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Analysis of students' generic science skills at Muhammadiyah 22 Surakarta Elementary School.

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ABSTRACT
Science learning in elementary schools is expected to provide students with an understanding of scientific terms through experiments that can provide generic science skills. But this is still rarely done at the elementary school level. This study aims to analyze the science generic skills of elementary school students as an effort by the teacher to create learning that is able to make students understand and remember scientific terms. This study is qualitative approach. Sources of data in this study were obtained from class teachers and fifth grade students at Elementary School Muhammadiyah 22 Surakarta. Data collection techniques using observation, interviews and documentation. Test the validity of the data using the credibility test and source triangulation. Data analysis techniques consist of data collection, data presentation, drawing conclusions, and verification. The results showed that students' generic science skills in science learning obtained a percentage of 75%. The highest score is in the aspect of symbolic language (25%) shown by the activities of students mentioning symbols, symbols and scientific terms in presentations related to the water cycle process. The lowest score 0% absence of student activities. The research contribution is teachers must teach science through experimental activities of measuring rainfall, or similar experiments that are adapted to the topic of the material so that aspects of generic science skills can be developed in a more balanced way in each aspect so as to be able to provide more comprehensive science skills and knowledge in learners.

ABSTRAK
Pembelajaran IPA di sekolah dasar diharapkan dapat memberi pemahaman peserta didik tentang istilah ilmiah melalui percobaan yang dapat membekali keterampilan generik sains. Namun hal ini masih jarang dilakukan di jenjang sekolah dasar. Penelitian ini bertujuan untuk menganalis keterampilan generik

Kata Kunci:
Keterampilan generik sains;
Pembelajaran IPA;
Sekolah dasar.

Sains siswa dalam pembelajaran IPA SD. Penelitian ini menggunakan pendekatan kualitatif. Sumber data yang terlibat adalah guru kelas dan peserta didik kelas V SD Muhammadiyah 22 Surakarta. Teknik pengumpulan data menggunakan observasi, wawancara dan dokumentasi. Uji keabsahan data menggunakan uji kreadibilitas dan triangulasi sumber. Teknik analisis data terdiri dari pengumpulan data, penyajian data, penarikan kesimpulan, dan verifikasi. Hasil penelitian menunjukkan bahwa keterampilan generik sains siswa dalam pembelajaran IPA memperoleh persentase sebesar 75 %. Nilai paling tinggi terdapat pada aspek bahasa simbolik (25%) ditunjukkan kegiatan peserta didik menyebutkan simbol, lambang dan istilah ilmiah dalam presentasi terkait proses siklus air. Nilai paling rendah terdapat pada aspek pengamatan tidak langsung dan aspek kesadaran akan skala besaran sebesar 0% yang ditunjukkan dengan tidak adanya kegiatan peserta didik. Kontribusi penelitian ini adalah guru harus membelajarkan IPA melalui kegiatan percobaan pengukuran curah hujan, atau percobaan sejenis yang disesuaikan dengan topik materi sehingga aspek-aspek keterampilan generik sains dapat dikembangkan lebih seimbang setiap aspeknya agar dapat membekali keterampilan dan pengetahuan IPA yang lebih komprehensif pada peserta didik.

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INTRODUCTION

Education entering the 21st-century era is faced with severe challenges. It is expected to produce human resources who are capable and ready to face global challenges in life. Education in the 21st century requires every learner to have learning skills as well as the ability to innovate [1] stated that 21st-century education follows a pattern of open scientific development and necessitates efforts to creatively and innovatively develop high-quality human resources. It is a modern form of learning that goes beyond mere memorization of information and

[1] Hasibuan, Ahmad Tarmizi, and Andi Prastowo. "Konsep Pendidikan Abad 21: Kepemimpinan Dan Pengembangan Sumber Daya Manusia Sd/Mi." *MAGISTRA: Media Pengembangan Ilmu Pendidikan Dasar Dan Keislaman* 10, no. 1 (2019): 26–50. https://doi.org/10.31942/mgs.v10i1.2714.

knowledge. Learners are also expected to comprehend the information and knowledge they acquire[2].

In accordance with the vision of 21st-century education, which is grounded in logical and rational thinking, science encompasses three fundamental aspects: product, process, and attitude [3]. Scientific facts, principles, laws, and theories constitute the product of science, while the process of gaining profound understanding through natural knowledge represents science as a process[4]. Science, as an attitude, forms the foundation for the scientific process, encompassing behaviors and actions such as curiosity, a critical mindset, openness, and more [5].

In the present era, some products stem from scientific advancements, which undoubtedly rely on the contributions of highly skilled human resources. The significance of science in our lives is such that it demands greater emphasis on mastering scientific concepts. Consequently, the government has incorporated science education into the elementary school curriculum, intending to introduce science in[6] being able to develop students in critical thinking, develop scientific attitudes and support the progress of the nation through technology. Implementing science with basic concepts at the elementary school level to equip learners for the next level of schooling.

Science learning is a discipline that possesses inherent characteristics aimed at exploring and comprehending the natural world in a structured manner, ultimately leading to discoveries [7]. Students' problems in learning science often arise and it is found that students have difficulties in processing or receiving information related to scientific terms. Strengthened by the results of interviews conducted with 5th-grade teachers from Muhammadiyah 22 Surakarta Elementary School, who likewise expressed similar sentiments. According to the teacher, over the course of 19 years of teaching, the challenges faced by students have remained consistent. Specifically, students encounter difficulties in

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[2] Mulyono and Ilham Ampo, "Pemanfaatan Media Dan Sumber Belajar Abad 21 Dalam Dunia Pendidikan Di Indonesia," *Jurnal Paedagogia* 9, no. 2 (2020): 93–112, https://doi.org/10.24239/pdg.Vol9.Iss2.72.

