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The Impact of Diorama-Based Instruction on Elementary Students' Understanding of the Hydrological Cycle in IPAS Learning

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Abstract

Objective: This study aims to determine the effectiveness of diorama learning media in improving students' learning outcomes in the hydrological cycle material in the subject of Natural and Social Sciences (IPAS) grade IV SDN Kalicari 02 Semarang. **Theoretical framework:** This research is based on Edgar Dale's theoretical framework, which states that the use of concrete media provides a richer learning experience and improves students' understanding of abstract concepts. In this context, diorama media is considered to be able to present a three-dimensional visualization of the water cycle process, thus making learning easier to understand and interesting for elementary school students. **Literature review:** A literature review shows that concrete media such as dioramas can increase learning effectiveness by stimulating multisensory learning activities and building a more meaningful understanding. In addition, the use of media that is by the characteristics of students can increase motivation, involvement, and absorption of the material. **Methods:** The research method used is quasi-experimental with a Group Pretest-Posttest Design. The research subjects consisted of 27 students of grade IV A. Data were collected through observation, interviews, and tests. Data analysis was carried out using normality tests and paired sample t-tests. **Results:** The results showed a significant increase in student learning outcomes, namely the average pretest score of 44.07 increased to 55.22 in the posttest, with a significance value of 0.000 (< 0.05). **Implications:** The implications of this study show that diorama media can be an effective learning solution for abstract materials, especially at the elementary education level. **Novelty:** this research lies in the application of diorama media as a concrete tool in science learning that combines science and social concepts, as well as empirically testing its effectiveness in the context of public elementary schools with limited resources.

Keywords: dioramic media, learning outcomes, hydrological cycles, social studies, concrete learning.

INTRODUCTION

In the realm of elementary education, fostering scientific understanding through meaningful and engaging learning experiences is a continuous challenge. One of the fundamental science topics in the primary curriculum is the water cycle, which involves abstract and dynamic concepts such as evaporation, condensation, precipitation, and

collection. These concepts are often difficult for elementary students to grasp due to the limitations of traditional teaching methods that rely heavily on verbal explanations and textbook illustrations. As a result, students frequently demonstrate low achievement and limited conceptual understanding [1].

At SDN Kalicari 02 Semarang, this issue is evident in the low average learning outcomes of fourth-grade students in the subject of Natural and Social Sciences (IPAS), particularly on the topic of the hydrological cycle. Based on initial observations and data collection, the learning process still heavily depends on teacher-centred methods and lacks the integration of interactive or concrete teaching media [2]. This creates a significant gap between the intended learning objectives and the actual learning outcomes. The gap in existing research lies in the lack of empirical studies that examine the impact of diorama-based media on improving IPAS learning outcomes at the elementary level, particularly in public schools with limited access to advanced educational resources [3].

To address this pedagogical gap, the current study explores the effectiveness of using diorama media, a three-dimensional educational model that visually simulates the water cycle process as a means of enhancing student understanding and learning outcomes. Dioramas offer a tangible, visual, and multisensory representation of abstract scientific processes, aligning with Edgar Dale's Cone of Experience, which suggests that learners retain more information when they engage with more concrete forms of experience [4].

Significance of the Research. This research is essential for several reasons. Firstly, it provides an alternative teaching strategy that aligns with the characteristics of elementary school students who tend to be more responsive to visual and tactile stimuli [5]. Secondly, it supports the movement toward more student-centered learning approaches as advocated by contemporary educational theories and policies that emphasize active, experiential, and contextual learning. Thirdly, this study contributes empirical evidence to the growing body of literature that supports the integration of instructional media into science education, especially in under-resourced classrooms [6].

Moreover, the study responds to the educational need to bridge the gap between theory and practice in science teaching. By incorporating diorama media, teachers can facilitate the transformation of abstract concepts into concrete experiences that are more easily understood and retained by students. This approach not only enhances learning outcomes but also fosters higher-order thinking skills, such as analysis and application, which are crucial for sustainable development in education (SDG 4: Quality Education) [7].

Research Implications. The implications of this research are multifaceted. For educators, the findings offer a practical and replicable model for implementing diorama media in science instruction. Teachers can utilize this media not only for the topic of the hydrological cycle but also for other complex topics in science and social studies. The positive learning outcomes observed in this study suggest that the adoption of such media could become a low-cost yet highly effective solution to improving student engagement and performance [8]. For policymakers and curriculum developers, the research underscores the importance of integrating concrete and visual learning resources into the national curriculum. The results advocate for increased support in training teachers to design, develop, and use interactive media, particularly in public elementary schools. In terms of academic contribution, the study provides empirical data that reinforces existing theoretical frameworks such as Dale's learning theory, while also opening avenues for further research on how different types of instructional media affect learning outcomes in various educational contexts [9].

