JURNAL EDUSCIENCE (JES)
p-ISSN : 2303 - 355X | e-ISSN : 2685 - 2217
PUBLISHED BY : LPPM of UNIVERSITAS LABUHANBATU

Jurnal Eduscience (JES)

Volume 11, No.3

Desember, Year 2024

Submit : 01 November 2024

Accepted : 09 Desember 2024

ANALYSIS OF SCIENCE PROCESS SKILLS AND SCIENTIFIC ATTITUDES JUNIOR HIGH SCHOOL STUDENTS IN NUNUKAN REGENCY

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ABSTRACT

This study examines the profile of science process skills and scientific attitudes among students in Nunukan Regency. The study population includes 9th-grade students from junior high schools during the 2023/2024 school year. The research involved 243 students to evaluate science process skills and 332 students to assess scientific attitudes through questionnaires spanning 21 different schools. The research type is descriptive quantitative with the sampling technique being conducted through accidental sampling. The study administered 27 questions on electrical circuit material and a scientific attitude questionnaire with 40 statement items using a Likert scale. The results show that (1) varying levels of science process skills: observing (40%), classifying (39.4%), predicting (30.87%), planning experiments (40.6%), formulating hypotheses (40.2%), interpreting data (38.4%), implementing concepts (38.7%), measuring (37.3%), and communicating (36.2%). The average score for science process skills was 38%, falling into the low category. (2) In contrast, scientific attitude scores were higher: curiosity (71.3%), critical thinking (71.3%), respecting data/facts (63%), open-mindedness (74.1%), cooperation (68.1%), and honesty (72.2%), with an average score of 70%, falling into the high category. (3) The results of the correlation analysis indicate that H_0 is rejected, and Ha is accepted. This means there is a significant relationship between scientific process skills and scientific attitude, which is weak but positive.

Keywords: Analysis; Science Process Skills; Scientific Attitude

ABSTRAK

Penelitian ini mengkaji profil keterampilan proses sains dan sikap ilmiah di kalangan siswa di Kabupaten Nunukan. Populasi penelitian mencakup siswa kelas 9 SMP pada tahun ajaran 2023/2024. Penelitian ini melibatkan 243 siswa untuk mengevaluasi keterampilan proses sains dan 332 siswa untuk menilai sikap ilmiah melalui kuesioner yang mencakup 21 sekolah berbeda. Jenis penelitian adalah deskriptif kuantitatif, dengan pengambilan sampel dilakukan melalui accidental sampling. Penelitian ini memberikan 27 pertanyaan tentang materi rangkaian listrik dan kuesioner sikap ilmiah dengan 40 item pernyataan menggunakan skala Likert. Hasil penelitian menunjukkan (1) tingkat keterampilan proses sains yang bervariasi: mengamati (40%), mengklasifikasi (39,4%), memprediksi (30,87%), merencanakan percobaan (40,6%), merumuskan hipotesis (40,2%), menginterpretasi data (38,4%), menerapkan konsep (38,7%), mengukur (37,3%), dan berkomunikasi (36,2%). Skor rata-rata untuk keterampilan proses sains adalah 38%, yang termasuk dalam kategori rendah. (2) Sebaliknya, skor sikap ilmiah lebih tinggi: rasa ingin tahu (71,3%), berpikir kritis (71,3%), menghargai data/fakta (63%), berpikiran terbuka (74,1%), kerja sama (68,1%), dan kejujuran (72,2%), dengan skor rata-rata 70%, yang termasuk dalam kategori tinggi. (3) Hasil analisis korelasi menunjukkan bahwa H_0 ditolak, dan Ha diterima. Ini berarti ada hubungan signifikan antara keterampilan proses sains dan sikap ilmiah, yang bersifat lemah namun positif.

Kata Kunci: Analisis; Keterampilan Proses Sains; Sikap Ilmiah

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INTRODUCTION

In facing the challenges of the 21st century, the Merdeka Curriculum is designed to shape future Indonesian generations with the ability to adapt, innovate, and compete globally. The Merdeka Curriculum is used to ensure learning takes place by adapting to students' abilities and focusing on core learning materials, student competencies, and character development (Safitri et al., 2023). The Independent Curriculum aims to develop 21st-century competencies, including critical thinking skills, creativity, communication, and collaboration (Sartini & Mulyono, 2022; Arifah & Utami, 2023). Essential learning in the Merdeka Curriculum, including science learning, contains two elements: scientific understanding and process skills. This is in line with Chiappetta & Koballa, (2010) the perspective that science learning must encompass four main dimensions: science as a way of thinking emphasizing critical and creative thinking skills, investigation methods involving students in scientific investigation activities, a body of knowledge to understand scientific concepts and theories, and interaction with technology, society, and the environment. Therefore, the role of science process skills and scientific attitudes becomes fundamental in science learning at the Junior High School level.