[3, 4] Sayekti, Ika Candra, Ika Fajar Rini, and Fawzia Hardiyansyah. "Analisis Hakikat IPA Pada Buku Siswa Kelas IV Sub Tema 1 Tema 3 Kurikulum 2013." *Jurnal Profesi Pendidikan Dasar* 6, no. 2 (2019): 129–44. http://dx.doi.org/10.23917/ppd.v1i2.9256

[5] Sayekti, Ika Candra, and Arum Mawar Kinasih. "Kemampuan Guru Menerapkan Keterampilan Proses Sains Dalam Pembelajaran Ipa Pada Siswa Sekolah Dasar." *Jurnal Profesi Pendidikan Dasar* 4, no. 1 (2017): 97–105.

[6] Desstya, Anatri, Istiani Indah Novitasari, Aldi Farhan Razak, and Kukuh Sandy Sudrajat. "Refeleksi Pendidikan IPA Sekolah Dasar Di Indonesia (Relevasi Model Peneltian Paulo Freire Dengan Pendidikan IPA Di Sekolah Dasar)." *Jurnal Profesi Pendidikan DasarDasar* 4, no. 1 (2017): 1–11.

[7] Rahmawaty, "Keterampilan Proses Sains Pada Praktikum IPA Materi Asama Basa Pada Mahasiswa PGMI," *Jurnal Paedagogia* 8, no. 2 (2019): 95–112, https://doi.org/10.24239/pdg.Vol8.Iss2.44.

comprehending and retaining scientific terminology. Consequently, this poses a challenge when they come across other scientific terms that sound similar, leading to confusion in understanding and memorization. Ultimately, this has a direct impact on students' academic performance.

The teacher further highlighted that scientific terms related to the water cycle process, such as evaporation, condensation, infiltration, and others, are particularly challenging for students to comprehend and retain. This observation underscores the importance of enhancing students' science generic skills through various learning activities.

Science generic skills are a set of scientific skills that can be applied to learn diverse concepts, acquire factual knowledge, and solve scientific problems[8]. Science generic skills are the ability of the combination of science knowledge and skills [9]. Science generic skills are key skills, core skills, and basic skills that must be mastered so that students are able to think at a higher level in learning [10].

According to Brotosiswoyo, science generic skills encompass nine aspects, namely [11] direct observation, indirect observation, symbolic language, scale awareness, logical framework, logical inference, mathematical modeling, cause and effect laws, and concept building. It is worth noting that employing specific models or methods in science education may occasionally prove ineffective in teaching scientific content.

Science generic skills have been studied by many previous researchers. First, according to [12] the science generic skills of third-grade students are still insufficient. This has been supported by research findings, which indicate that only the aspects of direct observation and indirect observation are apparent among the nine aspects. This demonstrates that the application of science generic skills remains extremely limited. Second, [13] the research shows that the teacher's

[8] Wijaya, I Komang Wisnu Budi, and Ni Wayan Sri Darmayanti. "Mengembangkan Keterampilan Generik Sains Pada Siswa Sekolah Dasar Untuk Menyongsong Era Revolusi Industri 4.0." *Prosiding Seminar Nasional Dharma Acarya* 1, no. 1 (2019): 81–88.

[9] Sarita, Rahma, and Yenni Kurniawati. "Pengembangan Lembar Kerja Peserta Didik (LKPD) Kimia Berbasis Keterampilan Generik Sains." Journal of The Indonesian Society of Integrated Chemistry 12, no. 1 (2020): 31–39. https://doi.org/10.22437/jisic.v12i1.7846.

[10] Izetbigovic, Muhammad Alija, Solfarina, and Indah Langitasari. "Penerapan Model Discovery Learning Untuk Meningkatkan Ketrampilan Generik Sains Siswa." *EduChemia (Jurnal Kimia Dan Pendidikan)* 4 (2019): 164–74. http://dx.doi.org/10.30870/educhemia.v4i2.6118.g4562.

[11] Ngazizah, Nur, Dea Rizky Saputri, Fatma Prahastiwi, Dorojatun Maulannisa, and Dhiana Safitri. "Pengembangan Perangkat Pembelajaran KEterampilan Generik Sains Terintegrasi Karakter Tema 6 Kelas III Sekolah Dasar." Jurnal Cakrawala Pendas 7, no. 1 (2021): 81–89.

[12] Prahstiwi, Fatma Ayu, Nur Ngazizah, and Muflikhul Khaq. "Pengembangan Lembar Kerja Siswa (LKS) Berbasis Keterampilan Generik Sains Terintegrasi Karakter Pada Tema 6 Energi Dan Perubahannya Di Kelas III Sekolah Dasar." Jurnal Pendidikan Dasar 2, no. 2 (2021): 79–87.

[13] Wijaya and Darmayanti, "Mengembangkan Keterampilan Generik Sains Pada Siswa Sekolah Dasar Untuk Menyongsong Era Revolusi Industri 4.0."

strategy in developing nine aspects of science generic skills has been seen such as inviting students to conduct observations, introducing students to symbols in the laboratory, and so on.

Third, [14] science generic skills in Biology lessons still require retraining by implementing the ADDIE learning model and utilizing animated media to enhance the comprehension of science concepts. Fourth,[15] the research findings demonstrate that science generic skills can be nurtured by implementing interactive multimedia products as both a learning resource and medium for students in the third grade of elementary school.

Fifth [16] the research findings regarding science generic skills revealed that the aspect of abstraction obtained the highest average value of 81.5, while the aspect of indirect observation obtained the lowest score of 32.83. The average scores for the other aspects were as follows: sense of scale 48.43, symbolic language 74.87, logic 72.55, concept building 78.67, and logical inference 66.66.

