

**A Study of Elementary Teachers and Students  
Understanding the Nature of Science (Case Study in West Java)**

**Chaerun Anwar<sup>1</sup>, Ari Widodo<sup>2</sup>, Subuh Anggoro<sup>3</sup>, Anasufi Banawi<sup>4</sup>,  
Ridwan Jusuf<sup>5</sup>, Rif'at Shafwatul Anam<sup>6</sup>**

<sup>1</sup>National Science Teachers training Center of Bandung  
Diponegoro Street No. 12, Bandung, East Java  
Telp: (022) 4231191  
[chaeruna@yahoo.com](mailto:chaeruna@yahoo.com)

<sup>2</sup>Indonesia University of Education Bandung,  
Setiabudhi Street no. 229 Bandung 40154, East Java  
Telp. 022-2001197, 2002320, Fax. 022-2005090  
[widodo@upi.edu](mailto:widodo@upi.edu)

<sup>3</sup>Muhammadiyah University of Purwokerto, Central Java  
Dukuhwaluh Street Kembaran Banyumas 53182  
Telp. 0281-636751, Fax. 0281-637239  
email : [subuhanggoroupi@gmail.com](mailto:subuhanggoroupi@gmail.com)

<sup>4</sup>Institute of Islamic State Ambon  
Dr. H. Tarmizi Taher Street, Kebun Cengkeh, Batu Merah Atas, Ambon, Maluku  
Telp: (0911) 344816  
[anasufibanawi@yahoo.co.id](mailto:anasufibanawi@yahoo.co.id)

<sup>5</sup>Khairun University of Ternate  
Gambesi, Ternate Sel., Kota Ternate, North Maluku  
Telp. 0921-21550.  
[ridwanjusuf79@gmail.com](mailto:ridwanjusuf79@gmail.com)

<sup>6</sup>STKIP 11<sup>th</sup> April Sumedang  
Angkrek Situ Street No. 19 Sumedang 45323 East Java  
Telp: 0261-202911  
[rifat.shafwatul@gmail.com](mailto:rifat.shafwatul@gmail.com)

## Abstract

The nature of science (NOS) do not well understood by teachers and students. Teacher's knowledge of NOS, affects the learning which they performs in the classroom. The purpose of this study to determine understanding of NOS's teachers and students. Respondents are 94 teachers that the educational background and the teaching experience vary, and 404 elementary school students grades 4 - 6. The method of research used descriptive method. The research instrument used questionnaires, structured interviews and classroom observation. Test the validity of the instrument (questionnaire) used the construct validity testing by referring to expert opinion (expert judgment) and the empirical validity. Empirical validity (item) is calculated by the product moment correlation rough figure with 0.3 criteria. The results showed (1) understanding NOS's teachers affect students' understanding of NOS; (2) teaching experience to contribute positively to understanding NOS and science teaching in the classroom; (3) educational background of teachers determines the perspective to understand NOS and (4) the goal of students affected by their understanding of NOS. The need for training on NOS and the learning process is based on NOS that teachers have a better insight into science learning goals for students' future.

Keywords: Nature of Science (NOS), elementary teachers and students

## INTRODUCTION

The nature of science (NOS) is not yet fully understood by students, teachers and prospective teachers even scientists (Dagher & BouJaoude, 2005; Irez 2006; Koksas & Sormunen, 2009; Sandoval & Morrison, 2003; Koksas & Sormunen, 2011; Tsai, 2006; Koksas & Sahin, 2014). In fact, understanding NOS impact on classroom practice (Abd-El-Khalick, Bell, & Lederman, 1998; Brickhouse, 1990; Lederman 1999; Aslan & Taşar, 2013). Along with the Brickhouse (1990) found that teachers' knowledge of NOS, affects the learning they put into practice in classroom. Furthermore, Aslan & Taşar (2013) reported that the conception of NOS held by teachers and classroom practice is still far from the expected ,

According to Linda Bosman (2006: 59), effective science teaching depends on teachers' understanding of how children develop intellectually, how they think, what they think, and how they learn and process information. Knowledge (formal education) and experience influence the way teachers teach and for students to practice their IPA (Hashweh, 1996; Chan & Elliott, 2004; Chan, 2004).

According to Winkel (2006) motivation to learn is affected interests, ideals, curiosity, the desire to implement something successfully and well. Interest has a very important role in learning activities (Darmadi, 2009). So Effendi et.al (2007) said that learning with interest would be better than learning without interest. Motivation to learn can determine whether or not a goal is reached or ideals (Hidayat, 2015).