Science is the study of understanding scientific concepts through the scientific method, which involves various stages to produce discoveries (Tursinawati & Widodo, 2019). Science learning aims to acquire competencies and attitudes and develop concepts related to natural phenomena (Sakti et al., 2021). Science education should focus on cultivating students' scientific process skills and attitudes. This approach is valuable because it aids students in grasping scientific concepts, promotes hands-on learning and exploration, and develops their abilities to think critically, analytically, and creatively.

In the era of globalization and technology, science process skills are becoming increasingly important. Applying scientific processes and methods is crucial for equipping students to tackle the complex challenges they will encounter in the 21st century (Turiman et al., 2012; Wardani & Djukri, 2019). Scientific process skills play a crucial role in science education as they foster students' critical thinking capabilities (Purwanti & Heldalia, 2022), solve problems (Widyaningsih et al., 2020) and understand scientific concepts deeply (Inayah et al., 2020). The skills of scientific processes not only enhance students' scientific knowledge but also prepare them to face real-world challenges by applying the scientific method in daily life (Harlen, 2013; Juniar et al., 2021), and has an impact on student's academic achievement (Listiani & Kusuma, 2024; Sideri & Skoumios, 2021).

The learning of science should emphasise the ability to develop various skills and abilities, especially those used in scientific processes (Darmaji et al., 2023). The science learning process focuses on understanding concepts and requires science process skills, which involve the ability to investigate and

discover, used by scientists to solve problems and formulate results (Musliman & Damayanti, 2023). The development of students' conceptual understanding and higher-order thinking abilities is significantly enhanced by their science process skills (Lederman & Lederman, 2012). Developing scientific process skills during early childhood education can establish a robust basis for children's future comprehension of scientific concepts (Jirout & Zimmerman, 2015).

The abilities to think critically, reason logically, and act efficiently are fundamental scientific process skills that enable individuals to achieve specific outcomes effectively (Elvanisi et al., 2018). Science process skills are designed to encourage students to take a more active role in comprehending and mastering their learning journey (Prasasti, 2018). Scientific process skills play a crucial role in education, enabling students to cultivate critical and analytical thinking capabilities essential for comprehending and implementing scientific principles, using scientific process skills in learning yields more significant learning outcomes than learning that relies on textbooks (Akcay & Yager, 2016). Science learning is more meaningful (Kurniawan & Djukri, 2022). Other research shows that scientific process skills help students effectively carry out observations, classifications, measurements, and data interpretation, which in turn enhances their deep understanding of science material (Mustain et al., 2015).

Besides knowledge and skills, attitudes are also learning achievements, one of which is the scientific attitude. A scientific attitude enables students to act rationally, consistently, and objectively when facing a problem. The scientific attitude is closely related to creating engaging and meaningful science learning (Suryantari et al., 2019). The scientific attitude is developed through the learning experiences gained by students (Saputra et al., 2023). The scientific mindset plays a crucial role in determining how well students perform academically. Those who possess a strong scientific attitude tend to participate more actively in their studies and attain superior academic results compared to their peers who lack such an attitude (A. T. Putri et al., 2017).

The scientific attitude is an attitude that a scientist must possess when facing problems (F. F. K. Sari & Lahade, 2022). Students' strong scientific attitude is shaped by various elements, including instructional approaches, learning resources, motivational factors, psychological well-being, and environmental support. Scientific attitude positively influences learning outcomes (Hardiyanti et al., 2024; Mustain et al., 2021). Scientific attitudes can be improved through quality learning (Sati & Mutmainnah, 2023). Good science learning is learning that can involve students in understanding the material and forming attitudes or character in students (Putri & Gumala, 2023). Scientific attitude needs to be instilled during science learning so that students dare to express opinions and attitudes of perseverance, responsibility, and discipline.

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With the explanations above, science process skills and scientific attitudes must be measured in junior high school students. Based on initial observations and findings in several junior high schools in Nunukan Regency, it was discovered that science learning is still predominantly teacher-centered, with insufficient emphasis on developing process skills and attitudes. Many students remain passive and lack enthusiasm during science practical activities. Numerous schools in remote areas lack laboratory facilities, consequently making it difficult for students to apply scientific activities, and most schools have not utilized virtual laboratories in science learning. These findings indicate that junior high school students' science process skills and scientific attitudes are relatively low. Therefore, this research is crucial to analyze the profile of science process skills and scientific attitudes of junior high school students in Nunukan Regency.

Based on the urgency of learning problems, specifically the low science process skills and scientific attitudes of junior high school students in Nunukan Regency, several comprehensive solutions can be offered by referring to previous studies. Improving science process skills through the use of PhET integrated with discovery-based worksheets (Widyastuti et al., 2024; Novebrini et al., 2021), inquiry-based worksheets integrated with PhET (Buhera et al., 2024), inquiry-based PhET usage (Saputra et al., 2017; Mahulae, 2023), using STEM (Şimşek, 2019; Dacumos, 2021), virtual labs and guided inquiry models are more suitable for enhancing science process skills (Aditiyas & Kuswanto, 2024).

