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INFLUENCE MEDIA DIORAMA BASED ON WINDMILL: THE IMPACT OF WATER ON THE UNDERSTANDING OF THE CONCEPT OF ECOSYSTEM COMPONENTS IN SCIENCE LEARNING IN GRADE V ELEMENTARY SCHOOL

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Abstract
This quasi-experimental study evaluates the impact of water-wheel-based diorama media on the conceptual understanding of ecosystem topics among fifth-grade students at SDN 1 Panggungrejo and SDN 3 Mojosari. Using a pretest-posttest control group design, data were collected through multiple-choice instruments and analyzed using t-tests via JAMOVI 2.3.28. The results indicated no significant difference in students' initial understanding during the pretest ($p = 0.667$). However, the posttest analysis revealed a significant difference between the experimental and control groups ($p < 0.001$), confirming that the diorama media significantly enhances students' conceptual mastery. These findings suggest that integrating concrete and interactive instructional media is essential for visualizing abstract scientific concepts in primary education. This study encourages educators to develop innovative media to improve pedagogical quality and student learning outcomes.

***Keywords**: Waterwheel-Based Diorama; Ecosystem; Conceptual Understanding; Material Components*

Abstrak
Penelitian kuasi-eksperimen ini bertujuan mengevaluasi pengaruh penggunaan media diorama kincir air terhadap pemahaman konsep ekosistem siswa kelas V SDN 1 Panggungrejo dan SDN 3 Mojosari. Instrumen penelitian menggunakan tes pilihan ganda (pretest-posttest) pada kelas kontrol dan eksperimen. Analisis data menggunakan uji-t melalui perangkat lunak JAMOVI 2.3.28. Hasil penelitian menunjukkan tidak terdapat perbedaan signifikan pada tahap pretest ($p = 0,667$), namun terdapat perbedaan signifikan pada tahap posttest ($p < 0,001$). Temuan ini menyimpulkan bahwa penggunaan media diorama kincir air berpengaruh signifikan terhadap peningkatan pemahaman konsep sains siswa dibandingkan pembelajaran konvensional. Implikasinya, penggunaan media konkret dan interaktif diperlukan untuk membantu visualisasi konsep abstrak pada pendidikan dasar.

Kata kunci: Diorama Berbasis Kincir Air; Ekosistem; Pemahaman Konsep, Komponen Material

Introduction

Learning is a collaborative process between teachers and students aimed at acquiring knowledge, attitudes, and competencies; it is a process of change in both the individual and the individual's environment. Learning is a process that enables humans to acquire competencies in knowledge, attitudes, and skills. The learning process is crucial because it involves the exchange of information between teachers and students to enable successful learning in the learning environment (Pane & Dasopang, 2017; Wiratman et al., 2019). Meanwhile, Mujtahidin (2014) defines learning as a teacher-led activity that has a positive influence on student behavior.

Based on the description above, it can be concluded that learning is a process of teaching and learning activities involving teachers and students. Both engage in learning activities to achieve learning objectives. However, in this case, teachers and students have different responsibilities, not only determined by the fact that teachers are the ones who teach or transfer knowledge to students, while students are merely the recipients of knowledge from teachers. However, learning is an activity in which teachers and students work together to ensure the learning process runs smoothly (Santoso, 2020). Based on the previous paragraph, it is clear that teachers are not the sole facilitators of learning activities.

Students can also obtain information from books, the internet, magazines, newspapers, and so on. Therefore, the government developed and implemented a new curriculum, the Independent Curriculum (Kurmer), which incorporates science and technology learning into educational activities. Thus, with this curriculum, teachers can more easily assign problems to students, and students are expected to actively solve these problems using their own expertise. According to Aisyah (2017), thematic learning is a technique of multi-subject learning. This allows students to have a more meaningful learning experience.