One major concern for the science lesson is to equate understanding of NOS by teachers and students. Before teachers teaching learning materials science teachers need to first know NOS well. Therefore, in this paper elaborated on NOS, understanding NOS's teachers and students, teachers 'understanding of NOS associated with teachers' educational background, teaching experience, depth of understanding of NOS. While the students' understanding of NOS is associated with the ideals of the students. Here are expected to make full understanding of the NOS by teachers and students to achieve science educational goals aspired.

From the above background can be formulated the following questions, among others: (1) How NOS generally understood by teachers and students ?; (2) How NOS understood by teachers compare to students ?; (3) How NOS understood by teachers according to teaching experiences and educational background; and (4) How NOS understood by students based on their goals?

### Nature of Science (NOS)

NOS or Science mentioned by Kuslan and Stones (1968: 2) and Campbell (1953: 1) indicates that science includes two aspects, processes and products. Science process or aspect of the method is the one that includes the discovery of the problem and its formulation, formulation of hypotheses, design experiments, perform measurements, analyze the data and conclusions maneraiakan (Sund, 1982). As the science product consists of a variety of facts, concepts, principles, laws, and theories in the form of building systematically organized knowledge (body of knowledge) (Dawson, 1994: Carin & Sund, 1989) as a result of the process carried out by scientists. In addition to

the above there are two aspects of the third aspect in IPA, which is the scientific attitude. What is meant by the attitude aspect is the beliefs, opinions and values that must be maintained by a scientist, especially when searching for or developing new knowledge, including responsibility, curiosity, discipline, diligent, honest, and open to other people (Banawi, 2010: 3).

Science knowledge or science is durable, not absolute or uncertain (Koseoglu and Koksall, 2015; Saredine and BouJaoude, 2013). Besides, the knowledge of science is tentative because the subject knowledge to change with the discovery of the latest facts or reconceptualization of the fact that there are (Lederman, et al., 2013; Yalcinoglu and Anagun, 2012; Gencer, USA, 2014; Koseoglu and Koksall, 2015; Wan et al., 2013) or due to natural change (tentative nature) (Akerson, et al., 2014).

Science knowledge IPA is based on a relation or link between theory and laws of science (Lederman, et al., 2013; Erduran, 2014), but there are different kinds of knowledge with the rules or roles within science (Saleh and Khine, 2014; McComas and Kampourakis, 2015) or in other words "distinct kinds of science knowledge" (Erduran, 2014). The laws of science is the statement or description of the relationship between the observed phenomena, whereas science theories are alleged statement (inferred explanations) about a phenomenon that can be observed (Sarkar and Gomes, 2010). The theory is more complex and dynamic as it is based inferred explanations latest, and often including underlying laws (Akerson, et al., 2014), but there is no level or hierarchy between theory and laws of IPA (Wan et al., 2013 ).

Knowledge IPA requires imagination and creativity of researchers (Lederman, et al., 2013; Sarkar and Gomes, 2010) through a phenomenon observed with interpretation (Gencer, USA, 2014; Bloom, et al., 2015; Wan, et al., 2013). Knowledge of science is objective as well subjective, or theory-laden (Gencer, USA, 2014; Erduran, 2014; Bloom, et al., 2015) depending on the background studies or field ditekuninya (Erduran, 2014; Wan, et al., 2013) , Nevertheless Science different with technology and engineering techniques but mutually influence each other's development (McComas & Kampourakis, 2015).

Itself IPA is an image of epistemology and sociology of science and how science is built (Akerson, et al., 2014; Koseoglu & Koksall, 2015) or "way of knowing" (Bloom, et. Al., 2015, Erduran, 2014; Wan et al., 2013). IPA explain the nature of the phenomenon and building a theory developed (Saleh and Khine, 2014) and show aspects of science from the perspective of epistemology (Erduran, 2014).

Science knowledge is empirically-data base wich based and / or generated from observations and withdrawal conclusion of natural phenomena (Lederman, et al., 2013; Wan, et al., 2013; Saleh & Khine, 2014; Erduran, 2014) supported the theory and the science law (Sarkar & Gomes, 2010; Akerson, et al., 2014; Bloom, et al., 2015) .Science knowledge reliable (believed as science knowledge) (Yalcinoglu and Anagun, 2012), or trusted after a testing empirically so that the hypothesis can be a theory (Sarkar and Gomes, 2010).

The creativity and imagination of researchers needed to obtain empirical evidence of scientific knowledge (Gencer, A. S., 2014; McComas & Kampourakis, 2015). In addition the process and the design of the science investigation require

creativity (Akerson, et al., 2014; Erduran, 2014; Wan et al., 2013) when designing, planning investigations (Leden, et al, 2005) and when designing hypotheses (Saleh & Khine, 2014).