Improving scientific attitudes can be achieved through the use of inquiry models (Sari Hs & Kistian, 2020; Wulandari et al., 2024), guided inquiry learning models (Putri & Gumala, 2023), 5E learning cycle-based worksheets (Ramlah et al., 2024), inquiry-based worksheets (Sati & Mutmainnah, 2023). Simultaneously improving science process skills and scientific attitudes is more effective using virtual labs (Tawil et al., 2024), inquiry-based laboratories (Acarli & Dervişoğlu, 2021), discovery-based PhET usage (Alatas & Sakina, 2019). Therefore, improving students' science process skills and attitudes can be accomplished through innovative approaches based on technology, inquiry, and virtual laboratories, which have been proven effective in optimizing science learning processes.

Several previous studies on the level of science process skills and scientific attitudes among junior high school students in Indonesia. A study conducted on 30 seventh-grade students at SMP Muhammadiyah in Bima City showed that the average science process skills score was 30.88%, categorized as low (Fathurrahman, 2023). A study conducted in eighth grade at SMPN 2 Sembawa involving 81 students showed that the average science process skills were 48.69%, categorized as low (Susanti et al., 2023). A study conducted in state schools in Tarakan City involving 74 students found that the average science process skills score was 48.55%, categorized as low (Listiani & Kusuma, 2024). A study conducted

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at SMP Pademawu found the average scientific attitude score to be 66%, categorized as quite good (Afifah et al., 2022). A study in one of the state junior high schools in Sukabumi with 65 eighth-grade students found that the average scientific attitude score was 26.41%, categorized as low (Kusherawati et al., 2020). A study at SMP Satu Atap Pulau Tunda found that the average student scientific attitude was 42%, which is low (Rahman et al., 2017)

Based on previous studies on science process skills and scientific attitudes of junior high school students in Indonesia, there are several novel aspects in this study. This research was conducted in Nunukan Regency, which had not been previously studied regarding science process skills and scientific attitudes, thus filling a research gap in the border region of Kalimantan. It involves a representative sample size from various areas in Nunukan Regency, allowing for broader generalization of results compared to previous studies. The research not only measures the level of science process skills and scientific attitudes but also examines the correlation between these two variables and investigates the influence of science process skills on scientific attitudes or vice versa. Previous studies showed that there was a positive but not significant relationship between scientific attitudes and science process skills (Nurlaelah et al., 2022), and that science process skills and scientific attitudes together influence the scientific concept of understanding (Guswita et al., 2018; Putra et al., 2015).

This research aims to analyze the science process skills and scientific attitudes of junior high school students in Nunukan Regency. This border region has long been overlooked in educational research. Through an in-depth study, the research will identify students' proficiency levels in science process skills, measure their scientific attitudes, and explore correlations between these variables. The importance of this research lies in its effort to go beyond merely describing empirical conditions and provide tangible contributions to developing contextual and meaningful science learning strategies.

Measuring science process skills and scientific attitudes enables teachers to evaluate students' understanding of applying scientific concepts in real-world situations. Through this assessment, teachers can identify areas of student difficulty and design appropriate pedagogical interventions. The research is expected to be a foundation for developing innovative learning models, locally responsive curricula, and methodologies that stimulate critical thinking skills. The accurate data generated will be useful for further research and help policymakers and educators design programs that meet student needs and address contemporary challenges. Philosophically, this research contributes to the transformation of future education, where science education is more than just knowledge transfer but a process of character building and scientific thinking. We hope that this research will drive the development of excellent Indonesian

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human resources that are characterized by scientific attitudes and critical thinking abilities and capable of facing global challenges with intellectual rigor and adaptability.

RESEARCH METHODS

This study employs a quantitative approach with a descriptive survey method to measure the science process skills and scientific attitudes of 9th-grade students in the 2023/2024 academic year in Nunukan Regency. The sampling technique was conducted through accidental sampling by distributing research instruments in the form of a scientific attitude questionnaire and science process skills test questions on electrical circuits via Google Forms. Data collection was conducted online, allowing students from various schools to participate according to their ability and willingness. The distribution process involved contacting schools and seeking teacher assistance to encourage students to fill out the online form. The instrument distribution reached 21 schools, with participation details: 332 students completed the scientific attitude questionnaire, and 243 students worked on the science process skills questions. Data analysis was performed using descriptive statistics and inferential statistics to describe the characteristics and levels of science process skills, scientific attitudes of students in Nunukan Regency, and the correlation between scientific process skills and scientific attitudes. The list of junior high schools and the distribution of students participating in this assessment can be observed in Table 1.