Sixth,[17] the creative problem-solving learning model exhibited a significant increase in science generic skills percentage in the experimental class compared to the control class. The experimental class achieved an average increase of 21.80, with the observation aspect showing the highest average percentage. Seventh, [18] the research findings indicate that through observation sheets and test questions in the magnitude and measurement practicum, students' science generic skills showed the following percentages for each aspect: 71.75% for direct observation, 59.6% for magnitude scale awareness, 66% for symbolic language, 65.3% for logical inference, and 65.6% for mathematical modeling.

Eighth,[19] the research demonstrated that the implementation of guided inquiry learning had a significant positive effect on improving students' science

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[14] Hasian, Hanna Paramiertha, Risya Pramana Situmorang, Marisa Christina Tapilouw, Program Studi, Pendidikan Biologi, Fakultas Biologi, Universitas Kristen, and Satya Wacana. "Pengembangan Media Animasi Sistem Gerak Berbasis Model POE Untuk Meningkatkan Pemahaman Konsep Dan Keterampilan Generik Sains." JIPVA (Jurnal Pendidikan IPA Veteran) 4 (2020): 116–31. https://doi.org/10.31331/jipva.v4i2.1148

[15] Maulannisa, Dorojatun, Nur Ngazizah, and Titi Anjarini. "Pengembangan Multimedia Interaktif Berbasis Keterampilan Generik Sains Terintegrasi Karakter Pada Tema 6 Energi Dan Perubahannya Kelas III Sekolah Dasar." Jurnal Pendidikan Dan Konseling 3, no. 1 (2022): 1–9.

[16] Rosidah, Tin, Andari Puji Astuti, and Andri Wulandari. "Eksplorasi Ketrampilan Generik Sains Siswa Pada Mata Pelajaran Kimia Di SMA Negeri 9 Semarang." Jurnal Pendidikan Sains 5, no. 2 (2017): 130–37. https://doi.org/10.26714/jps.5.2.2017.130-137.

[17] Mayasari, Putri, A. Halim, and dan Suhrawardi Ilyas. "Model Pembelajaran Creative Problem Solving Untuk Meningkatkan Penguasaan Konsep Dan Keterampilan Generik Sains Siswa SMP." Jurnal Unsyiah 1, no. 1 (2013): 57–67.

[18] Sri Agustina and Muhammad Muslim, "Praktikum Besaran Dan Pengukuran Kelas X Di SMA Muhammadiyah 1 Palembang," *Jurnal Inovasi Dan Pembelajaran Fisika* 3, no. 1 (2016): 1–7, https://doi.org/10.36706/jipf.v3i1.3435.

[19] Yuniarita, Fitha. "Penerapan Pembelajaran Inkuiri Terbimbing Untuk Meningkatkan Keterampilan Generik Sains Siswa SMP." Jurnal Pengajaran MIPA 19, no. 1 (2014): 111–16. https://doi.org/10.18269/jpmipa.v19i1.36163.

generic skills. The aspect of direct observation, particularly when observing the habituation of light, obtained the highest average score. Ninth, [20] the research findings revealed that the application of interactive multimedia had a significant impact on increasing students' science generic skills. The aspect of modeling exhibited the highest increase, while the aspect of causal law demonstrated the lowest increase. Tenth,[21] the science generic skills of students showed improvement with the assistance of the applied MASTER learning model, as evidenced by the comparison between pre-treatment and post-treatment test results.

Based on the findings derived from several reviewed journals, it can be concluded that the application of science generic skills in elementary school science learning is generally satisfactory, although its implementation is still suboptimal. The reviewed journals indicate several key points: (1) the application of science generic skills at the elementary school level remains minimal, (2) there is a lack of teacher understanding regarding science generic skills, (3) while the application of science generic skills has been initiated, it tends to be simplistic in nature, and (4) the observation aspect of science generic skills tends to dominate, with less emphasis on other aspects. Considering these conclusions, further research is necessary to analyze the application of science generic skills in science learning, particularly at the elementary school level.

Methods

This research utilizes a qualitative approach, which is expected to yield in-depth findings through the examination of speech, writing, and behavior. The purpose of this research is to analyze students' science generic skills at an elementary school, as part of the teacher's efforts to create effective learning experiences that enhance students' understanding and retention of scientific terms. The research was conducted 25 students fifth grade at Muhammadiyah 22 elementary School in Surakarta.

The primary data for this study consists of observations and interviews conducted to assess students' science generic skills. Additionally, secondary data was obtained from the documentation of fifth-grade science learning materials, including lesson plans, LKPD (Student Activity Worksheets), teaching materials, media, and assessments. The researchers collected data during the science learning sessions in the classroom.

Data collection techniques were conducted through observation, interviews, and documentation. The observation technique aimed to monitor students' activities pertaining to science generic skills during science lessons in

[20] Agustin, Rika Rafikah. "Pengembangan Keterampilan Generik Sains Melalui Penggunaan Multimedia Interaktif." Jurnal Pengajaran MIPA 18, no. 2 (2013): 253–57. https://doi.org/10.18269/jpmipa.v18i2.36144.

[21] Makrifatul Khasanah, Sri Jumini, and Nugroho Prasetya Adi, "Analisis Keterampilan Generik Sains Dan Pemahaman Konsep Siswa Pada Pembelajaran MASTER," *JET:Journal of Education and Teaching* 4, no. 2 (2023): 261–75.

fifth grade, specifically focusing on the topic of the water cycle. Researchers employed a structured observation sheet comprising 16 points to facilitate the observations. A structured interview sheet was prepared and administered to the fifth-grade teacher, who also taught science, in order to corroborate and reinforce the findings from classroom observations. Documentation involved collecting, examining, and analyzing relevant documents pertaining to science learning. A documentation sheet was prepared to assess the alignment between the learning materials for the water cycle process, created by the class teacher, and the actual implementation of science learning in the classroom.

