOS | Total Score | Percentage | Criteria |
|---------|---------------|-------------|------------|----------|
|         | Empiris Base  | Tentative   | Theories and Law | Socio, Cultural Embeddedness | Creativity | Scientific Method | Subjective |         |
| Student |               |             |             |             |           |                   |            | 8169     | 64.05 | Enough |
|         | 66.41         | 59.06       | 68.59       | 64.71       | 66.51     | 59.94              | 62.12       |          |
| Teacher | 72.5          | 66.88       | 70.63       | 64.38       | 76.25     | 78.75              | 69.38       | 859      | 71.58 | Good   |
| Sum     | 138.91        | 125.94      | 139.22      | 129.09      | 142.76    | 138.69             | 131.5       | 9028     | 64.72 | Enough |
| Average |               |             |             |             |           |                   |            |          |
| Percentage | 69.46 | 62.97 | 69.61 | 64.55 | 71.38 | 69.35 | 65.75 |

In Table 5, it can be seen that the level of understanding of the nature of science by elementary school students and teachers in general in the city of Padang scored 64.72. With this score means the level of understanding of the nature of science by students and elementary school teachers in three sub-districts of Padang, in general, is in the criteria of sufficient. The score of understanding the nature of teacher science is higher than students. The highest score for understanding the nature of science by students in the Theories and Law aspects is 68.59% while the highest score of the understanding of the nature of science is by the teacher on the aspects of Scientific Method which is 78.75%. For the lowest score of the nature of science/science understanding by students in the Tentative aspect amounted to 59.06% while the lowest score of the understanding of the nature of science/science by the teacher on the Socio-Cultural Embeddedness aspect is 64.38%. The level of understanding of the nature of the Creativity aspect of Science has the highest score for the combined average score of the percentage of elementary school students and teachers in three sub-districts of Padang City with a value of 71.38% with Good criteria and Tentative aspects having the lowest score of 62.97%. Very interesting findings certainly see the absence of a relationship between the score of understanding the nature of natural science students and elementary school teachers in three sub-districts of Padang City with a value of 71.38% with Good criteria and Tentative aspects having the lowest score of 62.97%. Very interesting findings certainly see the absence of a relationship between the score of understanding the nature of natural science students and elementary school teachers in three sub-districts of Padang City with a value of 71.38% with Good criteria and Tentative aspects having the lowest score of 62.97%. Very interesting findings certainly see the absence of a relationship between the score of understanding the nature of natural science students and elementary school teachers in three sub-districts of Padang City with a value of 71.38% with Good criteria and Tentative aspects having the lowest score of 62.97%. Very interesting findings certainly see the absence of a relationship between the score of understanding the nature of natural science students and elementary school teachers in three sub-districts of Padang City with a value of 71.38% with Good criteria and Tentative aspects having the lowest score of 62.97%. Very interesting findings certainly see the absence of a relationship between the score of understanding the nature of natural science students and elementary school teachers in three sub-districts of Padang City with a value of 71.38% with Good criteria and Tentative aspects having the lowest score of 62.97%. Very interesting findings certainly see the absence of a relationship between the score of understanding the nature of natural science students and elementary school teachers in three sub-districts of Padang City with a value of 71.38% with Good criteria and Tentative aspects having the lowest score of 62.97%. Very interesting findings certainly see the absence of a relationship between the score of understanding the nature of natural science students and elementary school teachers in three sub-districts of Padang City with a value of 71.38% with Good criteria and Tentative aspects having the lowest score of 62.97%. Very interesting findings certainly see the absence of a relationship between the score of understanding the nature of natural science students and elementary school teachers in three sub-districts of Padang City with a value of 71.38% with Good criteria and Tentative aspects having the lowest score of 62.97%. Very interesting findings certainly see the absence of a relationship between the score of understanding the nature of natural science students and elementary school teachers in three sub-districts of Padang City with a value of 71.38% with Good criteria and Tentative aspects having the lowest score of 62.97%. Very interesting findings certainly see the absence of a relationship between the score of understanding the nature of natural science students and elementary school teachers in three sub-districts of Padang City with a value of 71.38% with Good criteria and Tentative aspects having the lowest score of 62.97%.

4. Conclusion

Based on the results of data analysis it is known that the level of understanding of the nature of science by teachers is higher than the level of understanding of the nature of science by students and the level
of understanding of the nature of science by elementary school students and teachers in the three sub-districts of Padang both of which are sufficient criteria. Creativity aspects of the nature of science obtain the highest score from the combined level of understanding of elementary school students and teachers in three sub-districts of Padang City. This means that there is no relationship that is aligned between the level of understanding of science students and elementary school teachers in three sub-districts of Padang City. This can be seen from the inverse of the highest and lowest score values in the aspects of creativity and tentatively by elementary school students and teachers. From the results of interviews at the time of data collection, it is known that the teacher still feels unfamiliar with the term Nature of Science (NOS). Given that the understanding of the nature of science is very important, this should be considered by all elements of education. There needs to be an effort to improve the understanding of this science by all parties involved in the education sector in the city of Padang. Teachers must better examine the nature of science, lecturers and researchers need to conduct research, service, and need to publish research related to understanding this science better.

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