Table 1. List of Schools and Distribution of Respondents

No.	School Name	Total of respondent's Science Process Skills	Total of respondent's Scientific Attitudes
1	SMPN 1 Nunukan	23	27
2	SMPN 2 Nunukan	12	17
3	SMPN 3 Nunukan	12	15
4	SMPN 1 Nunukan Selatan	8	10
5	SMPN 2 Nunukan Selatan	9	10
6	SMPN 3 Nunukan Selatan	6	9
7	SMPN 4 Nunukan Selatan	11	16
8	SMP IT Ibnu Sina Nunukan	10	13
9	SMP Frateran Santo Gabriel	9	16
10	SMPN 1 Sebatik	15	18
11	SMPN 1 Sebatik Utara	9	15
12	MTs Alkhairat	11	17
13	SMPN 2 Sebatik Barat	9	12
14	SMPN 1 Krayan	8	14
15	SMPN 1 Tulin Onsoi	16	19
16	SMPN 2 Tulin Onsoi	11	23
17	SMP Integral Hidayatullah	9	13

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18	SMPN 1 Sebuku	15	22
19	SMPN 2 Sebuku	17	19
20	SMPN 1 Sei Menggaris	13	17
21	MTS As'adiayah	10	10
	Total Respondents	N = 243	N = 332

Data collection was conducted for approximately one month, from July 11 to August 5, 2024. The collected data was analyzed using descriptive statistical techniques to examine the high and low levels of science process skills among 9th-grade junior high school students in Nunukan Regency. In this study, multiple-choice questions focusing on electrical circuit material were used. Information regarding the science process skills indicators used in this research can be seen in Table 2.

Table 2. Science Process Skills Indicators

No.	Science Process Skills Indicators	Question number	Total of Question
1	Observing	2, 12, 17	3
2	Classifying	5, 22, 27	3
3	Predicting	1, 16, 18	3
4	Planning experiments	3, 14, 19	3
5	Proposing a hypotheses	4, 7, 20	3
6	Interpreting data	6, 24, 25	3
7	Applying concepts	8, 9, 23	3
8	Measuring	10, 13, 21	3
9	Communicating	11, 15, 26	3
	Total		27

The science process skills instrument in Table 2 underwent empirical testing, was validated by four experts using Aiken's V equation, and was analyzed using the QUEST program to assess its compatibility with the Rasch model. The Aiken's V value for all items was 1, indicating a high level of validity. The INF MNSQ values for all test items ranged from 0.88 to 1.12, with an estimated reliability value of 0.83. This indicates that all questions align with the Rasch model and meet good criteria. INF MNSQ values within the range of 0.77 to 1.30 fit the Rasch model, and the Rasch model reliability criterion of 0.81 to 0.90 is considered good (Susdelina et al., 2018). The science process skills instrument demonstrates high validity and reliability, aligns well with the Rasch model, and meets good criteria. Thus, the instrument is suitable for measuring students' science process skills.

The instrument used to assess scientific attitude capabilities employs a questionnaire with a four-category Likert scale: 4 points for strongly agree, 3 points for agree, 2 points for disagree, and 1 point for strongly disagree, with a total of 40 statements. The indicators of scientific attitude are shown in Table 3.

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Table 3. Scientific Attitude Indicators

No.	Scientific Attitude Indicators	Statement Number		Number of Statements
		Positive	Negative	
1	Curiosity	1, 4, 6	2, 3, 5, 7	7
2	Being critical	8, 10, 12	9, 11	5
3	Respect for data/facts	13, 16, 20, 21	14, 15, 17, 18, 19	9
4	Open-minded	22, 24, 26	23, 25, 27, 28	7
5	Collaboration	29, 30, 32,34	31, 33, 35	7
6	honesty	36, 38, 39	37, 40	5
	Total			40

The scientific attitude instrument in Table 3 has been empirically tested, validated using Aiken's V, and analyzed using the QUEST program. It was found that Aiken's V value for all items was 1, and the INF MNSQ values ranged from 0.88 to 1.26, with a reliability value of 0.77, which falls into the medium category. This indicates that the scientific attitude instrument conforms to the Rasch model, making it suitable for measuring students' scientific attitudes. The criteria for each indicator of science process skills and scientific attitude measured can be seen in Table 4.

Table 4. Range of Values for Science Process Skills and Scientific Attitude

No.	Range of Values	Criteria
1	$81 \leq X$	Very high
2	$61 \leq X < 81$	High
3	$41 \leq X < 61$	Medium
4	$21 \leq X < 41$	Low
5	$X < 21$	Very low

modified from (Febryana et al., 2020; Bahri et al., 2022; Santiawati et al., 2022).

Based on the data collected through science process skills test instruments and scientific attitude questionnaires, 223 students completed both. The research method employed inferential statistics using SPSS 25 software to conduct a correlation test to determine the strength and direction of the relationship between science process skills and scientific attitudes. The research hypotheses proposed were **H_0**: There is no significant relationship between science process skills and scientific attitudes, while **Ha**: There is a significant relationship between science process skills and scientific attitudes. Testing was performed with a significance level of $\alpha = 0.05$, where if the Sig. value is < 0.05, then **H_0** is rejected, and **Ha** is accepted, and vice versa.

