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THE EFFECTIVENESS OF USING THE SUBJECTIVE IN LEARNING (SIL) LEARNING MODEL IN IMPROVING THE UNDERSTANDING OF NATURE OF SCIENCE (NoS) SUBJECTIVE ASPECTS IN ELEMENTARY SCHOOL STUDENTS

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Abstract
Understanding the Nature of Science (NoS) is essential because it helps students appreciate, understand and criticize science more effectively. The subjective aspect, which is one aspect of the Nature of Science (NoS), still needs to be better understood among elementary school students. This Research discusses the effectiveness of using the Subjective In Learning (SIL) learning model in increasing understanding of the Nature of Science (N0S).) subjective aspects of elementary school students. This Research was conducted using a quantitative approach, a pre-experimental research type with a one-group pretest post-test design. The instruments used were questionnaires and interviews. The research location is at a leading private elementary school in Garut Regency, West Java. Based on the Research that has been carried out, the results show that the Subjectivies in Learning (SIL) learning model is effective in increasing students' understanding of the subjective aspect of the Nature of Science (NoS), with an increase of 0.34, which can be included in the medium category. The author recommends that further researchers develop other learning models to increase students' understanding of different aspects of NoS.
Keywords: *learning model subjectives in learning (sil); understanding nature of science (nos) subjective aspects*

Abstrak
Pemahaman mengenai Nature of Science (NoS) sangatlah penting karena membantu siswa untuk menghargai, memahami, dan mengkritisi ilmu pengetahuan secara lebih efektif. Aspek subjektif yang merupakan salah satu aspek dalam Nature of Science (NoS) masih sering kurang difahami di kalangan siswa Sekolah Dasar.Tujuan dari penelitian ini adalah untuk membahas efektivitas dari penggunaan model pembelajaran *Subjektif In learning* (SIL) dalam meningkatkan pemahaman Nature of Science (NoS) aspek subjektif pada siswa Sekolah Dasar. Penelitian ini dilakukan dengan menggunakan pendekatan kuantitatif jenis penelitian pre-eksperimen dengan desain penelitian one group pretest postest design. Instrumen yang digunakan berupa angket dan wawancara. Lokasi penelitian bertempatkan di Sekolah Dasar swasta unggulan di Kabupaten Garut-Jawa Barat. Berdasarkan penelitian yang telah dilakukan diperoleh hasil bahwa model pembelajaran *Subjectivies in Learning* (SIL) efektif dalam meningkatkan pemahaman siswa mengenai *Nature of Science (NoS*) aspek subjektif, dengan peningkatan sebesar 0,34 yang dapat dimasukan dalam kategori sedang. Penulis merekomendasikan untuk peneliti selanjutnya dapat mengembangkan model pembelajaran lain untuk meningkatkan pemahaman siswa dalam aspek NoS yang lainnya.
Kata Kunci: model pembelajaran subjectives in learning (sil); pemahaman nature of science (nos) aspek subjektif

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Introduction

Nature of Science (NoS) is often considered an essential element because the role of NoS in teaching is to help students understand what science is and how it works as a unique way of knowing things (Jiang & McComas, 2014). Nature of Science (NoS) refers to the epistemology of science, so science can be used to know the values and beliefs inherent in the development of scientific knowledge (N. Lederman et al., 2013). According to Khalik et al. (2008), students' understanding of the Nature of Science (NoS) can be used as a graduation standard from science education before entering lectures so that they have science literacy (Jumanto & Widodo, 2018). The aspects of Nos provide knowledge to students of how scientists work, the process of forming ability, then validating the knowledge and drawing conclusions (Mccomas, 2015). Students' understanding of the Nature of Science (NoS) is emphasized as an essential educational goal worldwide (N. G. Lederman & Lederman, 2019), because the Nature of Science (NoS) is a complex concept that is a nature of knowledge involving sociology, physiology and history of knowledge and psychology of science (Nugraheny & Widodo, 2021) So that it will make it easier for students to understand various knowledge. An understanding of NoS will also be decisive in decision-making because NoS obeys the scientific thinking of students or teachers (Adal & Cakiroglu, 2023). NoS is divided into six different aspects, namely scientific knowledge that is tentative, empirical, subjective, involves the interruption of two humans, imagination, and creativity, certainly consists of a combination of observation and conclusion and is embedded socially and culturally (N. G. Lederman, 1999).