One of the characteristics or aspects of the is the essence of the scientific method (Erduran, 2014). But not only the methods or steps in the scientific method that applies to all science theories (McComas and Kampourakis, 2015) or universally accepted (Wan et al., 2013) which can be secured validity in the development of scientific knowledge (Leden, et al, 2005; Sarkar & Gomes, 2010).

Science knowledge is influenced by assumptions and prior knowledge and theory-laden researchers (Saleh, and Khine, 2014), using the inductive approach and hypothetico-deductive testing (McComas & Kampourakis, 2015).

Science knowledge is knowledge of the subject undergoes a series of stages of change (Leden, et al, 2005). Therefore science is self-corrections and open to revision due to the development of the latest facts (Leden, et al, 2005; McComas and Kampourakis, 2015).

Knowledge of science is embedded socially and culturally to humans (Gencer, A. S., 2014; Erduran, 2014. Akerson, et al., 2014; Koseoglu & Koksall, 2015; McComas & Kampourakis, 2015; Wan et al., 2013). IPA conducted and directed by the condition of the historical, cultural and social human (Sarkar & Gomes, 2010; Saleh & Khine., 2014) because the charge of learning science and appreciation of the science is a culture or human culture (Gencer, USA, 2014) as part of the decision-making race humans based on socio-scientific questions (Koseoglu & Koksall, 2015; McComas & Kampourakis, 2015). Scientific inquiry is influenced by the worldview (mind-set) of researchers that is based on knowledge, training received, experience, commitment, religion or beliefs held, political views, gender and ethnicity (Yalcinoglu & Anagun, 2012).

NOS should be recognized as an endeavor (human failure can be a barrier, but can not be eliminated) and human creativity (lay the foundations of future knowledge) (Yalcinoglu & Anagun, 2012). Modern biology as an important part of the IPA has been extended from the physical evolution of the organism into the ethical aspects, legal and human moral and social context (Gencer, A. S., 2014).

Personality tentative knowledge of science (scientific knowledge tentativeness) (Erduran, 2014; Bloom, et al., 2015) and the uncertainty of the sign / evidence (Meichtry, 2005) as well as the process of generating knowledge, constantly reexamination make science knowledge evolving (Lederman and Lederman, 2005).

## Teachers And Students Comprehension of NOS

Knowledge and understanding of NOS's teachers is one of the main factors that affect students' knowledge and understanding about it (Abd-El-Khalick, Bell & Lederman, 1998; Abd-El Khalick & Lederman, 2000). The results of the study showed that teachers who do not or who have received formal education in science had a naive and inadequate comprehension of NOS (Abd-El-Khalick & Lederman, 2000; Jordan & Duncan, 2009; Lederman, 1992 ). Teachers who teach science can not memamami a

clear idea about the nature of science (Abd-El-Khalick & Lederman, 2000). Therefore, the purpose of the program is to improve science education preservice teachers' views about the nature of science (Morrison, Raab, & Ingram, 2009).

NOS is considered as an important component of science literacy. However, several previous studies showing that students from elementary-high school level do not gain an understanding of the nature of science (eg Akerson, 2009; Bell, Blair, Crawford, & Lederman 2003). In addition, other studies have shown that teachers should have an effective understanding the nature of science and the understanding of how to teach it before teaching it to students to learn (Abd-El-Khalick, Bell, & Lederman, 1998; Akerson, 2009, Matkins & Bell, 2007) , Past research has shown that through training instructional appropriate for elementary school teachers can improve their understanding of the essence of IPA (Akerson, Abd-El-Khalick, & Lederman, 2000; Lederman, 2007), and in some cases teachers are able to transfer their understanding in practice in class (Akerson & Volrich, 2006).

Knowledge and experience influence the way teachers teach and practice science for their students (Chan & Elliott, 2004; Chan, 2004). According to Linda Bosman (2006: 59), effective teaching of Natural Sciences depending on teachers' understanding of how children develop intellectually, how they think, what they think, and how they learn and process information.

Gerber, Cavallo, and Marek (2001) states that the fundamental purpose of learning science is to increase science literacy of students, helping them develop an understanding of the concepts and transfer them to new situations when solving a problem.