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RESULTS AND DISCUSSION

A. RESULTS

After going through the data analysis stage, the science process skills of 243 middle school students with different academic backgrounds, representing students in the Nunukan Regency area, were obtained, as shown in Figure 1.

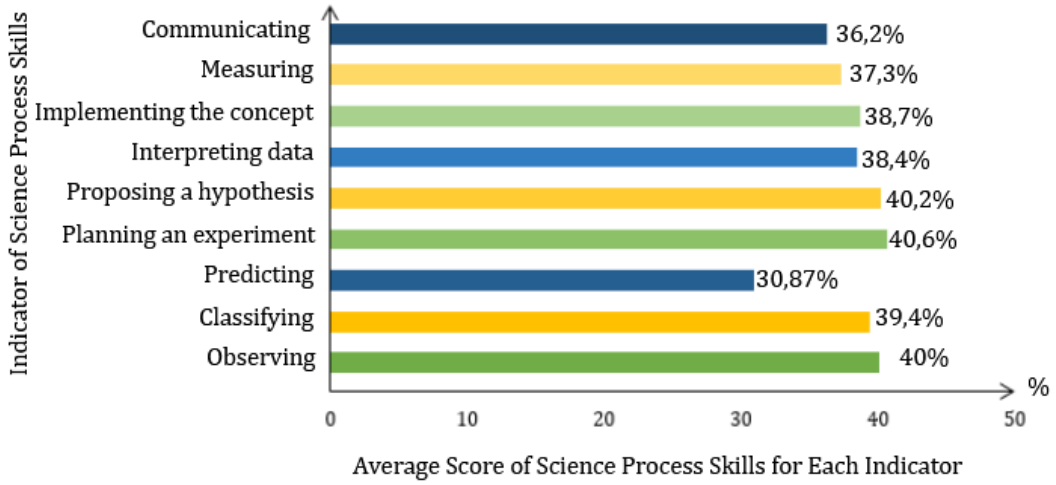

Figure 1. Scores for Each Indicator of Science Process Skills

Based on Figure 1, it was found that the science process skills for each indicator are as follows: observing 40%, classifying at 39.4%, predicting at 30.87%, planning experiments 40.6%, formulating hypotheses at 40.2%, interpreting data 38.4%, implementing concepts 38.7%, measuring 37.3%, and communicating 36.2%. To see the average values and categories for each indicator, refer to Table 5.

Table 5. Results of Each Indicator of Science Process Skills

No.	Science Process Skills Indicators	Average Score of Each Indicator (%)	Category
1	Observing	40	Low
2	Classifying	39,4	Low
3	Predicting	30,87	Low
4	Planning experiments	40,6	Low
5	Proposing a hypotheses	40,2	Low
6	Interpreting data	38,4	Low
7	Applying concepts	38,7	Low
8	Measuring	37,3	Low
9	Communicating	36,2	Low
Average Score of Science Process Skills		38	Low

Based on Table 5, it can be concluded that all indicators of science process skills fall into the low category. The average score for students' science process skills is 38, which is considered low. If respondents

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are grouped according to the criteria from Table 4 regarding science process skills, the results are shown in Figure 2.

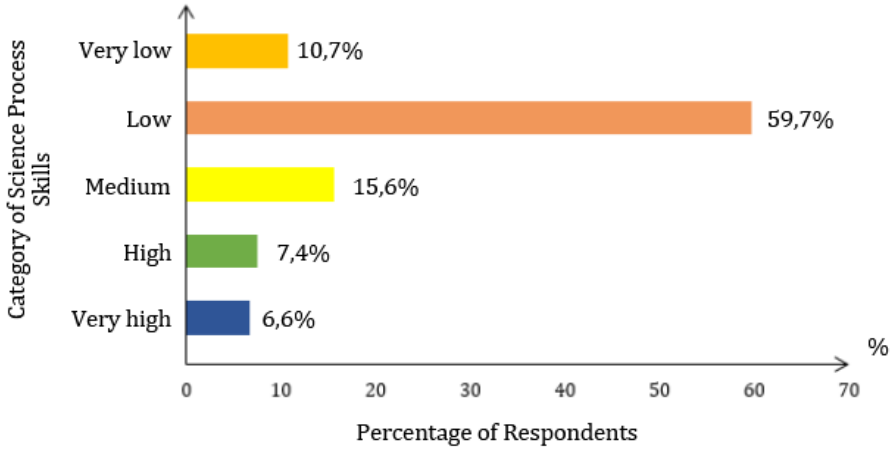

Figure 2. Percentage of Respondents by Category

Based on Figure 2, the category of students' science process skills shows that 6.67% of students, or 16 students, fall into the very high category, 7.4% of students, or 18 students, fall into the high category, 15.6% of students, or 38 students, fall into the medium category, 59.7% of students, or 145 students, fall into the low category, and 10.7% of students, or 26 students, fall into the very low category.