The data validity test employs credibility testing and source triangulation. The credibility test is conducted to enhance accuracy and consistency while examining the collected data from various sources. At this stage, researchers double-check the correctness of both primary and secondary data collected. The purpose is to ensure data accuracy. Detailed scrutiny is also applied, focusing on data points that are challenging to comprehend. In this study, technical triangulation is employed. Researchers employ triangulation techniques by comparing data findings from observations, interview results, and documentation data.

The data analysis technique is conducted through several stages: data collection, data presentation, drawing conclusions, and verification. Data collection involves gathering primary data through observations and interviews, as well as secondary data in the form of documentation. The data collection stage entails a series of processes that simplify, classify, and discard irrelevant data that does not pertain to the topic of generic science skills. This stage yields meaningful information focused on science generic skills, facilitating researchers in drawing conclusions.

The data presentation stage is conducted by the researcher once the primary and secondary data have been systematically organized and made easily comprehensible. During this stage, the researcher presents the data on the calculation of science generic skills indicators and the overall scores of all aspects of science generic skills. Additionally, the researcher presents the findings from the interviews conducted. The stage of drawing conclusions and verification is the final step undertaken by the researcher to derive meaning from the collected data. In this stage, the researcher examines the results of data analysis, including both the observations and interview findings, and compares the two sets of results. The researcher also explores any differences found in previous studies that are relevant to the topic of generic science skills. These comparisons and analyses enable the researcher to draw conclusions based on the conducted research.

The steps that were taken to analyze the process of science generic skills are as follows: a) Preparing instrument sheet; b) Providing a check for each indicator of science generic skills appearing in the learning; c) Summing up the

indicators that appear; d) Calculating the percentage of each indicator of science generic skills with the formula:

$$\mathbf{NR} = \frac{\boldsymbol{N}}{\boldsymbol{S}} \mathbf{\ x\ 100\ \%}$$

Explanation:

NR = Percentage of generic science skills aspects
N = Score of each indicator checked for each aspect
S = Total score of generic science skills indicators

Then Calculating the overall percentage of generic science skills using the following formula:

$$\mathbf{NP} = \frac{\boldsymbol{R}}{\boldsymbol{M}} \mathbf{\ x\ 100\ \%}$$

Explanation:

NP = Percentage of generic science skills score
R = Total score of checked indicators
M = Total score of indicators

RESULT AND DISCUSSION

The data analysis process began with the first step of preparing the instrument sheet. In the second step, each indicator of science generic skills that appeared during the learning process was checked, accompanied by recording the number of indicators observed. The next data analysis was to calculate the percentage for each indicator of science generic skills. The results showing the percentage of science generic skills of fifth-grade students of Muhammadiyah 22 Surakarta Elementary School in various aspects were presented in Table 1.

Table 1. Percentage of science generic skills aspects

No	Criteria	Percentage
1	Aspects of Direct Observation	*18,75%*
2	Aspects of Indirect Observation	*0%*
3	Aspects of Scale Awareness	*0%*
4	Aspects of Symbolic Language	*25%*
5	Legal Aspects of Causation	*12,5%*
6	Aspects of Logical Inference	*18,75%*
	Total	**75%**

The calculation results presented in Table 1 indicate that the highest value is observed in the symbolic language aspect, while the lowest values are found in the indirect observation aspect and the awareness of the scale of magnitude aspect. Despite having two aspects related to observation in science generic skills, the calculated percentages reveal different figures. Contrary to previous relevant studies, which showed that direct observation aspect was dominant in learning, this study yields different results. Instead of the dominant direct observation aspect, it is the symbolic language aspect that tends to prevail in learning. As a result, the subsequent step involves calculating the overall percentage of science generic skills. The calculation results reveal that the science generic skills in

science learning for fifth-grade students at Muhammadiyah 22 Surakarta Elementary School, based on the observations and interviews, amount to 75%.

From the results of observations further strengthened by the results of interviews and documentation obtained that the science generic skills in each aspect are described as follows:

The aspect of direct observation has been evident throughout the learning process. Students have demonstrated the utilization of multiple senses, gathering factual information from experiments, and identifying differences or natural phenomena. The first indicator, which involves the use of as many senses as possible, is supported by the observation results indicating the use of sight and hearing senses. It is apparent that students employ their sense of sight to observe the cloud experiment and the water cycle diorama, while the sense of hearing is utilized to listen to video explanations of the water cycle process.

Learner activities also include documenting the factual results of the cloud experiment, following the instructions provided in the distributed LKPD (Student Activity Worksheets) from the class teacher. In carrying out activities related to this indicator, learners are provided with experimental tools and materials and are instructed to conduct the experiment according to the steps outlined in the LKPD. Learners are also prompted with questions such as 'what happened in the jar?' and 'why did it happen?' as a stimulus to write down the factual results of the experiment. By incorporating these guiding questions, teachers encourage students to document the factual outcomes of the cloud experiment. Furthermore, the indicator of seeking differences or natural phenomena is demonstrated through learners' ability to discern each stage in the water cycle process during the activity of creating water cycle dioramas.