## Method

This research uses descriptive quantitative method. The population were a teacher and a student in West Java. Samples taken by the teachers and students using stratified random techniques (grade IV, V, and VI) at 9 Elementary School which responden 94 teachers and 404 students. Data obtained by the instruments Non-Tests, including: questionnaires (questionnaires) with Likert scale, interview (interview), and observations (observation). In simple terms is presented in Table 1. Measurement based on the score obtained from filling the questionnaire about NOS (NOS components: product, process, social, and attitudes) by teachers and students, observations and interview. Validity test of the instrument (questionnaire) in this research used the construct validity of the test by referring to expert opinion (expert judgment) and the empirical validity. Empirical validity (item) is calculated by the product moment correlation rough numbers with criteria 0.3 (Suharsimi Arikunto, 2006: 72).

Tabel 1. Instrument and Trial Respondent

Variabel	Type Instrument	Code	Respondent	Total
NOS Component	Questionnaire	HS-1	Students	404
		HS-1	Teachers	94
	Observation	HS-2	Students	
	Interview	HS-2	Students	
		HS-3	Teachers	

Reliability tests performed using Cronbach alpha formula with criteria 0.6 (Kaplan, 1982: 107). Data were analyzed using descriptive statistics, by presenting data in the form of tables, percentages (Sugiyono, 2006: 57). Presentation of data in the form of percentages hereinafter described and drawn conclusions based on the information disclosed criteria (Hopkins, 1993: 67). Data were analyzed using MS-Excel and SPSS 20 For Windows For Windows. Skor obtained averages are then categorized (less, pretty, good, and excellent) (Djemari Mardapi, 2008: 123).

## RESULTS

### Understanding NOS in General

Understanding NOS in general related Teacher and Student feedback about the nature of science is presented in the following figure.

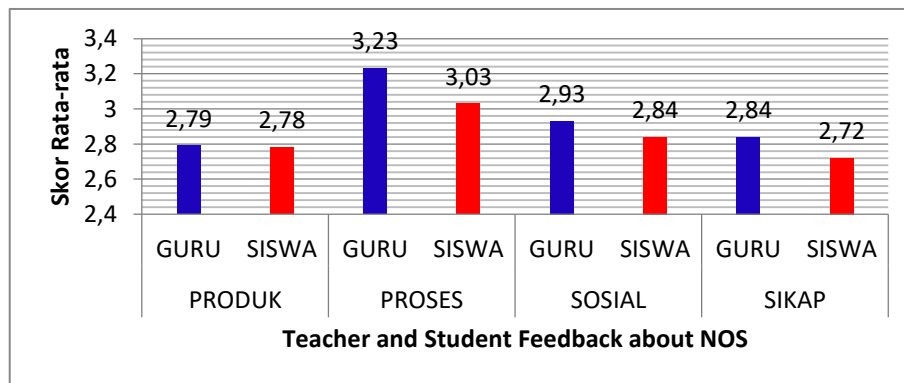


Figure 1. Distribution of Score average Teachers & Students feedback of NOS

Figure 1 shows a view of teachers and students to NOS. In general teacher and students understanding of NOS do not differ in all aspects of NOS. Knowledge and understanding of NOS is one of the main factors that affect students' knowledge and comprehend it (Abd-El-Khalick, Bell & Lederman, 1998; Abd-El Khalick & Lederman, 2000).

Impact of NOS understanding of teachers in their teaching practice and to the understanding of the students has been investigated in various studies (Abd-El-Khalick, Bell, & Lederman, 1998; Brickhouse, 1990; Lederman 1999; Aslan & Taşar, 2013). Lederman (1999) and Bell, Lederman and Abd-El-Khalick (1997), states that many

factors contribute to the implementation of the conception of NOS into classroom practice, some of which include the level of teacher experience, willingness to teach the nature of science, and perceptions of students. Bell, Lederman and Abd-El Khalick (1997), argues that in order to translate the exact NOS into practice in the classroom, teachers must be given an understanding of the importance of teaching the nature of science and emphasize the NOS in their classroom instructional strategies.

Understanding of teachers and students to NOS as a process in the highest position, while the NOS as a product and attitude occupies the lowest position. This finding contrasts with previous research. BouJaoude and Abdel-Khalick (1995) reported that teachers only teach science as a product of knowledge regardless of the nature of science aspects of the other. Similarly, BouJaoude (1999) found that most teachers and students have a traditional view of NOS because it comes from an emphasis on science and ignore the content of epistemology and sociology of science in its curriculum.