Research Novelty. The novelty of this research lies in its specific focus on the use of diorama media for teaching the water cycle in the integrated subject of IPAS, which combines natural and social sciences [10]. While previous studies have explored the use of visual aids or media in science teaching, few have examined the direct impact of dioramas in a real classroom setting using a quasi-experimental approach with a pretest-posttest design. Additionally, this research is conducted in a public elementary school with relatively limited

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access to digital technologies, highlighting the adaptability and scalability of diorama media in low-resource environments [11].

Furthermore, the study provides detailed statistical analysis to support its conclusions, including normality tests and paired t-tests, adding methodological rigor to the educational research landscape. The findings not only validate the effectiveness of diorama-based instruction but also emphasize the importance of combining it with well-planned pedagogical strategies to maximize student learning [12]. In conclusion, this research contributes a unique and impactful perspective to the field of elementary science education by demonstrating that simple, concrete learning tools like dioramas can make a significant difference in student achievement. It invites educators, researchers, and policymakers to rethink how abstract scientific concepts can be made accessible, engaging, and meaningful for young learners [13].

And it is well known that basic education is an important stage in forming a student's knowledge foundation. However, social studies learning at SDN Kalicari 02 Semarang showed low learning outcomes due to the limited learning media used by teachers. Concrete media, such as dioramas, are needed so that students can understand abstract concepts such as the water cycle more easily. Based on this, this study was conducted to determine the effectiveness of the use of diorama media.

LITERATURE REVIEW

Learning at the elementary school level demands an approach that is appropriate to the characteristics of the child's cognitive development. Elementary school students tend to think concretely, so they need learning media that can present abstract concepts in real and easy-to-understand forms [14]. In the context of Natural and Social Sciences (IPAS) learning, materials such as hydrological cycles are included in abstract topics, as they describe natural processes that are not directly visible in everyday life. Therefore, concrete media is needed that can bridge students' understanding of the concept [15].

One of the relevant concrete media used in learning social studies is the diorama media. Dioramas are visual representations in the form of three dimensions that depict an event or process in a real and interesting way [16]. This medium can present processes in the water cycle, such as evaporation, condensation, precipitation, and water flow, visually structured manner. In the world of education, the use of dioramas has strategic value because it can activate students' visual and kinesthetic senses, strengthen memory, and increase interest in learning [17].

Various studies have shown that concrete learning media can increase learning effectiveness. One of the main principles in learning theory is that the more concrete a medium is, the greater the potential for students to understand and remember the material presented [18]. In this case, the diorama is not only a visual aid but also a vehicle for a direct learning experience for students. Through dioramas, students can visually witness how the processes in the hydrological cycle occur and are interrelated. This makes concepts that were originally abstract easier to digest and more relevant to real life [19].

In addition, diorama media also supports active learning, where students not only become passive recipients of information but are also directly involved in the learning process. By observing and discussing miniature processes in dioramas, students can develop critical thinking and analytical skills. This process is in line with a constructivist approach that emphasizes that knowledge is built through experience and active interaction with the learning environment [20].

Although diorama media has many advantages, its effectiveness is still influenced by several factors, such as teachers' skills in developing and utilizing the media, the time available, and the readiness of students to learn. Teachers must be able to organize diorama-based learning systematically and integrate it with learning objectives. Without careful

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planning, the use of dioramas will only be a visual decoration that does not have a significant impact on students' understanding [21].

Previous research on diorama media in the context of science learning has also shown a significant increase in student learning outcomes. This media is considered effective in helping students understand complex and invisible processes. In addition, the use of this media also has a positive impact on students' learning attitudes, such as increased motivation, curiosity, and active involvement in the learning process [22]. In the context of IPAS learning in elementary school, the selection of media must consider the characteristics of the students, the complexity of the material, and the learning objectives. The hydrological cycle, as one of the important materials to understand from an early age, is closely related to environmental and water resource issues. Therefore, a deep understanding of the water cycle will not only help students in academic achievement but also instill environmental awareness from an early age [23].

The literature review also underlines the importance of media diversity in the teaching and learning process. When concrete media such as dioramas are used in conjunction with a participatory learning approach, the results will be more optimal. In addition to enriching students' learning experience, this combination also increases the absorption of materials and accelerates the achievement of competencies [24]. Thus, this literature review confirms that diorama media is an effective alternative in learning science studies, especially in conveying abstract material such as hydrological cycles. This medium not only helps students understand concepts better, but also increases their interest and motivation in learning. Therefore, teachers need to continue to develop their ability to design and implement concrete media to create fun, meaningful, and effective learning [25].

METHODOLOGY

This study uses a quantitative approach with a quasi-experimental type of research, which is a form of experiment that does not fully meet the requirements of pure experimentation because it does not use a control group. The research design used is a Group Pretest-Posttest Design, which involves giving treatment to one group of subjects and measuring changes before and after treatment. This design allows researchers to observe differences in student learning outcomes after being treated in the form of the use of diorama media in learning [26].

