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APPLICATION OF SCIENCE PROCESS SKILLS IN COURSES OF BASIC SCIENCE CONCEPTS

Farida Istianah[1], Suryanti[2], Mintohari[3], Julianto[4], Nadia Lutfi Choirunnisa[5]
[12345]Universitas Negeri Surabaya; Indonesia
Correspondence email; faridaistianah@unesa.ac.id

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Abstrak

The aim of this research is to determine the effect of applying the science process skills (KPS) approach to student learning outcomes in the Basic Concepts of Science course. This research uses a quantitative approach with a one group pre-test post-test design. Data collection is carried out by observation, tests and documentation. Primary data sources are obtained from learning outcomes and student responses regarding the implementation of learning using a process skills approach. Meanwhile, secondary data is based on literature and previous research related to science process skills. Data analysis was carried out using the normality test, paired sample t test and N-Gain test. The population in this study were students of the 2023 class of the Primary School Teacher Education Study Program, Surabaya State University. Using a random sample from class B with a total of 43 students. The research results showed that the average pre-test score was 68.76, then after applying science process skills the average post-test score was 84.27, which shows effectiveness in increasing students' understanding of basic science concepts courses. This is supported by N-Gain data which produces an increase of 0.60 in the moderate increase category.

Keywords Science Process Skills, Learning Outcomes, Basic Concepts of Science.

INTRODUCTION

Rapid developments related to science and technology occurred in the 21th century (Rosyid & Mubin, 2024). Science is one of the sciences that continues to progress by paying attention to technological advances. Natural Sciences (IPA) is a branch of science that uses scientific methods to systematically understand various phenomena in the world. Therefore, IPA has many characteristics that can make it different from non-science. Science learning essentially has four main elements, namely attitude, process, product, and application (Dewi, 2022). This essence encourages science learning to help students develop their skills not only in the realm of knowledge but also in the realm of attitudes and skills (Nashrullah et al., 2022).

Natural Sciences (IPA) is one of the fields of study that teaches life (Sholihat & Anwar, 2023); for example, there are several objects that cannot be sensed, as well as objects that are outside or even inside the earth. IPA is also interpreted as a collection of concepts or even materials that are explained and applied using scientific methods (Wastriami & Mudinillah, 2022), for example, observations based on scientific attitudes, for example, honesty, thoroughness, tolerance, and others. Regulation of the Ministry of Education and Culture Number 35 of 2018 states that the goal of science education is to increase understanding of the surrounding environment and nature, as well as knowledge that needs to be studied and discussed from a biological, physical, and chemical perspective. The approach used in science learning is called the scientific approach (Sari et al., 2022). In addition, one of the learning skills that can be used in science learning is the science process skills (Angelia et al., 2022).

KPS refers to a series of skills needed to carry out various scientific activities or experiments to understand scientific concepts. This is something that is very important in teaching Natural Sciences (IPA) because it is not only an understanding of theory but also the ability to observe, formulate questions, identify problems, and conduct experiments to find solutions (Ali et al., 2024). Science education has a very important role in shaping an understanding of the world around us and developing critical thinking skills (Rahim, 2023). In the context of education in Indonesia, Natural Sciences (IPA) is one of the most important curriculum components, with the aim of providing an understanding of basic applicable science concepts (V. Z. Putri et al., 2024). However, although science is taught at almost all levels of education, many students have difficulty understanding the material that has been presented. One of the causes is the less-than-optimal learning process carried out in the classroom, both in terms of the methods and approaches used

(Firdaus et al., 2023).