To present learning materials, teachers must also utilize learning media. Class science. Activity learning is possible, but will be considered not effective enough without the existence of learning media, and students will not understand the lesson material completely, which can impact the achievement of learning objectives. According to Yahya (2019), learning media is a tool or gadget that can help students understand content lessons that are presented by the teacher. In contrast, learning media often refers to individuals, objects, or events that can create the conditions necessary for students to acquire information, attitudes, and skills (Arsyad, 2015:3).

Learning media has an important role in helping students understand science concepts effectively. More concrete. Many studies have previously developed media visuals like posters, video animations, or dioramas. However, the media's own limitations include a lack of interactivity, a lack of dynamic representation of natural processes, and the inability of students to observe changes or movements occurring within an ecosystem. This research gap demonstrates the need for more open, practical learning media capable of realistically depicting ecosystem processes.

Diorama open is Wrong One media learning three dimensions, which allows students to interact directly with the model and see the structure or process clearly. When this diorama is expanded with the addition of a water wheel mechanism, students can observe the relationship between component ecosystems and the dynamic flow of energy in a more concrete way. This has the potential to increase students' interest in learning, strengthen conceptual understanding, and support the principles of hands-on learning based on science.

Based on these problems, this research was conducted to develop an Open Diorama Media Based on Water Wheels on the material of ecosystem components for fifth-grade students of the School. Base. Study This aim For know process development media, media suitability according to experts and practitioners, and student responses towards the media that is developed. Thus, this research is expected to be able to provide alternative learning media that are innovative, interactive, and relevant to the needs of science learning in elementary schools.

Research Methods

The instrument used in this study is an objective assessment instrument (IPO). Shaped choice double. Instrument, it is said reliable if score observations have a a high correlation with actual scores. Reliability is defined as the correlation coefficient that measures the agreement between the scores of two parallel tests. Therefore, the understanding that can be derived from this statement is that a test is reliable if the measurement results closely reflect the actual condition of the test participants (Retnawari in the journal (Ayu & Putri, 2024)).

Instruments related to these variables were tested on 38 students. Reliability Use Test *Factor: Reliability Analysis* on application JAMOVI 2.3.2. Determination of the classification level of *the Cronbach's Alpha coefficient* presented in accordance with the *Cronbach's Alpha (Guilford, 1956)coefficient table* (Guilford, 1956 which includes:

Table 1. Classification of Cronbach's Alpha Coefficient

Coefficient *Cronbach's Alpha*	Classification *Cronbach's Alpha* Coefficient
0.40 – 0.69	Moderate Reliability
0.70 – 0.89	High Reliability
0.90 – 1.00	Very High Reliability

(Guilford, 1956)

The reliability (U) of a test is generally expressed numerically in the form of a coefficient of -1.00 d +1.00 dU/d. A high coefficient indicates high reliability. Conversely, the lower the test score coefficient, the lower the reliability. Optimal reliability is achieved when the reliability coefficient approaches +1.00, indicating perfect. The expectation is that the reliability coefficient is positive. Reliability is also related to measurement error. A high reliability coefficient indicates consistency and accuracy of measurement results. The more reliable something instrument, the smaller the error measurement; thus, also, on the contrary, the smaller the reliability score, the bigger the results measurement (Retnawati, in the journal (Ayu & Putri, 2024)).

This study uses a test validity construct. Validity construct is validity, which indicates the extent to which an instrument actually measures a theoretical ability or construct. certainly what I want to measure. Process validation construct starts with identifying and limiting the variables to be measured, then defining them specifically based on the theory that is relevant. This allows the development of hypotheses about results measurement under certain conditions. If the results are in accordance with expectations, the instrument is considered to have validity. construct Which Good (Retnawati, in journal (Ayu & Daughter, 2024)). In a study that measures conceptual understanding, consisting of recognizing and understanding definitions, characteristics, and examples of something drafted. In this study, the determination of validity uses EFA. This is used when the measurement model of the instrument construct is still being sought or explored (Retnawati, in the journal, Ayu & Putri, 2024). Next, the computer compiles a matrix variance-covariance, then counts Mark's eigenvalues. This is then used to calculate the percentage of explained variance, as well as to draw the scree plot (Retnawati, in journal (Ayu & Putri, 2024). Determination validity construct using the JAMOVI 2.3.2 application.