#### The essence of understanding related science Teacher teaching experience

The results from 94 teacher respondents composed of teachers with teaching experience of more than 5 years as many as 65 people and less than 5 years as many as 29 people, obtained comparative understanding of the nature of science as follows:

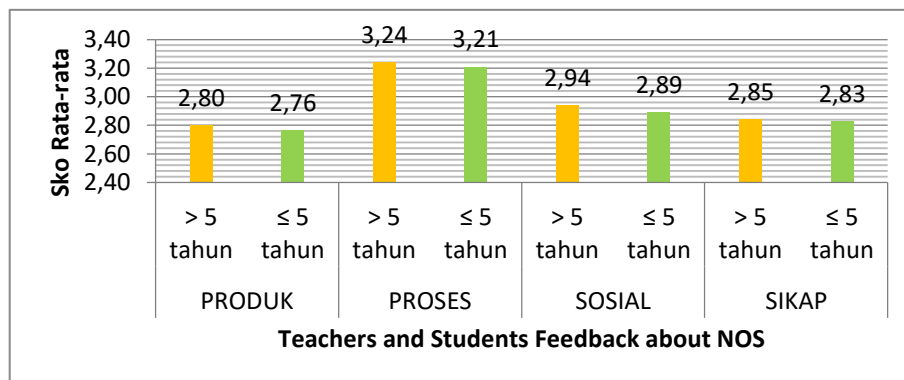


Figure 2. Distribution of Teacher score average response Based on Teaching Experience

Figure 2 shows the scores understanding of the nature of elementary school teachers based on teaching experience demonstrated by the length of teaching. Teachers with length teaching experience teaching time of more than 5 years appear higher in all aspects of the nature of science, although not significantly. Knowledge and experience influence the way teachers teach and for students to practice their Science (Hashweh, 1996; Chan & Elliott, 2004; Chan, 2004). According to Linda Bosman (2006: 59), effective teaching of Sciences depending on teachers' understanding of how children develop intellectually, how they think, what they think, and how they learn and process information, and it is influenced by experience teach.

The dissenting opinion expressed by Akerson & Volrich (2006) which showed that the ability of teachers who have not received training on the nature of science, then get the opportunity to intern and teach the NOS is guided, was not only successful in understanding the conceptualization of the NOS for himself, but he was also able to teach the ideas of science to elementary students where he served. McDonald (2010) found that learning the NOS through scientific argumentation proved to be effective to improve the understanding of NOS concepts elementary school teacher. Good scientific arguments emphasize the role of the NOS in science teaching load.

The results of this study indicate that the teachers are learning to apply the scientific process in learning albeit scientific process is applied solely by the demands of learning syntax, while the three other components of the nature of science is not optimally appeared in learning. From questionnaire data and reinforced by observation and interviews obtained information that turned out to teachers not yet fully implement the essence of Science in learning. Some teachers whose background was in science education, did know about the nature of science, but in learning not to apply the learning-based nature of science, what is conveyed by the teacher to the students seem to follow the demands of the existing teaching materials also may not have been entirely based on the nature of science.

#### Understanding NOS related to Teacher Education Background

Based on the results of research conducted on 94 respondents composed of teachers with science education background as much as 22 people and non science 72 people. Obtained comparative understanding of the NOS as follows:

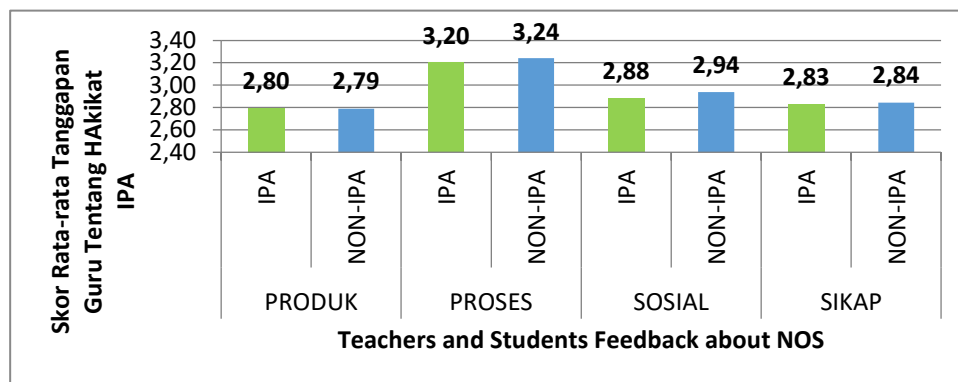


Figure 3. Distribution of Score average response Teachers by Educational Background

Figure 3 shows the level of understanding of the NOS is based on the type of formal education acquired teachers. Teachers with non-formal education in Science has a score of understanding the NOS that is higher on aspects of the process, social change and attitudes. While understanding the NOS as a product of teachers with science education higher than non-science. This is consistent with the results of research and Abdel-Khalick BouJaoude (1995) that teachers only teach science as a product of

knowledge regardless of the nature of science aspects of the other. Similarly, BouJaoude (1999) found that most teachers and students have a traditional view of the NOS because it comes from an emphasis on science and ignore the content of epistemology and sociology of science in its curriculum.