According to literature studies, science process skills in science learning can improve understanding and science learning outcomes (Aras et al., 2021). These skills have the purpose of observing, asking questions, designing experiments, analyzing data, and making conclusions based on findings (Widodo et al., 2024). Through the process, science thinking skills can help students connect theories with real-life phenomena and help them understand several science concepts. The importance of science learning for students is to provide a strong foundation for developing critical and analytical thinking (I Ketut Suparya, 2020). Through science, students are trained to solve complex problems and make decisions based on evidence. In addition, this learning encourages innovation and creativity, allowing students to create new solutions (Dacholfany et al., 2023). Science also helps students understand natural phenomena and environmental issues, which are crucial for sustainability (Marlina et al., 2024). With practical skills gained from experiments and research, students are better prepared to face challenges in the world of work. Overall, science education equips students with the knowledge and skills they need to make a positive contribution to society and the environment. However, the application of these skills in science learning in Indonesia is still considered less than good and less than optimal (Humayra* et al., 2022).

Based on the results of observations of the lack of motivation in lectures on the basic concepts of science courses for S1 PGSD FIP students, Surabaya State University. This can be seen from the low average value of the basic concepts of science lectures which reached quite satisfactory. This is due to the lack of training of lecturers in mastering learning methods based on science process skills and limited adequate resources, such as laboratory equipment (Suhelayanti et al., 2023). Therefore, a systematic and structured approach is needed so that science learning with this approach can be implemented effectively and efficiently in the classroom (Ningrum et al., 2024). Therefore, one solution that can be offered to overcome the problem of low motivation and low learning outcomes is to apply the science process skills approach.

According to research by Durmaz & Mutlu (2016), students who focus on science process skills have higher learning outcomes than classes with normal treatment. Therefore, the science learning process is designed to help students develop critical thinking skills, solve problems, and apply their knowledge for long-term research through scientific inquiry activities. The goal is to help students gain a deeper understanding of the surrounding environment. How important science process skills are for students? In fact, science process skills are still very low in several regions in

Indonesia. The low level of students' science process skills was stated in the research (Rahayu & Anggraeni, 2017). The results of this research show that students' science process skills are included in the low category in every aspect.

Previous researchers Yuliati (2016) also stated that low science process skills (KPS) ultimately lead to low student science learning outcomes. The results of the TIMSS (Trends in International Mathematics and Science Study) survey show that the science achievements of Indonesian students tended to decline from 1999 to 2011. In 1999, Indonesia was ranked 32nd out of 39 countries, with an average score of 435. In 2003, the score decreased to 420 with a ranking of 37 out of 46, and in 2007, the ranking fell to 35 from 49 with an average score of 427. The 2011 results showed a ranking of 39 out of 41 with an average score of 406, while the international score reached 500. Cognitively, the average Indonesian student is still at the level of knowing ability. The low level of science process skills possessed by students is caused by several factors that cause students' science process skills to not appear. In accordance with the research conducted by Wismaningati et al. (2019), there are two factors that cause low science process skills, namely, low scientific background and lack of laboratory infrastructure. Therefore, it is necessary to strive for learning that can motivate students to develop their reasoning power and solve the problems they face through the application of science process skills. This is supported by research conducted Setiawan & Rusmana (2018) showing that increasing students' understanding of the material being taught can be influenced by science process skills.

The purpose of this writing is to provide analytical results related to the application of science process skills in improving science learning outcomes in the Basic Science Concept Course. The limitation of writing this journal is that it only focuses on reviewing science learning outcomes in the Basic Science Concept Course. By identifying existing challenges and solutions, this study is expected to contribute to improving the standards of science education in Indonesia, as well as providing broader insight into the importance of science process skills in the overall learning process.

METHOD

This research uses a quantitative approach with a one-group pre-test and post-test design. The aim of this research is to compare the conditions before and after research on research subjects. Research location at the Faculty of Education, Surabaya State University. The population in this

study were Elementary School Teacher Education students at Surabaya State University, class of 2023. Using a random sample from class B, totaling 43 students. Primary data sources are obtained from learning outcomes and student responses regarding the implementation of learning using a process skills approach. Meanwhile, secondary data is based on literature and previous research related to science process skills. Data collection methods include the first observation, which is carried out by observing during the learning process and guided by student observation instruments when carrying out learning activities. Then, the second is carrying out a test, namely a pretest, which is carried out before learning is carried out to determine students' initial knowledge. Then, after carrying out the learning process, a posttest is given to find out the extent of students' understanding after following the learning process. Third, documentation. In this research, documentation collection includes a list of names and photos of research implementation. The collected data will be analyzed quantitatively using descriptive and inferential statistical techniques. Hypothesis testing with the t distribution (t-student table) to gain a deeper understanding of the relationship between learning outcomes and the application of science process skills.