In the operational product trial, research was conducted using a quasi-experimental design. Two prerequisite tests must be carried out before the analysis is carried out, namely the normality test. With the objective to know the data that is used from each variable, it has been distributed in a normal or No. Test normality was done using the data program on students' conceptual understanding (pretest and posttest), which was applied to 2 classes, namely the control class (KK) and the experimental class (KE), and was then statistically tested using Jamovi 2.3.28 Shapiro-Wilk Multivariate Normality Test to see the prerequisites for normality. According to Sugiyono (2007:173), if $p > 0.05$, then the data is normally distributed, and vice versa. If $p < 0.05$, then the data is not normally distributed. Testing the normality of data distribution is an important prerequisite in statistical analysis, so it is carried out on the data pretest and posttest of students. Criteria If the mark sig > 0.05, then H0 is accepted and H1 rejected. If the sig value < 0.05, then H0 is rejected, and H1 is accepted at a significance level of 0.05. The criteria for the null hypothesis and its alternatives are as follows:

H0: Data normally distributed
H1: Data not normally distributed

The homogeneity test was conducted to determine whether the samples used in the study had the same variance or not. The homogeneity test was conducted using the Jamovi 2.3.28 program. The homogeneity test is determined by the significance level (sig.), If the value (sig.) > 0.05, then the data is declared homogeneous, and if the value (sig.) < 0.05, then the data is declared inhomogeneous. The homogeneity test was conducted on student pretest and posttest data. The criteria of the sig. value > 0.05 then H0 is accepted and H1 is rejected, whereas if the sig. value < 0.05 then H0 is rejected ,and H1 is accepted at a significance level of 0.05. The criteria for the null hypothesis and its alternative are as follows:

H0: Variants homogeneous group
H1: Variants group not homogeneous

The method in this field trial uses *a nonequivalent control group design,* which is almost the same as the pretest-posttest control group design, that is explained in the following figure (control and experimental classes):

Experimental *Pretest measure* *treatment* *Posttest measure*
Group (KE)

$O_1\ X_1\ O_2$

Control *Pretest measure* *treatment* *Posttest measure*
Group (KK)

$O_3\ -\ O_4$

Picture 1. ***Quasi-Experimental Design with Nonequivalent Control Group Design***

The t-test is chosen because of the known difference mark average class control compared with the values in the experimental class using a t-test. Hypothesis testing is conducted after the prerequisite tests are met. The hypothesis tests conducted are the t-test and the test of the effect of the independent variable on the dependent variable. The t-test **(** ***Independent Sample T-Test*** **)** is conducted to determine the difference between the class control and the experiment. t-test (*Independent Sample T-Test*) on This study used the Jamovi 2.3.28 program. The criteria for accepting or rejecting H0 at a significance level of 5% using significance, namely if the significance > 0.05, then H0 is accepted, and vice versa, if the significance < 0.05, then H0 is rejected. The research hypothesis is as follows:

Ho: There is no significant influence on the concept understanding test of components between students who participated in learning using waterwheel-based diorama media for ecosystem component material and students who participated in learning without using waterwheel-based diorama media for ecosystem component material. media diorama-based windmill water material component ecosystem. (**Ho : µ1 = µ2.)**

Ha: There is a significant influence on the concept understanding test of components between students who participated in learning using water wheel-based diorama media on ecosystem component material with students who participated in learning not using water wheel-based diorama media on ecosystem component material. (**Ho : µ1≠ µ2.)**

Based on the hypothesis that has been made, the criteria used in testing can be explained as follows:

H0 accepted: If p-*value* (sig) > 0.05 (α) then Ha rejected if p-*value* (sig) < 0.05 (α)
Ha accepted: If p-*value* (sig) < 0.05 (α) or H0 is rejected if p-*value* (sig) > 0.05 (α)

Results and Discussions

The Instrument used in the study is based on an understanding draft for students in the form of multiple-choice questions totaling 20 items. The multiple choice questions were tested on 38 students in class V school, based on known reliability and validity research. Based on the results of the test data on the students' conceptual understanding instrument on the JAMOVI application, the results were as described below:

Table 1 . ***Scale Reliability Statistics:*** **Instruments Understanding Draft Student**

	Cronbach's Mean	α
Scale	4.26	0.826

The student concept understanding test instrument has a reliability of 0.826 as indicated by *the Cronbach's Alpha coefficient* in the JAMOVI application, which shows the level of reliability of the measured data. Based on the determination of the classification level of *the Cronbach's Alpha coefficient,* presented in accordance with *the Cronbach's Alpha coefficient table* (Guilford, 1956) shows that 0.826 is in the high reliability range based on the Cronbach's alpha coefficient interpretation table. Thus, a high coefficient indicates high reliability (Retnawati, in the journal of Ayu & Putri, 2024).

Table 2. ***Item Reliability Statistics*** **Instrument Understanding Student Concept**

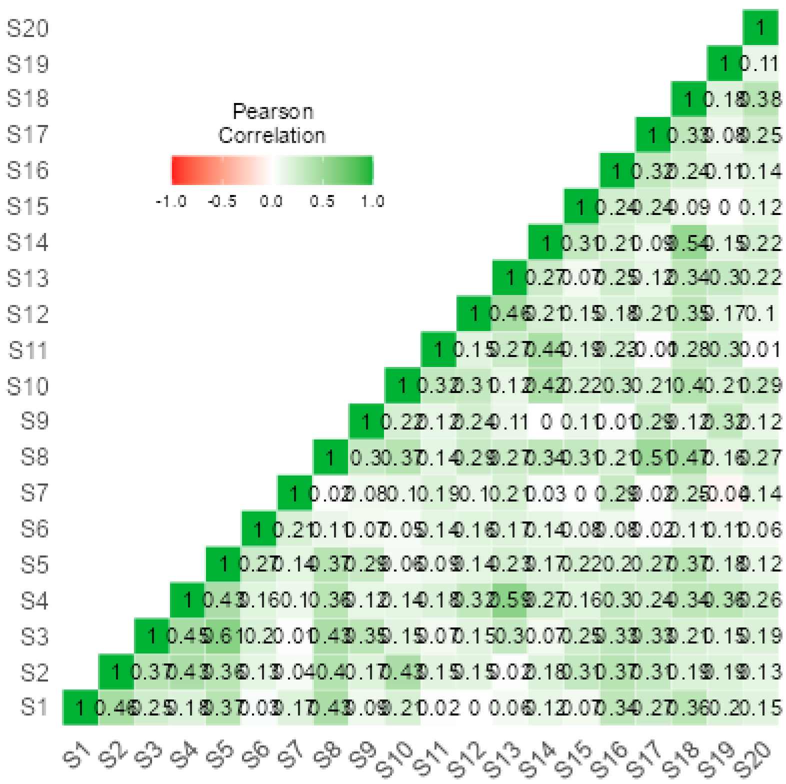
Item Reliability Statistics

	Mean	Item-rest correlation
S1	4.59	0.378
S2	4.43	0.474
S3	4.28	0.519
S4	4.18	0.603
S5	4.11	0.503
S6	4.13	0.237
S7	4.49	0.200
S8	4.29	0.609
S9	4.47	0.346
S10	4.38	0.446
S11	4.63	0.330
S12	3.89	0.414