The characteristics of each aspect of NoS are very different from one another (Kostøl et al., 2023). One aspect of the Nature of Science (NoS) is Subjective. Students need to understand that the nature of science (NoS) is subjective so that students know that what a scientist conveys can be influenced by their own opinions. Students who understand the emotional aspects of the Nature of Science (NoS) will be able to express new ideas or discoveries they acquire with more confidence because subjectivity in science is real, so knowledge in science will continue to develop. Based on the results of research conducted by Kuncoro (2018), students' understanding of the Nature of Science (NoS) falls into the sufficient category (Adi, Yogi., 2018). In addition, after researchers conducted previous preliminary studies on several elementary schools in Indonesia, it was found that student's understanding of the Nature of Science (NoS) in subjective aspects obtained the lowest presentation, namely 2.4 of the highest 4 points. The subjective aspect begins when the scientist learns so many things affect the scientist's subjectivity, such as background, scientific focus, and socio-culture. Personal subjectivity is inevitable in science; subjective indicators consist of personal values, beliefs, self-agendas, and previous experiences that will influence what and how a scientist does his work(Jumanto & Widodo, 2018; Imran & Wibowo, 2018). The development phase in the operational phase for elementary school students who require natural objects directly in the learning process can be one of the factors causing students' low understanding of subjective aspects in NoS. Therefore, researchers want to apply a learning model that can improve students' knowledge of subjective aspects of the Nature of Science (NoS).

Nature of Science (NoS) needs to be taught explicitly in the school environment and by the characteristics of elementary schools by utilizing Nature of Science (NoS) aspect-based learning because it will help students understand Nature of Science (NoS) holistically (Lestari & Widodo, 2021). The Nature of Science (NoS)-based learning model used is the Subjectivities in Learning (SIL) learning model. The Subjectivities in Learning (SIL) learning model was developed based on the results of preliminary studies, which stated that students' understanding of the Nature of Science (NoS) subjective aspects found the lowest percentage; the development

of this model also pays attention to cognitive activities that occur in students' brains when studying science, then the validation process is carried out by competent parties in the field of education by going through several revision processes to get development The suitable learning model. This model is applied in Ecosystem learning materials. The novelty in this study lies in creating a new learning model specifically designed to improve subjective aspects of students' understanding of the Nature of Science (NSS). This learning model develops the contextual and inquiry learning models developed concerning the constructivist approach. As an innovative educational approach, constructivism emphasizes that students can better understand information when they construct knowledge independently (Barbehön, 2022). This learning model also emphasizes concrete processes and directly dealing with learning objects so that students can directly feel the subjectivity of knowledge. After using this learning model, students are expected to understand the subjective aspects of the Nature of Science (NoS) more deeply.

Research Methods

This Research was conducted using a quantitative approach with the type of Pre Experimental Designs research with a research design one group Pretest-Postest Design (Creswell, 2014). The instrument is a questionnaire comprising ten statements covering the Nature of Science (NoS), subjective aspects and interviews. The research location is a leading private elementary school in Garut Regency-West Java. Sampling is used with convenience sampling techniques (Gall, J,. Borg, 2014). The researcher chose this Leading Private Elementary School in Garut Regency because this school is quite representative and meets the criteria for use as a research location. Besides that, the results of preliminary studies that have been carried out show that the understanding of the Nature of Science (NoS) subjective aspects in this school is in the low category. This study hypothesises that using the Subjective in Learning (SIL) learning model can improve elementary school students' understanding of the subjective aspects of the Nature of Science (NoS). The instruments used in this study were questionnaires and interviews. The research data is then processed using SPSS software to see the significance of the data obtained. Then, an N-Gain test will be conducted to see the magnitude of the increase in understanding the Nature of Science on these subjective aspects. The instruments used in this study are as follows:

Table 1. Research Instruments

No	Instrument
1	The personal interests of scientists can influence the final results of the Research they conduct
2	Science knowledge is based on Research, so it is not influenced by the personal mind of the researcher
3	Personal values held by scientists can influence the meaning (interpretation) of research results
4	Science is a science that is really what it is according to what happens
5	Science may be influenced by the background and personal interests of the inventor
6	Science knowledge that has been recognized as accurate is guaranteed not to be influenced by the personal thoughts of the researcher
7	The researcher's belief background influences scientific knowledge
8	Recognition of the latest science discoveries is not influenced by the popularity of researchers
9	Research source funders control scientific discoveries in science
10	Science knowledge is not affected by the culture of researchers

Results and Discussion

There are several stages of learning in the SIL learning model, namely (1) Question, (2) Identification, (3) Exploration, (4) Comparing, (5) Analysis, and (6) Conclusion. In each stage, there are activity steps, both in the form of activities carried out by teachers and in the form of activities carried out by students. More details of the learning activities by teachers and students can be seen in Table 2.