Data analysis was carried out using the normality test, paired sample t-test, and N-Gain test. The normality test is used to identify whether the observed data follows a normal distribution or not. In this research, the Shapiro-Wilk method was used. This method was chosen because the data to be tested was less than 50 (<50), with the criteria: If Sig ≤ 0.05, then the data is not normally distributed, and if Sig. > 0.05 then the data is normally distributed (Suardi, 2019). The following are the normality testing criteria with SPSS 29 in the following table:

Table 1. SPSS Normality Test Processing Criteria

sig ≥ 0,05	Normal Distribution
sig < 0,05	Not Normally Distributed

(Gunawan, 2018)

Then, a paired sample t-test was carried out, used to determine whether there were significant differences after being given treatment (Syafriani et al., 2023). The following are the criteria for the paired sample t-test with SPSS 29

H_0: There is no significant difference in learning outcomes regarding science process skills.

H_a: There are significant differences in learning outcomes for science process skills.

The following is the basis for decision-making in the t-test:

H_0 accepted or H_a rejected if the significance level of the t-test is > 0.05, which means there is no significant difference between learning outcomes and science process skills.

H_0 rejected or H_a accepted if the significance level of the t-test is <0.05, which means there is a significant difference between learning outcomes and science process skills.

Then, the N-Gain Test is carried out, which is a technique that is usually used to increase the effectiveness of certain learning or interventions in order to improve learning outcomes (Sukarelawan et al., 2024). The N-Gain test is a combination of pretest and posttest results so that you can see a significant increase in the results of the work completed in the research (Amalia & Fathurrahman, 2023). The following is the N-Gain formula:

$$< g > = \frac{Posttest - Pretest}{100 - Pretest}$$

(Wahab dkk., 2021)

The following are the N-Gain Criteria in the following table:

Table 2. N-Gain Test Criteria

Value	Criteria
g = 0,00	There is no decrease
0,0 < g ≤ 0,30	There was a low increase
0,30 < g ≤ 0,69	There was a moderate increase
0,70 ≤ g ≤ 1,00	There was a high increase

(Sundayana, 2016)

FINDINGS AND DISCUSSION

Findings

Based on the results of the normality test, it shows that Sig 0.054 > 0.05 means the data is normally distributed. The normality test is used to identify whether the observed data follows a normal distribution or not. In this research, the Shapiro-Wilk method was used. This method was chosen because the data to be tested was less than 50 (<50).

Table 3. Normality Test Results

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Before being given treatment	.126	43	.083	.922	43	.006
After being given treatment	.148	43	.019	.949	43	.054
a. Lilliefors Significance Correction						

Then, proceed with the Paired sample test. Based on the data in Table 4, it shows that H_0 is rejected or H_a Is accepted if the t-test significance level is 0.01<0.05, which means there is a significant difference between learning outcomes and science process skills.

Table 4. Paired Samples Test

Paired Samples Test										
		Paired Differences							Significance	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper	t	df	One-Sided p	Two-Sided p
Pair 1	Before being given treatment - After being given treatment	-25.27907	7.89914	1.20461	-27.71007	-22.84807	-20.985	42	<,001	<,001

Table 5 explains descriptive statistical data on learning outcomes before applying science process skills. The results obtained for the pre-test value showed an average value of 68.76, while the average post-test value was 84.27. This shows an increase in learning outcomes after implementing science process skills.

Table 5. Student Learning Outcome Score

	Pre test	Post test
N	43	43
Average	68,76	84,27
Sum	2957	3624

Table 5 explains descriptive statistical data on learning outcomes before applying science process skills. The results obtained for the pre-test value showed an average value of 68.76, while the average post-test value was 84.27. This shows an increase in learning outcomes after implementing science process skills.