The scientific attitude scores for each indicator among 9th-grade students in Nunukan Regency can be seen in the following Figure 3.

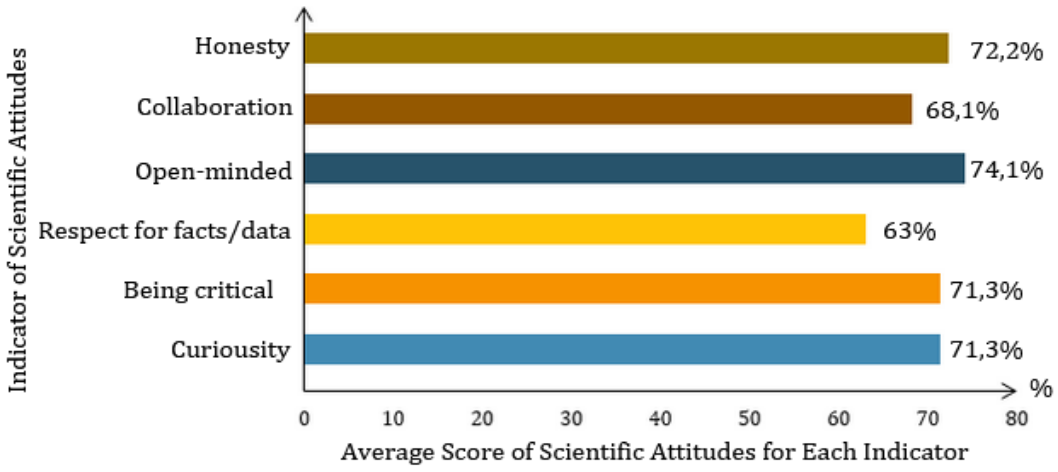

Figure 3. Average Scientific Attitude Scores

Figure 3 shows scientific attitudes' values: curiosity at 71.3%, critical thinking at 71.3%, respect for data/facts at 63%, open-mindedness at 74.1%, cooperation at 68.1%, and honesty at 72.2%. This

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indicates that the scientific attitudes of 9th-grade students in Nunukan Regency fall into the high category. To see the category of each scientific attitude indicator, refer to Table 6.

Table 6. Results of Each Scientific Attitude Indicator

No.	Scientific Attitudes Indicators	Average Score of Each Indicator (%)	Category
1	Curiosity	71,3	High
2	Being critical	71,3	High
3	Respect for data/facts	63	High
4	Open-minded	74,1	High
5	Collaboration	68,1	High
6	honesty	72,2	High
Average Score of Scientific Attitudes		70	High

Table 6 shows that the respondents generally have a high level of scientific attitudes, with an overall average score of 70%. The indicators that received the highest scores are "Curiosity" and "Being critical", both with a score of 71.3%. Meanwhile, the indicator with the lowest score is "Respect for data/facts", with a score of 63%. Additionally, other indicators such as "Open-minded", "Collaboration", and "honesty" are also categorized as high, with scores of 74.1%, 68.1%, and 72.2% respectively. This suggests that the respondents have a strong sense of curiosity, critical thinking ability, and an appreciation for openness, collaboration, and honesty in scientific activities. To see the percentage of students in each category, refer to Figure 4.

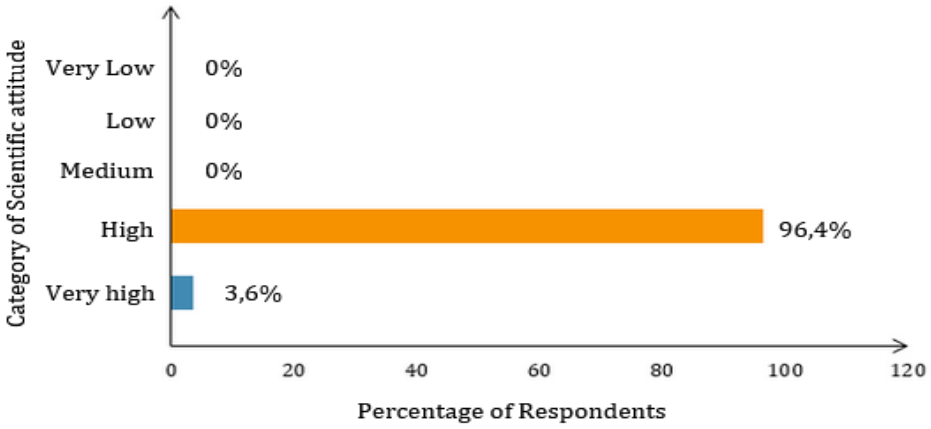

Figure 4. Percentage of Respondents in Each Category

Figure 4 shows that 3.6% of the students, or 12 students, have a very high level of scientific attitude, while 96.4% of the students, or 320 students, have a high level of scientific attitude, and 0% fall into the medium, low, or very low categories.