Akerson & Volrich (2006) showed that the ability of teachers who have not received training on the NOS, then get the opportunity to intern and teach the NOS is guided, was not only successful in understanding the conceptualization of the NOS for himself, but he was also able to teach ideas about science to elementary students where he served. McDonald (2010) found that learning the NOS through scientific argumentation proved to be effective to improve the understanding of the nature of science concepts elementary school teacher. Good scientific arguments emphasize the role of the nature of science in science teaching load.

Based on interviews with eight elementary school teachers can be drawn the conclusion that science teachers emphasize more on the capability of learning science students in mastering science product because they think it will determine the child's future education. They are not the essence of science components do not teach others but as long as they study science in college ever become their focus is how to understand the science product. As for teacher non science educational background tend to pay attention to other components, can be caused that thinking about the learning process is more important than learning products.

BouJaoude and Abdel-Khalick (1995) reported that teachers only teach science as a product of knowledge regardless of the nature of science aspects of the other. Similarly, BouJaoude (1999) and Saredidine & BouJaoude (2014) found that most teachers and students have a traditional view of the NOS because it comes from an emphasis on science and ignore the content of epistemology and sociology of science in its curriculum.

Non-science teacher's ability to draw on learning more humane and touching the social aspects are recognized as the advantages of non-science teachers in science teaching. Further it was found that non-science teachers more flexible and follows the contours of the psychology of students in an effort to build the concept of IPA. The alignment of the interests and aspects of learning in developmental psychology student thinking by teachers Non-IPA allows teachers easier IPA inculcate in students, which influences classroom atmosphere and teacher in teaching students about science is very influential in the development of science concepts to students.

#### Understanding NOS related to depth of understanding of Teachers and Students

Results of research conducted on 94 respondents primary school teachers based on the level of understanding of the nature of science is presented in Figure 4 below.

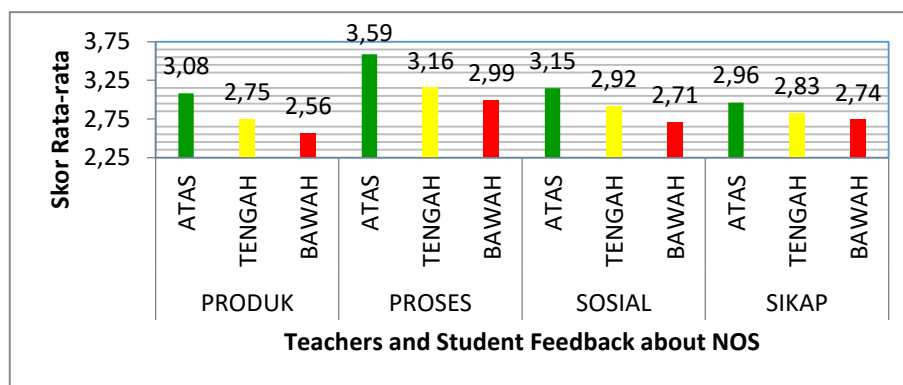


Figure 4. Distribution of Score average of Teacher's response Based on Depth Understanding of NOS

Figure 4 shows an understanding of teachers's NOS by level of comprehension scores. Difference scores of understanding NOS as a process between the degrees seems bigger than the other three aspects of NOS. Referring to the number of respondents with a dominant teacher education with non-formal education in science, results of this study indicate that understanding the NOS as a process is understood and carried out three other aspects.

Based on interviews with some elementary school teachers obtained information that they only focused on how to provide materials for teaching science (product). Because they think students will be considered to be science when he mastered the knowledge of science. When they go to college when he met with science subjects, subjects with more emphasis on how the ability in solving problems both about the science and the concept of a matter, not to the NOS. So the impact on the process of teaching activities give priority to the strengthening of the science product. And according to them also that ultimately can make the child pass the National Exam (UN) is on the cognitive abilities of students on the science products.

Matkins & Bell (2007) develop learning about the science of global warming and Howe & Rudge (2005) in the matter of the nature of science-based medicine. They found that the contextualization of the nature of science through phenomena that occur at this time and is controversial, it is effective in helping to improve preservice teachers' conceptions of understanding the NOS and develop awareness about their socio-scientific issues.