Then an N-Gain test was carried out with a result of 0.60 with a moderate increase category. The following are the results of the N-Gain test:

Table 6. N-Gain test results

No	Student Name	Pre Test	Post Test	N-Gain Score	N-Gain Score %	Criteria
1.	MA	55	87	0,71	71%	High
2.	AK	62	82	0,52	52%	Medium
3.	UAD	68	84	0,5	50%	Medium
4.	ARA	50	86	0,72	72%	High
5.	YCT	68	82	0,43	43%	Medium
6.	HAH	60	88	0,7	70%	High
7.	PT	55	87	0,71	71%	High
8.	VR	50	87	0,74	74%	High
9.	RHS	60	84	0,6	60%	Medium
10.	SI	52	85	0,68	68%	Medium
11.	DTS	57	80	0,53	53%	Medium

12.	AFS	55	87	0,71	71%	High
13.	AWA	68	83	0,46	46%	Medium
14.	BA	60	83	0,57	57%	Medium
15.	RC	57	83	0,60	60%	Medium
16.	MIL	70	82	0,4	40%	Medium
17.	NSH	60	83	0,57	57%	Medium
18.	NRI	70	82	0,4	40%	Medium
19.	HMS	68	83	0,46	46%	Medium
20.	SIF	50	86	0,72	72%	High
21.	CBM	55	86	0,68	68%	Medium
22.	TRI	70	83	0,43	43%	Medium
23.	NAB	61	82	0,53	53%	Medium
24.	NFH	57	85	0,65	65%	Medium
25.	FMA	70	83	0,43	43%	Medium
26.	AZA	72	86	0,5	50%	Medium
27.	KA	52	86	0,70	70%	High
28.	BSS	57	86	0,67	67%	Medium
29.	NLM	50	86	0,72	72%	High
30.	MDR	62	85	0,60	60%	Medium
31.	RTF	55	88	0,73	73%	High
32.	SRT	64	86	0,61	61%	Medium
33.	DNT	57	85	0,65	65%	Medium
34.	MRI	60	80	0,5	50%	Medium
35.	SSA	50	86	0,72	72%	High
36.	APQ	55	83	0,62	62%	Medium
37.	DAF	50	85	0,7	70%	High
38.	SGA	50	80	0,6	60%	Medium
39.	ANM	65	84	0,54	54%	Medium
40.	IN	50	85	0,7	70%	High
41.	NSP	65	84	0,54	54%	Medium
42.	CMS	60	83	0,57	57%	Medium
43.	NA	55	83	0,62	62%	Medium
	Rata-Rata	59	84,2790698	0,60	60%	Medium

Based on Table 5 and the calculation results above, it can be seen that the N-gain test results obtained a score of 0.60 (moderate increase). Thus, it can be concluded that the application of science process skills in basic science concept lectures has increased understanding of basic science concept courses.

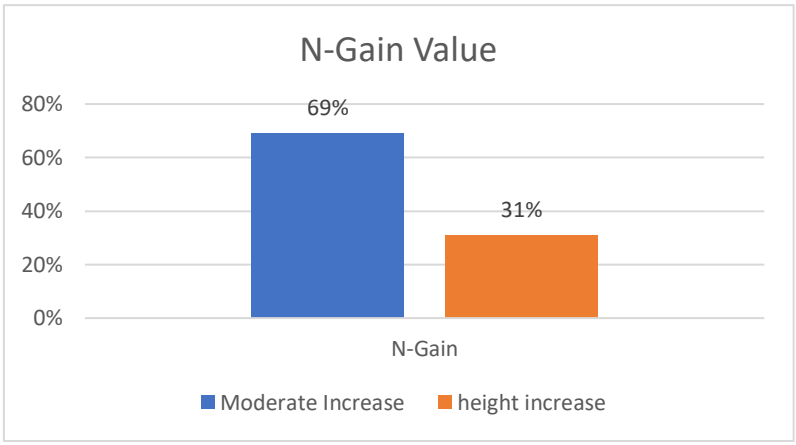

Figure 1. Diagram of n-gain results

Based on Figure 1, it is known that students who were in the moderate improvement category were 69%, while who experienced high improvement were 31%.