This is in line with research findings[22] that demonstrate the effectiveness of animated video media in enhancing students' understanding of scientific concepts. It is consistent with[23] that have shown a significant improvement in science learning outcomes, specifically regarding the water cycle material, through the implementation of audio-visual-based learning in the classroom. Consequently, students are better equipped to comprehend the abstract nature of the water cycle process through animated videos. Another study conducted[24]

[22] Lailia Arditya Isti and Arik Aguk Wardoyo, "Edustream: Jurnal Pendidikan Dasar Pengembangan Media Video Animasi Materi Sifat-Sifat Cahaya Untuk Siswa Kelas IV Sekolah Dasar," *Edustream: Jurnal Pendidikan Dasar* 4, no. 1 (2020): 21–28, https://doi.org/10.26740/eds.v4n1.p21-28.

[23] Mahfudin, Isah Cahyani, and Sandra Sukmaning Adji, "Penerapan Model Pembelajaran Berbasis Masalah Berbantuan Audio Visual Dan Motivasi Belajar Terhadap IPA Di Sekolah Dasar," *Didaktika Tauhidi:Jurnal Pendidikan Guru Sekolah Dasar* 8, no. 1 (2021): 68–85, 10.30997/dt.v8i1.4009.

[24] Retno Utaminingsih, Ayu Rahayu, and Dhimas Nur Setyawan, "Pengenalan Eksperimen Sederhana Untuk Anak Usia SD Di Dusun Tajem Baru Maguwoharjo Depok Sleman," *Prosiding Seminar Nasional Hasil Penelitian Dan Pengabdian Kepada Masyarakat* 1, no. 1 (2022): 296–304.

during the observed learning phase involved a simple experiment on cloud formation, which successfully generated water droplets that formed clouds. This experiment fulfilled the indicator of collecting experimental facts in the aspect of direct observation. It indicates that the utilization of the senses of sight and hearing is maximized and effectively applied in the learning process. Furthermore, other indicators, particularly those related to direct observation, have also been optimally employed.

The indirect observation aspect obtained the lowest score, as none of the indicators were observed during the learning process. This is evident in learning activities where students solely watch animated videos of the water cycle and the teacher explains the material using a lecture-based method. In line with[25] that in the control class where the lecture method was employed, there were no measuring activities conducted to observe experimental phenomena or natural occurrences. This is further supported by the interview results, which indicated that the teacher did not plan learning activities that involve the use of measuring instruments or sensory aids, as evidenced by the documentation of the previously prepared lesson plan materials. During the observed learning sessions, no measuring activities were observed, nor were there any efforts from the teacher to collect factual information about physics experiments or the water cycle phenomenon. Furthermore, there were no instructions provided by the teacher to explore differences and similarities related to the water cycle material. In contrast, students were assigned to create a water cycle diorama using printed pictures provided by the teacher, as shown in Figure 1. Utilizing the available tools and materials, students constructed a water cycle diorama through direct observation, as depicted in Figure 2.

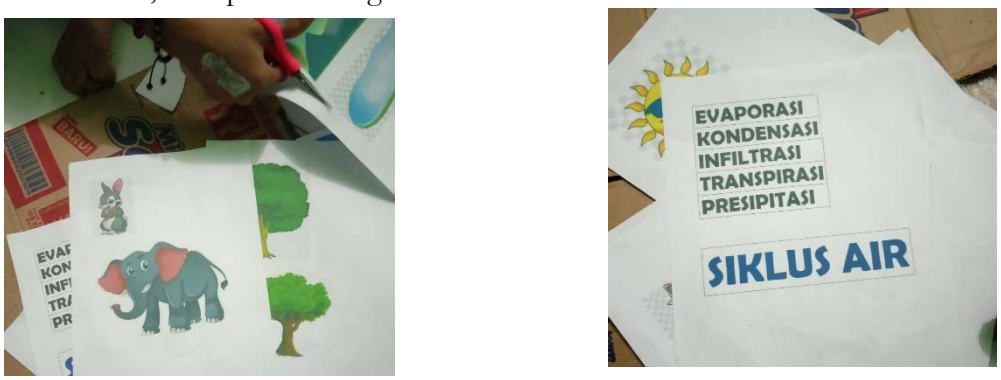

Figure 1. Materials for making Water Cycle Diorama

[25] Nida Adillah, "Perbedaan Hasil Belajar IPA Melalui Penerapan Metode Mind Map Dengan Metode Ceramah," *Indonesian Journal of Primary Education* 1, no. 1 (2017): 99–103, https://doi.org/10.17509/ijpe.v1i1.7521.

Figure 2. Process of Making Water Cycle Diorama

Figure 3. Diorama of Water Cycle Process

The water cycle diorama that has been created (Figure 3) is intended to enhance students' understanding of the sequential stages of the water cycle. In line with[26] the statement that students have reported feeling assisted in observing and comprehending the water cycle material more effectively through the medium of the water cycle diorama. By observing the diorama, students are not required to engage in measurement activities. This indicates that the learning of the water cycle process has not been conducted through the indirect observation aspect. On the other hand, teachers have the opportunity to incorporate activities that involve collecting factual information related to evaporation, condensation, and the precipitation process. Hence, teachers can diligently prepare instructional methods and media that align with the characteristics of the material.

The aspect of awareness of scale, which includes indicators of recognizing natural objects and displaying high sensitivity to magnitude or size, does not manifest in the learning process. This is evident from the absence of activities where students are prompted to recognize natural objects while introducing the concept of scale, such as distance and the number of objects, particularly in

[26] I Kadek Dwi Putra and Ni Wayan Suniasih, "Materi Diorama Materi Siklus Air Pada Muatan IPA Kelas V Sekolah Dasar," *Jurnal Ilmiah Pendidikan Dan Pembelajaran* 5, no. 2 (2021): 238–46, https://doi.org/10.23887/jipp.v5i2.32878.

relation to natural objects involved in the water cycle process, such as cloud formations. The interview findings further support this observation, revealing that teachers primarily focus on providing a basic introduction to the water cycle process, without delving into the intricacies of each stage in detail.