S13	3.72	0.478
S14	4.42	0.413
S15	4.51	0.306
S16	4.38	0.448
S17	3.72	0.409
S18	4.38	0.587
S19	3.88	0.322
S20	4.20	0.344

Based on Table 2, it can be seen that *the item-rest correlation* obtained a correlation result that (positive) indicates that the item can be used to reflect the concept measured by the instrument, while a low (negative) correlation may indicate a problem in the construction or formulation of the question, so that it must be discarded or replaced (Utama, 2022)

Item-rest correlation shows a mark that is positive for all. Item- test The correlation of 20 test items, all of which have positive values, can provide a strong picture regarding quality instrument measurement. A positive correlation between every item and the total score of the test shows that all questions or statements, in a way, consistently support the draft or the ability measured by the test. Positive results like this can be considered an indication that the instrument test has been designed with Good And capable measurement construction, which is desired in a way accurate. This gives the belief that every item, in a way, effectively assesses aspects that are desired, the total score test reflects a good level of ability, and mathematical creative thinking skills were measured. Thus, after being tested using the JAMOVI application, it showed that the reliability of the mathematical creative thinking ability test instrument was shown to a reliable category.



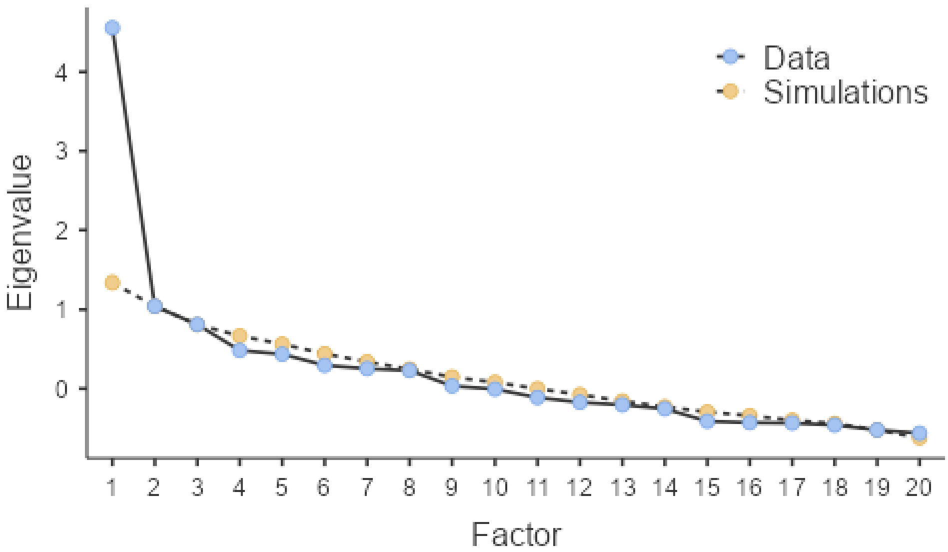
Picture 2. Correlations Headmap Reliability Instrument Ability Thinking Mathematical Creativity

In this study, validity was determined using EFA because it was unclear whether conceptual understanding, which consists of recognizing and understanding the definition, characteristics, and examples of a concept, had the same factors. The analysis results showed a Bartlett's Test of Sphericity value of <.001. (Retnawati, in the journal (Ayu & Putri, 2024)) explained that the p-value was less than 0.01 shown in the sample size, which was used in the analysis factor, has been enough.

Table 3. *Bartlett Test of Sphericity* Instrument Understanding Draft Student

χ^2	df	p
479	190	< .001

The number of factors included in the instrument can be seen from the scree-plot and eigenvalues. So obtained a chart which shows steep and sloping (Retnawati, in Ayu & Putri journal, 2024). The following is a Scree Plot analysis of the Student Concept Understanding Instrument.