Discussion

Based on Figure 1, it can be seen that there is an increase in students getting scores in the medium category by 69%. For the high category, it is 31%. Figure 1 shows the results of increasing science process skills for PGSD students at Surabaya State University, which experienced a moderate increase after being treated with the science process skills approach. However, students enjoy learning and easily understand the material by using a science process skills approach. According to Artayasa et al. (2017), improving student learning outcomes can be done with science process skills. (Mawardah et al., 2021) Stated that using a science process skills approach can be used by educators as a way to increase their understanding of learning material and also improve their learning outcomes.

In addition, the results of Zahroh et al., 2017 shows that improving the science skills process can be achieved with a science process skills approach, so that it is more guided and directed during the learning process. The process skills approach is a form of active learning, which is a learning approach that, in reality, aims to improve understanding of concepts by accelerating the learning process (Najiah, 2019). Through the skills process, students are encouraged to observe their own reflections, ask themselves questions, and engage in various learning activities to understand the concepts they will learn through investigation (Angin et al., 2022). Students are given more opportunities in education to actively participate in solving the problems faced. This makes it easier for students to understand the material and apply it in everyday life.

Implementation of Science Process Skills (KPS) in learning in the sense of being able to provide opportunities for students to solve problems that are learning topics independently or in groups (D. Wahyudi & Lazulva, 2021). Activity Practicum is one of the activities related to KPS (W. A. Putri et al., 2022). Based on the research results, it shows that where KPS is all scientific skills students have in following or carrying out all series of activities science learning. These skills include the skills of planning experiments, carrying out experiments, observing or observing, and interpreting data (A. Wahyudi et al., 2015). These skills are further divided to be more specific, namely instrument preparation skills or experimental tools, assembling instruments or experimental tools, re-checking the readiness of the instruments, putting forward a hypothesis, calibrating experimental equipment, conducting circuit measurements properly and correctly, identifying that phenomenon appearing on objects, identifying similarities or differences in objects, and read measuring instruments correctly. The assumption is that if most or even all the skills are part of the KPS carried out by students, it is suspected the student in question will be easy to comprehend and remember what has been studied (Dani et al., 2024).

This increase in student learning activities is caused by the science process skills approach used by teachers (Oviana & Biliyan, 2020). Student involvement in learning increases students' mastery of the material concepts provided by the teacher. This is in accordance with the opinion of Isnada & Muhajir, 2023 who state that learning requires active student involvement. The application of the process skills approach causes students not only to receive and memorize the information provided by the teacher but students try to discover concepts through direct experience (Syafiqah et al., 2024). This is also in accordance with the opinion of Jannah & Jainudin, 2019 that the higher the student's involvement in each learning activity, the better the learning outcomes will be.

To develop all science process skills in lectures, basic science concepts are certainly necessary. Learning is developed in accordance with the IPA way of thinking (Yuliati, 2016). Wisudawati & Sulistyowati, 2022 way of thinking Science includes belief, curiosity, imagination, reasoning, self-examination, and can be done to develop the skills needed 21st century. Through science learning, various aspects of the process are developed, one of which is the skills process (process skills).

CONCLUSION

Based on the results of the research and discussion above, it can be concluded that there is an increase in student learning outcomes using the science process skills approach. There are 31% of students experienced a high increase, while 69% of students experienced a moderate increase. The increase in student learning activities is due to the science process skills approach used by the teacher. Student involvement in learning increases student mastery of the concepts of the material given. The application of the process skills approach causes students not only to receive and memorize information given by the teacher but students try to find concepts through direct experience. With the results of this study, the use of the process skills approach is an option that can be used by teachers to help improve student learning activities.

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