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This research, in addition to determining the average science process skills (SPS) and scientific attitude (SA) of students, also analyzed the relationship between the two. The initial respondents were 243 students for science process skills and 332 students for scientific attitude. Still, 223 students were ultimately analyzed to see the correlation between the two variables as they had filled out the SPS and SA data links. Normality tests were then conducted, with the results shown in Figure 1.

Table 7. Result of The Kolmogorov-Smirnof Normality Test

Variables	Statistic	df	Sig.	Normality Assumption
Science Process Skills	0.177	223	0.000	Not Normal
Scientific Attitudes	0.146	223	0.000	Not Normal

Based on the results of the Kolmogorov-Smirnov normality test, it can be concluded that the data for science process skills (SPS) and scientific attitude (SA) are not normally distributed. The significance value for both variables is Sig. 0.000 < 0.05, indicating that the data do not meet the assumption of normality. Subsequently, a linearity test was conducted, with the results shown in Table 8.

Table 8. Result of Linearity Test

Value	Sum of Squares	Mean Square	Sig.	Conclusion
Deviation from Linearity	657.305	28.578	0.218	Linear

Based on Table 8, it indicates that the result of the linearity test shows a Sig. deviation from the linearity value of 0.218 > 0.05. It can be concluded that there is a linear relationship between scientific process skills and scientific attitudes. If the data is not normally distributed but meets the linearity assumption, the next step for correlation testing is to use a non-parametric correlation method, such as Spearman's correlation. The results of the Spearman correlation can be seen in Table 9.

Table 9. Result of Spearman Correlation Test

Variables	N	Correlation Coefficient	Sig. (2-tailed)	Strength of Correlation	Significance
Science Process Skills	223	0.222	0.001	Weak	Significant
Scientific Attitude	223	0.222	0.001	Weak	Significant

Table 9 shows that the significance value (2-tailed) is 0.001, which is less than 0.05. This indicates a significant relationship between science process skills and scientific attitudes. Furthermore, the correlation coefficient is 0.222, meaning the strength of the relationship between science process skills and scientific attitudes is weak. Additionally, the positive value of the correlation coefficient indicates a unidirectional relationship, meaning that as science process skills improve, scientific attitudes also improve.

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B. DISCUSSION

Based on research results related to students' science process skills, it was found that the average process skills of 9th-grade students in Nunukan Regency is 38%, categorized as low, and about 59.7% or 145 students fall into the low category. Based on observations and interviews with science teachers, it was found that most schools in Nunukan Regency do not yet have laboratories, resulting in rare practical activities. Additionally, there is an uneven distribution of science teachers with a Bachelor's degree in Physics and Biology Education. Teachers tend to focus more on textual learning and memorizing material. The use of practical-based learning models has not been maximized, and science learning is still teacher-centered. Students only take notes on the material written by the teacher and complete given exercises, resulting in the learning process only assessing cognitive abilities.

Based on the presentation of the issues related to the low science process skills in science learning faced by 9th-grade students in Nunukan Regency shows a correlation with previous research. Several earlier studies indicate that the low science process skills are caused by the lack of learning facilities and infrastructure in science education (Robiatul et al., 2020), mistakes in the selection of learning models (Santiawati et al., 2022), low scientific background, lack of laboratory facilities (Jack, 2013), learning that emphasizes only the mastery of concepts (Sukarno et al., 2013), learning that has not maximized student engagement (Rahmasiwi et al., 2015).

Teachers' use of teaching models has led to low science process skills in Indonesia (Gumilar & Wardani, 2020). Two factors contribute to the low level of science process skills: the low background in science and the lack of laboratory availability (Artun et al., 2020). The similarity in science process skills between male and female students is because they have access to the same facilities at their school, meaning both male and female students receive equal resources.(Darmaji et al., 2023).

Essentially, process skills-based learning in science is highly relevant to practical-based learning. This type of learning utilizes laboratory equipment as a medium and incorporates various learning models. Effective learning aimed at enhancing process skills in science focuses on models that encourage active student participation and the application of scientific concepts in real-world contexts. One particularly effective method is inquiry-based learning, which helps students understand scientific concepts more deeply, enhances critical thinking skills, and enables them to apply knowledge in real-life situations (Gizaw & Sota, 2023). Using guided inquiry learning models can improve science process skills (Wardani & Djukri, 2019). The POE model also effectively enhances science process skills (Kurniawan & Djukri, 2022). This is also supported by other studies showing that practical methods and performance assessments can effectively enhance science process skills (Rahmasiwi et al., 2015; Nurfitriani et al., 2018).