Table 2. SIL Learning Model Steps

Steps	Teacher Activities	Student Activities
Question	Provide an explanation of a material that will stimulate students' curiosity 1. Prepare a video about the ecosystem with the end showing some things that can stimulate students' curiosity 2. Answer student questions	Ask questions about the material presented by the teacher 1. Listen to the contents of the video displayed by the teacher 2. Ask teachers about video content
Identification	Ask students questions to help students identify emerging phenomena 3. Ask questions about the types of ecosystems and their peculiarities and peculiarities. 4. Linking students' answers to the subjectivity of scientists.	Answering teacher questions regarding the identification of phenomena that are considered to contain subjectivity 3. Answer questions from teachers 4. Listening to the teacher's explanation
Exploration	Explain practicum steps in accordance with scientific methods 5. Prepare the practicum module to be used 6. Provide assistance during practicum	Conducting practicum in accordance with scientific methods 5. Observing the types of ecosystems and their role in the environment around the school, both biotic and abiotic creatures 6. Determine the abiotic components in the surrounding environment by measuring air temperature with a barometer, then estimating lighting, wind and soil conditions. 7. Observe biotic components by recording all living things in the ecosystem. 8. Record plant species as existing producers. Then also record all types of animals that are consumers found in the ecosystem, both fixed and stopped by (flying animals). Also keep an eye out for small

		animals that may be in the soil/near the leaf surface. 9. Record all observations made on the table provided. 10. Make conclusions on the results of observations made.
Compering	Ask about students' opinions about the results of practicum that has been done 7. Ask each student the results of observations they have made 8. Help find points of disagreement from each student	Express each student's opinion about the results of the practicum carried out 11. Answer teachers' questions about observations they have made 12. Estimate differences of opinion that arise
Analysis	Helping students to be able to analyze the results of identification through practicum with differences in answers obtained from the results of opinion comparisons 9. Write down important pointers from different students' opinions 10. Help students find reasons for differences of opinion obtained 11. Helping students analyze the results of their differences of opinion and relate them to science is subjective	Analyze various differences of opinion regarding the results of practicum that have been carried out by students and relate them to the results of identification regarding science subjectivity. 13. Analyze the various differences of opinion obtained 14. Analyze the causes of dissent from each student 15. Linking differences of opinion with the subjectivity of science
Conclusion	Validate the truth of students' thinking that science is subjective 12. Directing students to the right conclusions 13. Validating the nature of IPA is subjective	Interpreting students' thoughts from the results of analysis of science is subjective 16. Summing up the results of the analysis 17. Recognize that IPA is subjective

Based on research conducted on the effectiveness of the *Subjectives in Learning* (SIL) learning model, the following results were obtained:

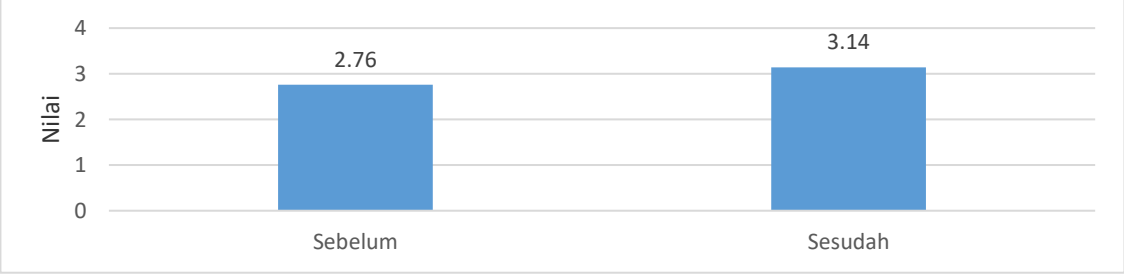

Figure 1. Comparison of Student Scores Before and After Using the Subjectives in Learning (SIL) Learning Model in Learning

Data from Figure 1 shows that the average score before using the Subjectives in Learning (SIL) learning model was 2.76, while the average score after using the Subjectives in Learning (SIL) learning model in education was 3.14. In addition to the difference in the value before and the use of the Subjective in Learning (SIL) learning model in learning, a significance test was also carried out using SPSS with a type of test using the t-test and obtained a significance value of 0.49 more minor than the α of 0.05; this shows that the SIL learning model is effective in enhancing students' understanding of science is subjective. In addition to the significant increase in the use of the Subjective in Learning (SIL) learning model, based on the N Gain test, it was found that the increase in student understanding of science is subjective in NoS by 0.36, which is included in the moderate criteria. Before and after using the SIL learning model, the highest value on the instrument is obtained at the point of personal values held by scientists, which can affect the meaning (interpretation) of research results. In contrast, the lowest value obtained at the point of science is science, which is what it is by what happened