The subjects in this study are students of grade IV A SDN Kalicari 02 Semarang for the current school year, which totals 27 students. This class was chosen because it is a class that is relevant to the material of the hydrological cycle in the subject of Natural and Social Sciences (IPAS) and has characteristics that are suitable for the application of concrete media. No random selection was carried out because all students in the class were used as research samples. The data collection technique is carried out through three methods, namely: 1) Observation, used to find out students' responses during the learning process and to observe the extent to which students are actively involved in learning activities using diorama media. 2) Interviews were conducted with classroom teachers and several students to get more in-depth information about the effectiveness of the use of diorama media and the obstacles faced during learning. 3). Tests, consisting of a pretest and posttest, are used to measure student learning outcomes before and after being treated. The test questions were developed based on learning indicators in the hydrological cycle material and have been validated by experts [27].

The data analysis technique used is the paired sample t-test with the help of statistical software. This test aims to find out if there is a significant difference between the results of the pretest and posttest. Before the t-test is carried out, the data is first tested for normality using the Shapiro-Wilk test [28]. If the data are normally distributed, then the paired t-test can be used to see the significance of the differences that occur after the treatment is given. Through this approach, it is hoped that an objective picture can be obtained regarding the

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effectiveness of diorama media in improving student learning outcomes on hydrological cycle materials at the elementary education level [29].

RESULTS AND DISCUSSION

The results of the pretest showed that the average score of students was below KKM, which was 44.07. After learning with dioramas, the average posttest increased to 55.22. However, only 15% of students who achieve KKM achieve KKM. This shows an improvement, although it is not optimal. This is in line with Dele that concrete media helps learning, but needs to be supported by sufficient methods and time.

Table 1. Pretest and Poster Results of SDN Kalicari 02 Semarang Students' Learning Outcomes

Source of Variation	Pretest	Posttest
Highest Score	74	87
Lowest Score	0	34
Average	37	60,5
Number of students completed	2	4
Incomplete	25	23

Normality Test

The normality test was performed using Shapiro-Wilk with the following results:

Table 2. Normality Test Results

Data	Sig. Shapiro-Wilk
Pretest	0,170
Posttest	0,100

The pretest data were declared normal (Sig. > 0.05), while the posttest did not fully meet the normal assumptions. However, the analysis can still be continued with consideration of the research design.

Paired t-test

The paired t-test shows the following results:

Table 3. Paired T-Test Results

Variable	Mean	N	Sig. (2-tailed)
Pretest	44,07	27	0,000
Posttest	55,22	27	

The significance value is 0.000 < 0.05, meaning that there is a significant difference between the results of the pretest and posttest, so it can be concluded that the use of diorama media is effective on student learning outcomes.

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This study aims to determine the effectiveness of diorama media on the learning outcomes of grade IV A SDN Kalicari 02 Semarang students.

Based on the results of data analysis, there was a significant increase in student learning outcomes after the application of diorama media. This is shown by the difference in the average pretest score of 44.07 to the average posttest of 55.22. The paired t-test showed a significance value of 0.000 (< 0.05), which means there was a significant difference between the results before and after treatment.

This research is by Edgar Dele's theory, which states that the more concrete the learning medium, the more learning experience students get. Therefore, the use of dioramas is expected to improve student learning outcomes by making the abstract concept of the water cycle more youthful and more interesting, by the principles put forward by Edgar Dele [30].

In line with Dale's theory, Irmade also stated that the use of appropriate learning media and the characteristics of students can increase the effectiveness of the learning process. Irmade emphasized the importance of choosing media that is not only visually appealing, but also supportive of the understanding of the material functionally [31]. Appropriate media will help students build knowledge in a more active and meaningful way. In the implementation of learning with diorama media, students can directly observe the processes that occur in the hydrological cycle, such as evaporation, condensation, and precipitation, through the miniatures displayed. This makes students more active and involved in the learning process. In addition, this approach also provides a multisensory learning experience that can improve memory and understanding of concepts [32].

Meanwhile, according to Rohani, R, learning media serve to clarify the presentation of messages so that they are not too verbalistic, overcome space and time limitations, and encourage students' motivation to learn. The media can also equalize students' perceptions of the material being taught [33]. Based on this view, the use of diorama media helps teachers communicate water cycle material more clearly. Dioramas overcome the limitations of visualization that may not be able to be displayed through lecture or textbook methods alone. In practice, the diorama media shows that most students experience an increased understanding of the material [34]. They look more enthusiastic and active in the learning process. This shows that learning experiences that involve direct observation of concrete objects have a positive influence on the understanding of concepts. However, obstacles are also still found, such as differences in students' ability to interpret the visualizations displayed and limited time to explain all parts of the media in depth [35].