This contradicts previous research[27] which explains that learning about rainfall at a scale size of 1 (one) millimeter holds significance. Specifically, it represents one square meter of water on a flat surface, with a height of one millimeter or one liter of water. Therefore, teachers, particularly during precipitation lessons, should include material about rainfall. Additionally, another study contradicts this[28] by explaining that during the evaporation process, water requires temperatures between 70-80ºC. This demonstrates that the water cycle process can introduce an awareness of volume and numerical scale, which was not addressed in the observed learning. Hence, teachers need to further develop specific materials to enhance students' comprehensive skills and understanding.

The aspect of symbolic language is evident in science learning, emphasizing the introduction of symbols, terms, and mathematical rules. Learners demonstrate this aspect by recognizing visual symbols associated with the water cycle, such as the representation of water dots indicating precipitation. They also mention the precipitation stage as the process of rainwater falling, symbolized by clouds with water dots beneath them. During presentation activities, learners successfully identify the term 'condensation' as one of the stages in the water cycle process, where water vapor changes form and becomes ice particles at low temperatures, resulting in the formation of cloud clusters. The indicator of using mathematical rules is evidenced by students using the reference to the theory of the hydrological cycle in the phenomenon of natural phenomena of the water cycle process. The indicator of reading graphs/diagrams is evidenced by learners seeing the water cycle graph displayed by the teacher through the video media of the water cycle process. The indicator of reading graphs is evidenced by the activities of students being asked to observe and see the graph of the water cycle. Consistent with research findings [29] that there is a significant increase in students' science learning outcomes after the action of applying the use of visual media. In this case the visual media is the water cycle graph. This shows that the use of

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[27] Ezza Qodriatullah Ajr and Fitri Dwirani, "Menentukan Stasiun Hujan Dan Curah Hujan Dengan Metode Polygonthiessen Daerah Kabupaten Lebak," *Jurnal Lingkungan Dan Sumber Daya Alam* 2, no. 2 (2019): 139–46.

[28] M.Hasan Habli, Pande I. Siregar, and Alif Rio Ginting, "Analisis Tekanan Pompa Ejector Dan Proses Evaporasi Dan Kondensasi Pada Fresh Water Generator Guna Memaksimalkan Produksi Air Tawar Di Kapal MV. Andhika Paramesti," *Jurnal Maritime Education on Transportation, Engineering and Navigation Online Research (Meteor)* 14, no. 1 (2021): 78–96, https://doi.org/10.36101/msm.v14i1.183.

[29] Ni Komang Tri Julia Agustin, I Gede Margunayasa, and Ni Nyoman Kusmariyatni, "Pengaruh Model Pembelajaran TPS Berbantuan Media Visual Terhadap Hasil Belajar IPA," *Journal for Lesson and Learning Studies* 2, no. 2 (2019): 239–49, https://doi.org/10.23887/jlls.v2i2.19148.

symbolic language aspects in learning has an impact on students' understanding of the material.

Legal Aspects of Causation is evident in the learning process, characterized by learners establishing connections between two or more variables and estimating the causes of natural phenomena in the water cycle. Students make associations between the variable of exposure to the sun's heat and the variable of water changing into steam. They also establish relationships between variables associated with colder temperature conditions and the formation of water droplets. Furthermore, learners are able to explain that during the condensation stage, water droplets fall as rain due to the process of changing form, fulfilling the second indicator of estimating the causes of natural phenomena. This understanding is further supported by the accurate documentation of the water cycle diorama results, aligning with the referenced theory. Consistent with[30] the assertion that condensation causes the formation of water droplets and subsequent rainfall, as depicted in the water cycle diorama, this demonstrates that students have effectively applied the legal aspects of causation by comprehending the relationship between variables and the causes underlying the water cycle phenomenon.

The aspects of logical inference have appeared in science learning. Understanding the rules of argumentation, explaining problems based on rules, drawing conclusions based on rules has appeared simply. This is indicated by students applying and understanding argumentation rules by following the proper sequence of raising their hands first, then seeking permission to present their arguments, and submitting their contributions when invited to do so. Indicators of explaining problems based on rules and making inferences are observed when students explain the material based on relevant theories. Consistent with the components of argumentation (Cetin, 2014)[31] which state that argumentation consists of data, claims, justification, support, and refutation, the rules of argumentation have been consistently emphasized by the teacher during each class session to reinforce students' comprehension. This illustrates that learners have, at the very least, applied the data component by presenting the water cycle process, justified the material with the guidance of the class teacher, and found support in reference materials from the assigned book.

CONCLUSION

Based on the analysis and data from the conducted research, several conclusions can be drawn. Firstly, the average percentage value of students' science generic skills in the science learning class V at Muhammadiyah 22

[30] Alda Sabna, "Pengaruh Media Komsa Terhadap Pemahaman Peserta Didik Dalam Materi Siklus Air" (Universitas Muhammadiyah Jakarta, 2022).

[31] Nurul Faiqoh et al., "Profil Keterampilan Argumentasi Siswa Kelas X Dan XI MIPA Di SMA Batik 1 Surakarta Pada Materi Keanekaragaman Hayati," *Jurnal Pendidikan Biologi* 7, no. 3 (2018): 174–82, https://doi.org/10.24114/jpb.v7i3.10122.