JURNAL EDUSCIENCE (JES)
p-ISSN : 2303 - 355X | e-ISSN : 2685 - 2217
PUBLISHED BY : LPPM of UNIVERSITAS LABUHANBATU

The improvement of science process skills among students is an important aspect of effective science learning. One instructional model that has proven effective in enhancing science process skills is the use of inquiry-based learning models (Angelia et al., 2022; Mardianti et al., 2020). Through the inquiry model, students are encouraged to actively explore problems, ask questions, and seek solutions, which trains their critical and analytical thinking skills. The guided inquiry learning model is also influential and effective in improving science process skills (Hediana & Nurita, 2022; Sulistiyono, 2020; Nuayi, 2020). Guided inquiry offers more directed guidance from the teacher, allowing students to develop scientific process skills with appropriate support without losing independence. The discovery learning model also effectively enhances students' scientific process skills (Yuliati & Susianna, 2023; Betan et al., 2022).

Additionally, incorporating teaching aids and digital technology in science education can enhance students' comprehension of concepts and science process skills, particularly through the effective use of PhET simulations that foster these skills (Fatimah & Suryandari, 2022), the inquiry-based PhET can improve science process skills (Subeki et al., 2022; Ulfa et al., 2022). The cooperative learning approach, where students work in groups to complete science tasks, has significantly improved science process skills (Avisya et al., 2019; Nurdin, 2021). Additionally, the connection between theory and practice through organized and goal-oriented laboratory activities is crucial for improving students' scientific process skills (Jannah & Refelita, 2023; Sari et al., 2019).

In contrast to the students' scientific attitude scores, the average score for scientific attitudes among students is 70%, categorized as high, with approximately 96.4% of students, or 320 students, falling into the high category and 3.6%, or 12 students, categorized as very high. Although educational facilities in Nunukan Regency are limited, students exhibit a good scientific attitude. If teaching emphasizes memorization of scientific concepts without many practical activities, students can better understand concepts and have a positive scientific attitude. The scientific attitude also develops through formal education or social environments that still emphasize local cultural values.

Scientific attitudes in science learning can be developed through efforts to preserve and maintain the environment, natural resources, and local community culture (Rahmatih et al., 2020). Learning based on local wisdom integrated science not only enhances the cognitive pillar but also improves character pillars through scientific attitudes (Lestari, 2019; Annisha, 2024). Science learning based on local wisdom can nurture and instill local wisdom values and student character, enabling students to become character-driven and competent learners (Foa et al., 2024). Values contained in local wisdom often align with the formation of strong character, including scientific attitude aspects such as honesty, hard work, and responsibility (Wahyuni & Hasanah, 2016). Local wisdom frequently encompasses social and emotional

practices that can help develop students' social and emotional skills, such as empathy and cooperation, which are aspects of scientific attitudes (Rahmatih et al., 2020). Therefore, the importance of integrating local wisdom values into learning is crucial for developing cognitive, emotional, social, aesthetic, and character pillars in the form of scientific attitudes.

In addition, the high scientific attitude among students in Nunukan Regency may be attributed to the education system's continued emphasis on the importance of scientific attitudes, such as curiosity, cooperation, and open-mindedness, as well as the local community's encouragement for individuals to adopt a scientific attitude. The presence of discussion forums and seminars in science can also motivate students to apply scientific attitudes. Additionally, students have a strong interest in science, which makes them appreciate the scientific method. Previous research has shown that a strong scientific attitude is the outcome of learning experiences (Saputra et al., 2023), the use of electronic-based books (Afifah et al., 2022), resources such as lesson plans and worksheets (Manalu et al., 2022), scientific paper writing (Mutiani et al., 2020).

Based on the correlation analysis results, the null hypothesis (H_0) was rejected, and the alternative hypothesis (Ha) was accepted. This indicates a significant relationship between scientific process skills (SPS) and scientific attitudes (SI) at a 99% confidence level. The obtained correlation coefficient is 0.222, which suggests that the relationship between these two variables is weak and positively correlated. This means that as a person's scientific process skills increase, their scientific attitude increases, or conversely. These findings highlight the importance of developing and improving students' scientific process skills to support the formation of positive scientific attitudes.

CONCLUSION

The results of this study indicate that: (1) the results show varying levels of science process skills: observing (40%), classifying (39.4%), predicting (30.87%), planning experiments (40.6%), formulating hypotheses (40.2%), interpreting data (38.4%), implementing concepts (38.7%), measuring (37.3%), and communicating (36.2%). The average score for science process skills was 38%, falling into the low category. (2). In contrast, scientific attitude scores were higher: curiosity (71.3%), critical thinking (71.3%), respecting data/facts (63%), open-mindedness (74.1%), cooperation (68.1%), and honesty (72.2%), with an average score of 70%, falling into the high category. (3) The results of the correlation analysis significance value (2-tailed) is 0.001, which is less than 0.05, indicating that the null hypothesis (H_0) is rejected, and the alternative hypothesis (Ha) is accepted. The correlation coefficient is 0.222, meaning the

strength of the relationship between science process skills and scientific attitudes is weak. Additionally, the positive.

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