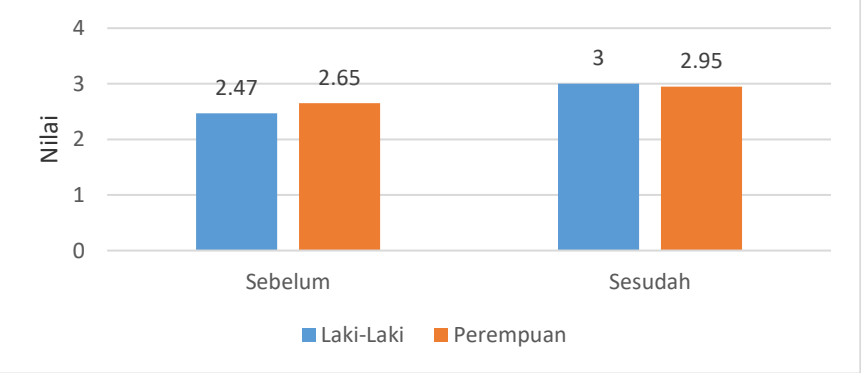

Figure 2. Comparison of Student Scores Before and After the Use of the Subjectives in Learning (SIL) Learning Model in Gender-Based Learning

Data from Figure 2 shows that test scores before the use of the Subjective in Learning (SIL) learning model with scores after the use of the Subjective in Learning (SIL) learning model in male students are higher than female students' scores, the N-Gain value for students' understanding of subjective aspects in NoS is 0.34 for male students and 0.2 for female students, it can be interpreted that the increase in scores in male students falls into the moderate category Meanwhile, the increase in scores in female students is in a low category.

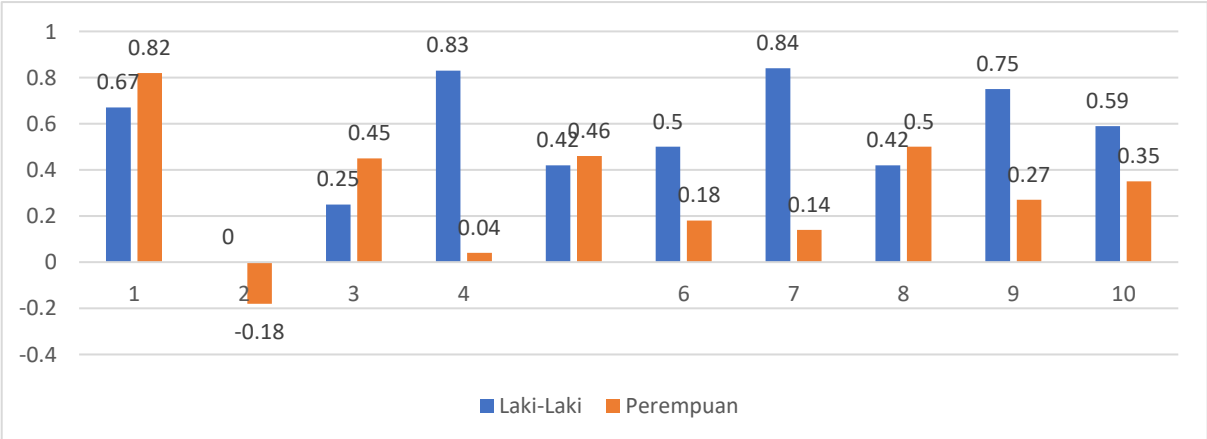

Figure 3. The difference in the results of the questionnaire of male students and female students regarding subjective aspects in NoS

The highest difference in male students is in point 7, namely about science knowledge influenced by the background of the researcher's beliefs. At the same time, in women, it is at point one, namely, the personal interests of scientists, that can affect the final results of the Research they do. Then, the lowest difference value for male and female students is the same, namely regarding science knowledge based on research, so the personal thoughts of the researcher do not influence it.

The Subjective in Learning (SIL) learning model affects the effectiveness of students' understanding of the subjective aspects of the Nature of Science (NoS). This is because this learning model provides direct experience to students in experimenting, and they can realize for themselves that everyone has subjectivity in interpreting the results of their experiments. Previously, Research on the influence of the Nature of Science (NoS) learning model on students' understanding of the Nature of Science (NoS) was carried out, where one aspect of NoS was subjective; from the Research carried out, it was found that the Nature of Science (NoS) learning model affects students' understanding of Nature of Science (NoS) (Lestari & Widodo, 2021). Likewise, in this Subjectives in Learning (SIL) learning model, several stages can help students understand the subjective aspects of the Nature of Science (NoS); the stage is where students can present arguments or opinions based on the results of research or experiments they have done before. The role of argumentation expressed by students in the learning process can support students' comprehensive view of the Nature of Science (NoS), as students are aware of science-related aspects, including subjectivity, when presenting their respective arguments (Martins & Justi, 2022). The process of subjectivity occurs in decision-making carried out by scientists. Scientists function as experts, namely people who have analytical skills based on practice and experience, but sometimes, in decision-making that is taken into consideration not only right and wrong scientific judgments but also whose recommendations should be accepted by the public regarding the credibility and authority of the recommender of the scientist's decision (Rychnovská et al., 2017).