Picture 3. Screen Plot Results Analysis Factor Exploratory Instrument Understanding Student Concept

Observing the scree plot results, there is one steep slope, and the blue dot is below the yellow dot. Therefore, this test instrument is only effective for measuring students' conceptual understanding. This is also supported by the Eigenvalues, which indicate that only one factor has a higher value than the others, as presented in the following table:

Table 4. Initial Eigenvalues Analysis Factor Exploratory Instrument Understanding Student Concept

	Initial Eigenvalues
	Eigenvalue Factor
1	4.55760
2	1.04184
3	0.81056
4	0.48345

5	0.43565
6	0.29478
7	0.25253
8	0.22900
9	0.03380
10	-0.00698
11	-0.11272
12	-0.17332
13	-0.20568
14	-0.25587
15	-0.41286
16	-0.43043
17	-0.43594
18	-0.46102
19	-0.52300
20	-0.56381

Based on the exploratory analysis factor, it can be concluded that the instrument, which is in the form of a questionnaire, the valid for measuring creative mathematical students generally and empirically proven.

One of the research problem formulations is to examine the influence of waterwheel-based diorama media on students' understanding of ecosystem material in fifth-grade elementary school. To answer this question, formulate a problem the so requires a study *quasi-experiment* with a pretest-posttest design. Because of that, the required calculation results *pretest* and the calculation results of the posttest. The test was given to 38 elementary school students, divided into 19 students in the control class (learning without using waterwheel-based diorama media) and 19 students in the experimental class (learning using waterwheel-based diorama media). The control class was conducted at SDN 3 Mojosari, while the experimental class was conducted at SDN 1 Panggungrejo. The questionnaire given consisted of 20 questions on conceptual understanding that were valid and reliable. This study used *a pretest-posttest design,* so measurements were needed for both *pretest* and *posttest data.* Data about understanding draft student *(pretest and posttest)*, treated to 2 classes, namely the control class (KK) and the experimental class (KE), were then tested statistically using JAMOVI 2.3.28 to see the prerequisites for normality and homogeneity.

Table 5. *Normality Test* (Shapiro-Wilk)

Normality Test (Shapiro-Wilk)

	W	p
Pre test	0.981	0.746
Post test	0.989	0.963

The table shows a p-*value* of 0.746 in the pretest and 0.963 in the posttest, which is greater than 0.05. This shows that data is distributed normally and Ho accepted. QQ *Plot Assessing Multivariate Normality* is shown in the Figure, showing the distribution of normality points related to the data presented, which can be shown in the Figure below.