According to Bartholomew, Osborne, and Ratcliffe (2004) is important for teachers to develop knowledge about NOS and scientific processes before they can effectively teach science in the classroom. Abd-El-Khalick and Lederman (2002) stated that teachers must have what is called 'NOS PCK'. To be able to teach the nature of science, teachers not only need to have a proper understanding of the nature of science but also need to have Pedagogical Content Knowledge. In addition, Schwartz and Lederman (2002) highlights the importance of strong linkages between the subject-matter knowledge, the nature of science, and pedagogical knowledge for teachers to succeed perform teaching and learning of NOS in the classroom.

## The understanding of NOS related to Students Goal

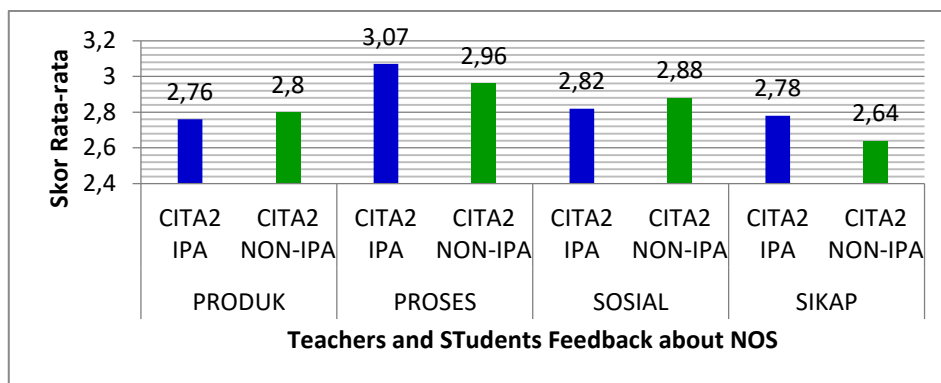


Figure 5. Distribution of Score average student feedback about NOS based on their Goal

Figure 5 shows the student responses about the essence of science is based on student's goal, who are generally classified by the science and non-science. Students who have ideals related to science had an average score higher understanding of the NOS on aspects of the process and attitude. While students who aspire not associated with a higher with science, their understanding of NOS to the component of products and social change.

Motivation to learn science affected interests, ideals, curiosity, the desire to implement something successfully and as well as possible (Winkel, 2006). Interest has a very important role in learning activities (Darmadi, 2009). While Effendi and Praja (2007) states that learning with interest would be better than learning without interest. Motivation to learn can determine whether or not a goal is reached or ideals (Hidayat, 2015).

Gerber, Cavallo, and Marek (2001) states the fundamental purpose of learning science is to improve the scientific literacy of students, helping them develop an understanding of the concepts and transfer them to new situations when solving a problem. Bybee and DeBoer (1994) sums up the purpose of science education as "(1) personal and social development, (2) knowledge of scientific facts and principles, and (3) scientific methods and skills and their applications" (p. 358 ). Cil and Çepni (2012) defines one of the objectives of education IPA as helping students to develop their awareness of the NOS. Schwartz and Lederman (2002) emphasized that, the depth of understanding of the NOS and knowledge about the subject content knowledge is practically considered important in guiding the instructional practice them. This teacher in the classroom to support students in determining the future (including aspiration) them.

## DISCUSSION

The results showed that understanding of NOS of the teacher and students do not differ in any component of the nature of science. It shows what is being taught by a teachers,

they also will be understood by students. So that there is a link between what is done by the teachers, and what will be done by students. Knowledge and understanding of the NOS's teachers is one of the main factors that affect students' knowledge and understanding about it (Abd-El-Khalick, Bell & Lederman, 1998; Abd-ElKhalick & Lederman, 2000; Nott & Wellington, 1996).

There needs to be a link between the learning process is based on the NOS and learning objectives are also based on NOS, so that there is coherence between the process that teachers and students with the objective to be achieved teachers and students. If a teacher has the ability to teach science-based of NOS, it will obtain alignment "process" based nature of science and a "destination" based nature of IPA, which will be manifested in the actions of teachers and students' actions.

The results showed that the teaching experience of teachers affects the way of teaching in the classroom and student learning outcomes. Teachers with experience teaching enough, over time, in addition to honing its competence optimally also can better understand the subject matter (the teacher has to understand the location of the difficulty of the material) so as to teach the material well in students. Students can easily understand the material being taught by experienced teachers. Other than that experienced teachers are also able to motivate and encourage student learning.

Knowledge and experience influence the way teachers teach and for students to practice their science (Hashweh, 1996; Chan & Elliott, 2004; Chan, 2004). According to Linda Bosman (2006: 59), effective teaching of Natural Sciences depending on teachers' understanding of how children develop intellectually, how they think, what they think, and how they learn and process information, and it is influenced by experience teach.