The delivery of arguments contained in the SIL learning model is the existence of an analysis stage, which is a stage where students must consider the results of their Research and also be connected with the sciences and customs that exist in the surrounding environment in analyzing, this gives the role that subjectivity is influenced by standards that exist in the student's school environment and also refers to those that do not have absolute significance (Jahn & Dunne, 2007), Instruction from an environment that supports the application of the Nature of Science (NoS) will make it easier for teachers to insert it into the learning process (Akerson et al., 2010). Judging from the results of filling in the instrument carried out, the point that states that personal values held by scientists can affect the meaning (interpretation) of research results gets the highest score; this can be because, in general, students already understand that a person's argument is formed from habits or values he holds and is influenced by his environment so that many students agree with the statement, while the lowest score obtained at the point of science is the knowledge that is really what it is by what happened because many students believe that the command in science is absolute truth, besides that teacher competence in mastering aspects of Nature of Science (NoS) is also still low (N. G. Lederman, 1999). *Nature of Science (NoS) is also rarely found in student subject matter; Nature of Science (NoS) is only found in additional teaching materials* (Lestar, Hana., Rahmawati, 2020). Then, some teachers still need to become more familiar with understanding NoS (Jumanto & Widodo, 2018), so they rarely apply *Nature of Science (NoS)* when science lessons are taught.

Then, based on gender, as seen in Figure 3, the average score of science understanding is subjective in male students higher than in females. The difference between men and women

is seen as a matter of gender, not gender. Sex refers very broadly biologically, while gender is a social construct involving various genetic differences. Psychological, social, and cultural between men and women (Wiyanto & Asmorobangun, 2020). That is, gender is something that cannot be avoided. Research conducted by M Lou (2021) states that the reasoning ability of male students is better than that of female students (Luo et al., 2021). In the learning process, one activity is to develop ideas or knowledge, and Research has shown that male students are better at generating ideas (Lailiyah, 2020). In addition, another ability that is no less important in the learning process is the mathematical ability. Male students do better than female students (Anggraini, N., Budiyono., 2019). Then, according to research that Larry Cahill has done, the size of the male brain is larger than the female brain. Besides that, the male amygdala is larger than the female, which means men can regulate emotions and are wiser in decision-making (Anggraini, N., Budiyono., 2019). In line with the thinking of Z Zhu (2007), who suggests that the problem-solving ability of male students is better than female students because psychology affects education (Zhu, 2007), Then the learning process will be better if the psychology of the students is also good. These can be some of the reasons why male students' understanding of the Nature of Science (NoS) is better than female students. Understanding the subjective aspect of the Nature of Science (NoS) is expected to reinforce students when they explore and publish a discovery. Like Science (NoS), emotional aspects, opinions or results of discoveries made by scientists are influenced by their personal views, whether they are motivated by culture, religion, habits, mindsets, etc. Therefore, students will be more critical and enthusiastic in developing new knowledge.

Conclusion

Based on the Research that has been done, it was found that the Subjectivies in Learning (SIL) learning model effectively increases students' understanding of the Nature of Science (NoS) subjective aspect, with an increase of 0.34, which can be included in the medium category. Then, for students' understanding of the Nature of Science (NoS) subjective aspects seen from gender, an increase of 0.34 for male students and 0.2 for female students was obtained; it can be interpreted that the rise in scores in male students falls into the medium category while the increase in scores in female students is included in the low sort. In addition, the difference in the value of understanding the Nature of Science (NoS) of the highest subjective aspect in male students is found in point 7, namely about Science Knowledge influenced by the background of the researcher's beliefs. At the same time, in women, it is at point one, namely the personal interests of scientists, that can affect the final results of the Research they do. Then, the lowest difference value for male students is at point two, namely about scientific knowledge based on research, so that the personal thoughts of the researcher do not influence it. Female students are at point 2, namely about scientific knowledge based on research, so that the private views of the researcher do not control it. The authors recommend that researchers further develop other learning models to improve students' understanding of different aspects of NoS.

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