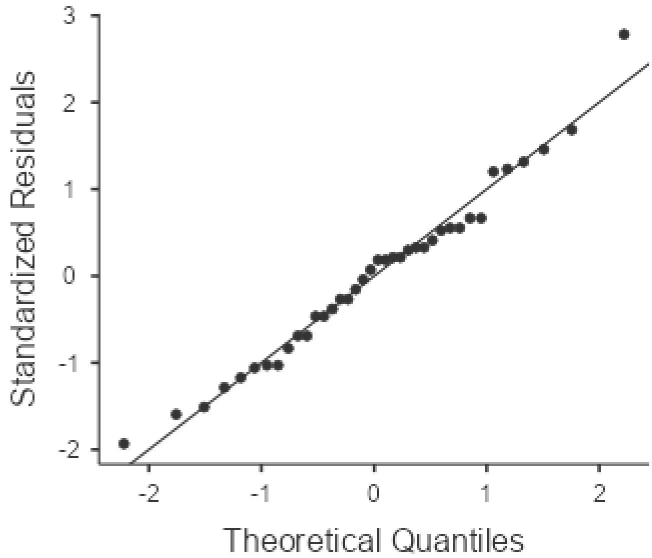


Figure 4. ***Q-Q Plot Assessing Multivariate Normality Pre Test***

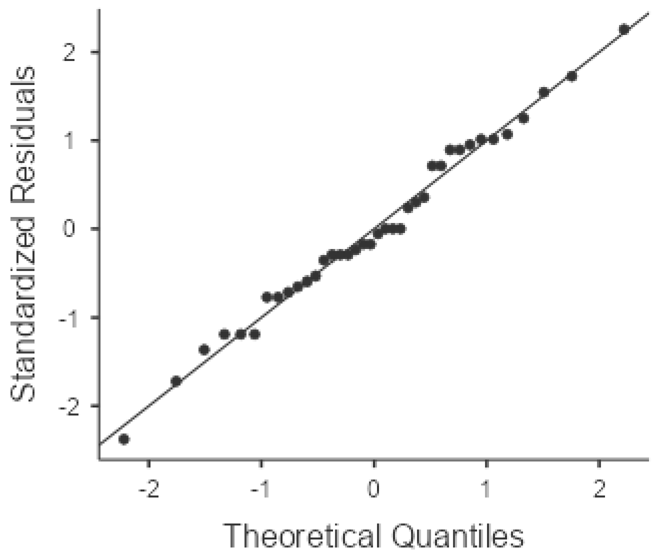


Figure 5. ***Q-Q Plot Assessing Multivariate Normality Post Test***

From figures 4 and 5, seen from the dots of the approach line parallel. So it can be concluded that the error is normally distributed. Next, a homogeneity test is performed.

Table 6. Homogeneity of Variances Test (Levene's)

Homogeneity of Variances Test (Levene's)

	F	df	df2	p
Pre test	0.236	1	36	0.630
Post test	0.159	1	36	0.693

The table shows a p-*value* of 0.630 for *the pretest* and 0.693 for the posttest, greater than 0.05. This indicates that the data is homogeneous and Ho is accepted. The prerequisite tests for using the *independent sample t-test* are met, namely that the data are normally distributed and homogeneous. So that continued for testing more carry-on. Furthermore, this is a result of the independent T-test of the samples.

Table 7. Independent Samples T-test

Independent Samples T-test

		Statistics	df	p
Pre test	Student's t	- 0.434	36.0	0.667
post test	Student's t	- 4,146	36.0	< .001

Note. H_a $\mu_1 \neq \mu_2$

Ho: There is no significant influence on the concept understanding test between students who participated in learning using waterwheel-based diorama media on ecosystem material with students who participated in learning who did not use waterwheel-based diorama media for ecosystem material. **(Ho: μ1 = μ2)**

Ha: There is an influence that is significant influence on test understanding draft between students who are participating in learning using waterwheel-based diorama media on ecosystem material, with students who follow the learning. No use media diorama-based windmill water material ecosystem. **(Ha : μ1 ≠ μ2.)**

Based on the hypothesis that has been made, the criteria used in testing can be explained as follows:

H0 accepted if p-*value* (sig) > 0.05 (α) or H0 rejected if p-*value* (sig) < 0.05 (α)
Ha accepted if p-*value* (sig) < 0.05 (α) or Ha rejected if p-*value* (sig) < 0.05 (α)

From Table 7, we can see that the obtained p-value is as big as 0.667. Because of value p > 0.05, then Ho is accepted. So it can be concluded that there is no influence whatsoever on the conceptual understanding of elementary school students in the experimental class and the control class during the pretest. Meanwhile, when the posttest was conducted in the control and experimental classes, based on Table 7 p-value obtained was < 0.001, which means less than/lower than (<) 0.05. When the value of p < 0.05, so Ho rejected, so we can conclude Ha accepted. Thus, there is an influence that is significant influence on test understanding draft between student who follows learning to use media diorama-based windmill water with student who do not follows learning using media diorama-based windmill water (Ha: μ1 ≠ μ2).

The research results show that the use of open dioramas based on water wheels can improve students' understanding of ecosystem components. This finding is in line with with essence of Science according to Carin and Sund in Graduates (2015), which states that science learning encompasses four dimensions: science as an attitude, process, product, and application. These four dimensions emerge in learning using dioramas. As the attitude reflected from increasing flavor, want to know, accuracy, and discipline, students observe water flow, movement of components in the diorama, and interactions between biotic and abiotic components. Science as a process is seen when students do activity observation directly, grouping ecosystem components, and drawing conclusions based on the visual data they see.