Surakarta Elementary School was found to be 75%. The highest percentage value was observed in the symbolic language aspect, with a score of 25%. Conversely, the lowest percentages were recorded in the aspects of indirect observation and the aspects of awareness of the scale of magnitude, both with a percentage of 0%. The aspects of direct observation and aspects of logical inference obtained a percentage of 18.75%, while the legal aspects of causation obtained a percentage of 12.5%. In terms of direct observation, students utilized their visual senses. Regarding symbolic language aspects, learners mentioned symbols, terms, and symbols related to the water cycle process. In the aspect of causal law, students successfully established relationships between two variables representing the cause and effect of natural phenomena. As for logical inference, students demonstrated their understanding and application of simple argumentation rules. The research highlights the importance of teachers incorporating rainfall measurement experiments or similar tailored experiments in science education to ensure a more balanced development of science generic skills in each aspect to equip more comprehensive science skills and knowledge in students.

REFERENCES

Adillah, Nida. "Perbedaan Hasil Belajar IPA Melalui Penerapan Metode Mind Map Dengan Metode Ceramah." *Indonesian Journal of Primary Education* 1, no. 1 (2017): 99–103. https://doi.org/10.17509/ijpe.v1i1.7521.

Agustin, Rika Rafikah. "Pengembangan Keterampilan Generik Sains Melalui Penggunaan Multimedia Interaktif." *Jurnal Pengajaran MIPA* 18, no. 2 (2013): 253–57. https://doi.org/10.18269/jpmipa.v18i2.36144.

Agustina, Sri, and Muhammad Muslim. "Praktikum Besaran Dan Pengukuran Kelas X Di SMA Muhammadiyah 1 Palembang." *Jurnal Inovasi Dan Pembelajaran Fisika* 3, no. 1 (2016): 1–7. https://doi.org/10.36706/jipf.v3i1.3435.

Ajr, Ezza Qodriatullah, and Fitri Dwirani. "Menentukan Stasiun Hujan Dan Curah Hujan Dengan Metode Polygonthiessen Daerah Kabupaten Lebak." *Jurnal Lingkungan Dan Sumber Daya Alam* 2, no. 2 (2019): 139–46.

Arditya Isti, Lailia, and Arik Aguk Wardoyo. "Edustream: Jurnal Pendidikan Dasar Pengembangan Media Video Animasi Materi Sifat-Sifat Cahaya Untuk Siswa Kelas IV Sekolah Dasar." *Edustream: Jurnal Pendidikan Dasar* 4, no. 1 (2020): 21–28. https://doi.org/10.26740/eds.v4n1.p21-28.

Desstya, Anatri, Istiani Indah Novitasari, Aldi Farhan Razak, and Kukuh Sandy Sudrajat. "Refeleksi Pendidikan IPA Sekolah Dasar Di Indonesia (Relevasi Model Peneltian Paulo Freire Dengan Pendidikan IPA Di Sekolah Dasar)." *Jurnal Profesi Pendidikan DasarDasar* 4, no. 1 (2017): 1–11.

Faiqoh, Nurul, Nadhirotul Khasanah, Lia Puji Astuti, Riski Prayitno, and Baskoro Adi Prayitno. "Profil Keterampilan Argumentasi Siswa Kelas X Dan XI MIPA Di SMA Batik 1 Surakarta Pada Materi Keanekaragaman Hayati." *Jurnal Pendidikan Biologi* 7,

no. 3 (2018): 174–82. https://doi.org/10.24114/jpb.v7i3.10122.

Habli, M.Hasan, Pande I. Siregar, and Alif Rio Ginting. "Analisis Tekanan Pompa Ejector Dan Proses Evaporasi Dan Kondensasi Pada Fresh Water Generator Guna Memaksimalkan Produksi Air Tawar Di Kapal MV. Andhika Paramesti." *Jurnal Maritime Education on Transportation, Engineering and Navigation Online Research (Meteor)* 14, no. 1 (2021): 78–96. https://doi.org/10.36101/msm.v14i1.183.

Hasian, Hanna Paramiertha, Risya Pramana Situmorang, Marisa Christina Tapilouw, Program Studi, Pendidikan Biologi, Fakultas Biologi, Universitas Kristen, and Satya Wacana. "Pengembangan Media Animasi Sistem Gerak Berbasis Model POE Untuk Meningkatkan Pemahaman Konsep Dan Keterampilan Generik Sains." *JIPVA (Jurnal Pendidikan IPA Veteran)* 4 (2020): 116–31. https://doi.org/10.31331/jipva.v4i2.1148.

Hasibuan, Ahmad Tarmizi, and Andi Prastowo. "Konsep Pendidikan Abad 21: Kepemimpinan Dan Pengembangan Sumber Daya Manusia Sd/Mi." *MAGISTRA: Media Pengembangan Ilmu Pendidikan Dasar Dan Keislaman* 10, no. 1 (2019): 26–50. https://doi.org/10.31942/mgs.v10i1.2714.

Izetbigovic, Muhammad Alija, Solfarina, and Indah Langitasari. "Penerapan Model Discovery Learning Untuk Meningkatkan Ketrampilan Generik Sains Siswa." *EduChemia (Jurnal Kimia Dan Pendidikan)* 4 (2019): 164–74. http://dx.doi.org/10.30870/educhemia.v4i2.6118.g4562.

Khasanah, Makrifatul, Sri Jumini, and Nugroho Prasetya Adi. "Analisis Keterampilan Generik Sains Dan Pemahaman Konsep Siswa Pada Pembelajaran MASTER." *JET:Journal of Education and Teaching* 4, no. 2 (2023): 261–75.

Mahfudin, Isah Cahyani, and Sandra Sukmaning Adji. "Penerapan Model Pembelajaran Berbasis Masalah Berbantuan Audio Visual Dan Motivasi Belajar Terhadap IPA Di Sekolah Dasar." *Didaktika Tauhidi:Jurnal Pendidikan Guru Sekolah Dasar* 8, no. 1 (2021): 68–85. 10.30997/dt.v8i1.4009.