Figure 1. Diorama Helps Students Visually Understand and Actively Engage with the Water Cycle

Discussion

The results of the study showed that the use of diorama media in learning science on hydrological cycle material had a positive impact on improving the learning outcomes of grade IV A SDN Kalicari 02 Semarang students. Based on the results of the pretest, the average student score was 44.07, which was below the Minimum Completeness Criteria

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(KKM). After being given treatment in the form of learning using diorama media, the average posttest increased to 55.22. Although the increase is not optimal, because only 15% of students have managed to achieve KKM, this still shows significant progress in students' understanding of the material [36].

The statistical test through a paired sample t-test yielded a significance value of 0.000 (< 0.05), which means that there is a significant difference between the pretest and posttest values. These findings support the hypothesis that diorama media is effective in improving student learning outcomes, although it needs to be improved in terms of overall completeness of achievement. From 27 students, the number of students who have completed has increased from 2 to 4 students, while those who have not completed have decreased from 25 to 23 students. This shows that the use of concrete media such as dioramas can accelerate students' understanding of abstract material, but it needs to be supported with additional strategies to make the results more optimal [37].

Theoretically, these results are in line with the view of Edgar Dale, who stated that concrete learning media provide a richer and more immersive learning experience. Dioramas, as a three-dimensional visual medium, can bridge abstract concepts into reality, so that students can observe, interpret, and understand processes such as evaporation, condensation, and precipitation directly. The multisensory experience offered by dioramas helps to increase students' attention and engagement during the learning process, as well as strengthen their memory of the material [38].

In practice, students appear more active and motivated when learning using dioramas. They show an interest in observing miniature water cycle processes and engage in discussions. This reinforces the theory that the selection of media that suits the characteristics of students can increase the effectiveness of the learning process. Interactive and contextual learning also encourages students to be more active in building their knowledge [39].

However, the effectiveness of this media has not been fully maximized. One of the obstacles found is that there are still differences in students' ability to interpret the visual information presented. Not all students have the same visual observation and interpretation skills, so more intensive guidance from teachers is needed in explaining the content of the media. In addition, time constraints in the learning process are also obstacles, especially in explaining all parts of the diorama media in detail and thoroughly [40].

Nevertheless, diorama media still provides solutions to the limitations of conventional methods, such as lectures or the use of textbooks. In the context of IPAS learning, which combines natural and social elements, the presence of concrete media helps to connect theoretical knowledge with real, observable experiences. This makes learning more meaningful and contextual for elementary school students [41].

Thus, the results of this study confirm that diorama media can be a strategic alternative in science learning, especially in abstract materials. Teachers are expected to make better use of this media by combining it with an active learning approach and structured guidance. The development of similar media also needs to be carried out on an ongoing basis to adjust to the level of ability of students and the complexity of the material taught.

CONCLUSION

Based on the results of research that has been carried out on the effectiveness of diorama media on the learning outcomes of Natural and Social Sciences (IPAS) on hydrological cycle materials in grade IV of SDN Kalicari 02 Semarang, it can be concluded that the use of diorama media has a positive and significant impact on improving student learning outcomes. This is evidenced by the difference in average score between pretest and posttest, which is from 44.07 to 55.22. Although the improvement has not reached maximum completeness, as only 15% of students have achieved the Minimum Completeness Criteria (KKM), this improvement shows that diorama media can help students understand abstract material.

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Statistical analysis using the paired sample t-test showed a significance value of 0.000 (< 0.05), which means that there was a significant difference between learning outcomes before and after the use of diorama media. Thus, it can be stated that the use of diorama learning media is effective in improving the understanding of the concept of the water cycle that was previously difficult to understand through conventional methods. The success of diorama media in learning IPAS is also supported by the multisensory approach presented, where students can directly see, observe, and discuss the processes in the hydrological cycle through concrete miniatures. This makes the learning process more fun, interactive, and meaningful for elementary school students who are still in the development stage of concrete thinking. However, the effectiveness of this media is inseparable from several obstacles, such as limited time in delivering material and the diverse abilities of students to interpret visualizations. Therefore, the use of diorama media must be balanced with good planning and appropriate mentoring strategies so that the results are more optimal. Based on these findings, it is recommended that elementary school teachers start using concrete media such as dioramas in the learning process, especially for materials that require visualization of abstract concepts. The use of this kind of media not only improves student learning outcomes but also helps create a more active, communicative classroom atmosphere and supports the achievement of overall learning goals.

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Author Contribution

All authors contributed equally to the study's conceptualization, methodology design, data collection, analysis, and manuscript writing. Their collaborative efforts ensured the successful completion and documentation of this research on diorama-based learning.

Conflicts of Interest

The authors declare no conflict of interest related to the research, authorship, or publication of this article. All processes were carried out ethically and independently without any external influence or bias.

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