Teachers with formal education Non-science has a score of understanding the NOS that is higher on aspects of the process, social change and attitudes. While understanding the NOS as a product of teachers with science education higher than non-science. Akerson & Volrich (2006) showed that the ability of teachers who have not received training on the NOS, then get the opportunity to intern and teach the NOS is guided, was not only successful in understanding the conceptualization of the NOS for himself, but he was also able to teach ideas about science to elementary students where he served. McDonald (2010) found that learning the NOS through scientific argumentation proved to be effective to improve the understanding of the NOS concepts elementary school teacher. Good scientific arguments emphasize the role of NOS in science teaching.

Based on interviews with teachers some teachers obtained information that they only focused on how the provision of material science subjects (product) while the other components are not so considered. Because they think students will be considered to be science when he mastered science products. According to them in the end to make the pass children at the National Examination (UN) is on the cognitive abilities of students on the science products.

Teachers do not understand how to implement the essence of science learning. Some teachers whose background was in science education, did know about the nature of science, but in learning not to apply the learning-based nature of science, what is

conveyed by the teacher to the students seem to follow the demands of the existing teaching materials also may not have been entirely based on the nature of science. It is also because at the time when they study science found that the lesson is concerned with how your ability in solving problems both about the science and the concept of a matter, not to the NOS. So the impact on the process of teaching activities give priority to the strengthening of the science product.

Meanwhile, according to the teacher who set a non-science seem science as a science that is intact and should be based on observation and empirical observation. This is because they view that science is a science that must be obtained from the evidence first and then only be credible and contextually to student life. So the process of learning science should begin with the evidence then the students can learn the product. Because through this learning proving to be more attractive to students. Although an understanding of their own products science claimed not so much to know.

Matkins and Bell (2007) developed a research-based nature of science through the contextualization of the nature of science as cargo in learning science about global warming. They found that the contextualization of the NOS through phenomena that occur at this time and is controversial, it is effective in helping to improve preservice teachers' conceptions of understanding the NOS and develop awareness about socio-scientific issues them. Howe and Rudge (2005) uses the context of medical science to explore the nature of science and its impact on students and found similar results with Matkins and Bell (2007).

Non-science teacher's ability to draw on learning more humane and touching the social aspects are recognized as the advantages of non-science teachers in science teaching. Further it was found that non-science teachers more flexible and follows the contours of the psychology of students in an effort to build the concept of science. The alignment of the interests and aspects of learning in developmental psychology student thinking by non-science teachers background allows teachers easier inculcate in students, which influences classroom atmosphere and teacher in teaching students about science is very influential in the development of science concepts to students.

From Figure clearly seen that the process components for higher group, Middle and Bottom relatively stable. Just as in figure 2, knowledge and understanding of the NOS's teachers is one of the main factors that affect students' knowledge and understanding about it. BouJaoude and Abdel-Khalick (1995) reported that teachers only teach science as a product of knowledge regardless of the nature of science aspects of the other. Similarly, BouJaoude (1999) found that most teachers and students have a traditional view of the NOS because it comes from an emphasis on science and ignore the content of epistemology and sociology of science in its curriculum. Abd-El-Khalick (2001) conducted an intervention study whose results revealed that teachers have an adequate conception of the nature of science and contemporary but able to transfer their knowledge into better teaching context. Likewise, Abdel-Khalick, Bell and Lederman (1998) asserts that although it has a sufficient framework for understanding the nature of science, teachers are not explicitly use them in planning their learning process. Besides, there are other factors that should be investigated to improve the ability of teachers about the intricacies of the classroom. One important factor that should be

investigated is the appropriate pedagogical ability required to teach the nature of science.

## CONCLUSION

1. Understanding of the NOS's Teachers in line with those of their students
2. Experience teaching teachers in science provide understanding NOS and learning process in the classroom
3. The educational background of teachers define their worldview in understanding the essence of science
4. Students goal are influenced by their understanding of the NOS

## RECOMMENDATION

1. Need to associate a learning process based on NOS and learning objectives are also based on the NOS, so that there is coherence between the process that teachers and students with the objective to be achieved teachers and students. If a teacher has the ability to teach science based on NOS, it will obtain alignment "process" based nature of science and a "destination" based on NOS, which will be manifested in the actions of teachers and students' actions.
2. Learning science in school of NOS need not be accompanied by nurturant effect (congenital effects) but an explicit (reinforced) in learning.
3. The teacher's teaching experience less impact on understanding the NOS, therefore, teachers who teach science subjects in primary schools need to follow related training for teaching science based on NOS.

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