Maulannisa, Dorojatun, Nur Ngazizah, and Titi Anjarini. "Pengembangan Multimedia Interaktif Berbasis Keterampilan Generik Sains Terintegrasi Karakter Pada Tema 6 Energi Dan Perubahannya Kelas III Sekolah Dasar." *Jurnal Pendidikan Dan Konseling* 3, no. 1 (2022): 1–9.

Mayasari, Putri, A. Halim, and dan Suhrawardi Ilyas. "Model Pembelajaran Creative Problem Solving Untuk Meningkatkan Penguasaan Konsep Dan Keterampilan Generik Sains Siswa SMP." *Jurnal Unsyiah* 1, no. 1 (2013): 57–67.

Mulyono, and Ilham Ampo. "Pemanfaatan Media Dan Sumber Belajar Abad 21 Dalam Dunia Pendidikan Di Indonesia." *Jurnal Paedagogia* 9, no. 2 (2020): 93–112. https://doi.org/10.24239/pdg.Vol9.Iss2.72.

Ngazizah, Nur, Dea Rizky Saputri, Fatma Prahastiwi, Dorojatun Maulannisa, and Dhiana Safitri. "Pengembangan Perangkat Pembelajaran KEterampilan Generik Sains Terintegrasi Karakter Tema 6 Kelas III Sekolah Dasar." *Jurnal Cakrawala Pendas* 7, no. 1 (2021): 81–89. http://dx.doi.org/10.31949/jcp.v6i1.2591.

Ni Komang Tri Julia Agustin, I Gede Margunayasa, and Ni Nyoman Kusmariyatni.

"Pengaruh Model Pembelajaran TPS Berbantuan Media Visual Terhadap Hasil Belajar IPA." *Journal for Lesson and Learning Studies* 2, no. 2 (2019): 239–49. https://doi.org/10.23887/jlls.v2i2.19148.

Prahstiwi, Fatma Ayu, Nur Ngazizah, and Muflikhul Khaq. "Pengembangan Lembar Kerja Siswa (LKS) Berbasis Keterampilan Generik Sains Terintegrasi Karakter Pada Tema 6 Energi Dan Perubahannya Di Kelas III Sekolah Dasar." *Jurnal Pendidikan Dasar* 2, no. 2 (2021): 79–87.

Putra, I Kadek Dwi, and Ni Wayan Suniasih. "Materi Diorama Materi Siklus Air Pada Muatan IPA Kelas V Sekolah Dasar." *Jurnal Ilmiah Pendidikan Dan Pembelajaran* 5, no. 2 (2021): 238–46. https://doi.org/10.23887/jipp.v5i2.32878.

Rahmawaty. "Keterampilan Proses Sains Pada Praktikum IPA Materi Asama Basa Pada Mahasiswa PGMI." *Jurnal Paedagogia* 8, no. 2 (2019): 95–112. https://doi.org/10.24239/pdg.Vol8.Iss2.44.

Rosidah, Tin, Andari Puji Astuti, and Andri Wulandari. "Eksplorasi Ketrampilan Generik Sains Siswa Pada Mata Pelajaran Kimia Di SMA Negeri 9 Semarang." *Jurnal Pendidikan Sains* 5, no. 2 (2017): 130–37. https://doi.org/10.26714/jps.5.2.2017.130-137.

Sabna, Alda. "Pengaruh Media Komsa Terhadap Pemahaman Peserta Didik Dalam Materi Siklus Air." Universitas Muhammadiyah Jakarta, 2022.

Sarita, Rahma, and Yenni Kurniawati. "Pengembangan Lembar Kerja Peserta Didik (LKPD) Kimia Berbasis Keterampilan Generik Sains." *Journal of The Indonesian Society of Integrated Chemistry* 12, no. 1 (2020): 31–39. https://doi.org/10.22437/jisic.v12i1.7846.

Sayekti, Ika Candra, and Arum Mawar Kinasih. "Kemampuan Guru Menerapkan Keterampilan Proses Sains Dalam Pembelajaran Ipa Pada Siswa Sekolah Dasar." *Jurnal Profesi Pendidikan Dasar* 4, no. 1 (2017): 97–105.

Sayekti, Ika Candra, Ika Fajar Rini, and Fawzia Hardiyansyah. "Analisis Hakikat IPA Pada Buku Siswa Kelas IV Sub Tema 1 Tema 3 Kurikulum 2013." *Jurnal Profesi Pendidikan Dasar* 6, no. 2 (2019): 129–44. http://dx.doi.org/10.23917/ppd.v1i2.9256.

Utaminingsih, Retno, Ayu Rahayu, and Dhimas Nur Setyawan. "Pengenalan Eksperimen Sederhana Untuk Anak Usia SD Di Dusun Tajem Baru Maguwoharjo Depok Sleman." *Prosiding Seminar Nasional Hasil Penelitian Dan Pengabdian Kepada Masyarakat* 1, no. 1 (2022): 296–304.

Wijaya, I Komang Wisnu Budi, and Ni Wayan Sri Darmayanti. "Mengembangkan Keterampilan Generik Sains Pada Siswa Sekolah Dasar Untuk Menyongsong Era Revolusi Industri 4.0." *Prosiding Seminar Nasional Dharma Acarya* 1, no. 1 (2019): 81–88.

Yuniarita, Fitha. "Penerapan Pembelajaran Inkuiri Terbimbing Untuk Meningkatkan Keterampilan Generik Sains Siswa SMP." *Jurnal Pengajaran MIPA* 19, no. 1 (2014): 111–16. https://doi.org/10.18269/jpmipa.v19i1.36163.