Science as a product is demonstrated through an understanding of concepts such as ecosystem structure, the relationships between components, and the fact that ecosystems are composed of living and non-living things. Meanwhile, science as an application is evident when students begin to link learning with the importance of guarding the environment and ecosystem so that it is not damaged.

The effectiveness of this media can be explained through learning theory. According to Edgar Dale's cone of experience (Arsyad, 2014), direct experience is the most concrete and effective in enhancing understanding. Learning using open dioramas allows students to experience the process of study, which is concrete through observation real to model ecosystem. This supports of the theory development of cognitive Piaget, which states that elementary school students are at the concrete operational stage, namely the stage where children understand concepts through real objects. When students interact with the media diorama that displays water flow and ecosystem components in detail in three dimensions, they can build concepts more easily and meaningfully.

The results of this study are also consistent with previous relevant research. For example, Setyorini's (2020) study showed that the use of three-dimensional dioramas can improve elementary school students' understanding of science concepts because the medium helps visualize abstract material in a concrete way. Dewi & Rahayu's (2021) study also concluded that concrete media, such as miniature ecosystems, significantly improve student learning activities and learning outcomes. Another study by Maulida (2019) found that diorama ecosystems increase the ability to observe, but are not interactive enough. Research findings. This gives a contribution in the form of a diorama open-based windmill water, which not only allows observation but also demonstrates dynamic processes through water movement. This differentiates it from previous research and strengthens the effectiveness of concrete media in science learning.

Thus, the findings of this study confirm that the open diorama media based on a water wheel aligns with constructivist learning theory, concrete experience theory, and previous research on concrete media in science learning. This media has been proven to increase student activity, make it easier to understand ecosystem concepts, and improve learning outcomes optimally.

Conclusion and Recommendations

Results from pretest and post-test*,* which contain a question choice with 20 grains questions. The results showed that the Experimental Class at SDN 1 Panggungrejo got higher scores compared to the Class Control in SDN 3 Mojosari. This is in accordance with the calculations carried out using JAMOVI 2.3.28. The P value obtained was 0.463. Therefore, mark $p > 0.05$, so Ho is accepted, and it can be said there is no influence whatsoever on the understanding of elementary school students' concepts in the experimental class with the control class when the pretest was conducted.

Meanwhile, when *the posttest was conducted* in the control and experimental classes, it was found p-*value was* < 0.001. That means, the p-value is not low enough or lower than (< 0.05). p-value < 0.05, so Ho is rejected, so we can conclude Ha is accepted. Thus, there is a significant influence on the concept understanding test between students who participated in the learning using media diorama-based windmill water with students who followed the learning No using media-based windmill water. Ha : $\mu 1 \neq \mu 2$. In conclusion, the application of open diorama media based on water wheels has been proven to have a significant impact on students' understanding of ecosystems in fifth-grade elementary school. This media is able to increase student engagement, attention, and learning activities because it provides a hands-on experience. Study concrete, which in accordance with the stage cognitive development child age school base which is on a concrete operational stage according to Piaget. By directly observing biotic and abiotic components and the dynamics of water flow in a diorama, students can build a more meaningful conceptual understanding, not just memorizing but understanding the relationship between ecosystem components in real terms.

Furthermore, the waterwheel-based diorama also fosters scientific attitudes such as curiosity, thoroughness, and observation skills. Learning becomes more interactive, contextual, and relevant because students don't just see images or verbal explanations. But get experience studying directly, which strengthens retention and conceptual understanding. Thus, this media can be used as an effective alternative science learning medium to help teachers improve the quality of learning, especially on abstract materials such as ecosystems.

This research certainly has many shortcomings. Therefore, suggestions and criticism are needed for further research. The author would like to thank the principals of SDN 1 Panggungrejo and SDN 3 Mojosari, the supervising lecturer, and all parties involved in this research.

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