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Interactive Five Senses Garden: Enhancing Elementary Students' Long-Term Memory Retention through Three-Dimensional Diorama Learning

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Abstract
This study was motivated by the poor retention ability of third-grade students regarding the topic of the five senses, which tends to be abstract. The purpose of this study was to analyze the influence and effectiveness of using three-dimensional dioramas in improving students' long-term memory retention. The method used was a quasi-experimental design with a non-equivalent control group. The research sample consisted of 31 students divided into an experimental class and a control class. Data were collected through retention ability tests measuring four specific indicators (recall, recognition, restating, and transfer of learning) administered before and after instruction. The results showed that the experimental class experienced a significant increase in retention ability, with the average score jumping from 40,13 to 79,20 ($p < 0,05$). Effectiveness measurements (N-Gain) indicated that the experimental class fell into the moderate category (0,65), while the control class experienced memory decay, falling into the low category (-0,06). In conclusion, the use of dioramas significantly and effectively facilitates dual coding to store information into long-term memory. These findings offer both theoretical and practical contributions to the development of interactive instructional media for elementary school teachers.

Keywords: Diorama Media, Five Senses, Learning, Retention Skills

Taman Pancaindra Interaktif: Meningkatkan Retensi Memori Jangka Panjang Siswa Sekolah Dasar Melalui Pembelajaran Menggunakan Diorama Tiga Dimensi

Abstrak
Penelitian ini dilatarbelakangi oleh lemahnya kemampuan retensi (daya ingat) peserta didik kelas tiga pada materi Pancaindra yang cenderung abstrak. Penelitian ini bertujuan untuk menganalisis pengaruh dan efektivitas penggunaan media diorama tiga dimensi dalam meningkatkan retensi memori jangka panjang peserta didik. Metode yang digunakan adalah kuasi-eksperimen dengan desain kelompok kontrol tidak ekuivalen (*nonequivalent control group design*). Sampel penelitian terdiri dari 31 peserta didik yang terbagi menjadi kelas eksperimen dan kelas kontrol. Data dikumpulkan melalui instrumen tes kemampuan retensi yang mengukur empat indikator (recall, recognition, restating, dan transfer of learning) sebelum dan sesudah intervensi. Hasil penelitian menunjukkan bahwa kelas eksperimen mengalami peningkatan kemampuan retensi yang signifikan, dengan nilai rata-rata melonjak dari 40,13 menjadi 79,20 ($p < 0,05$). Pengukuran efektivitas (N-Gain) menempatkan kelas eksperimen pada kategori sedang (0,65), sedangkan kelas kontrol mengalami peluruhan memori atau berada pada kategori rendah (-0,06). Kesimpulannya, penggunaan media diorama terbukti signifikan dan efektif dalam memfasilitasi pengodean ganda (*dual coding*) untuk menyimpan informasi ke dalam memori jangka panjang. Temuan ini memberikan kontribusi teoretis dan praktis bagi pengembangan media literasi interaktif bagi guru sekolah dasar.

Kata kunci: Kemampuan Retensi, Media Diorama, Pancaindra, Pembelajaran

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INTRODUCTION

The teaching of Natural and Social Sciences (IPAS) plays an essential role in fostering logical thinking skills regarding natural phenomena and oneself (Arief, 2021). The success of this learning process depends heavily on retention ability, or memory capacity that is, students' cognitive capacity to store, retain, and recall information they have learned over a specific period of time (Komariah et al., 2025). According to Cognitive Load Theory, this retention ability will increase significantly if the material is presented through appropriate visualization strategies designed to reduce barriers to information processing in the brain (Komariah et al., 2025). Without the support of media capable of concretizing these concepts, the information acquired by students tends to become merely temporary memorization that is easily forgotten.

However, the implementation of IPAS instruction particularly regarding human anatomy still faces significant challenges. Based on survey data collected from third-grade teachers at MI Roudlotul Khuffadz on September 2, 2025, IPAS material was generally identified as a subject that is difficult to teach in a way that ensures students truly understand it. More specifically, teachers of classes IIIA and IIIB agreed that the topic of the five senses is the most challenging for students. This material is complex because it involves concepts regarding the structure and function of body organs that are not (Azizah et al., 2026).

The main problem that arose in the classroom turned out not to lie in the students' level of participation, but rather in their weak memory or retention after learning. There was a contradictory phenomenon, in which 50% of the students actually showed a high level of enthusiasm when studying this material in class. However, this high level of enthusiasm is by no means directly proportional to their long term memory retention (Dendodi et al., 2025). Based on survey findings, as many as 80% of students tend to easily forget the material on the five senses just a few weeks after the lesson ends and have difficulty when asked to answer questions related to the topic again.

This weak memory retention was identified as being closely linked to the suboptimal use of instructional media in visualizing abstract concepts in the real world. The findings indicate that the learning process is still heavily dominated by the use of textbooks or printed materials (Blongkod et al., 2022). Although teachers occasionally incorporate media such as images or posters, these two dimensional materials are considered insufficient to represent the actual three-dimensional anatomical structure of the five senses. As a result, students often merely memorize the text verbally without visualizing the actual forms in their minds (Putra et al., 2023).

This issue was also strongly confirmed from the perspective of third-grade students. The data show that the majority of students 55.5% found it difficult to remember the IPAS material taught, while only 13.8% found it easy to remember. In addition, 86.1% of students stated that the learning process they were participating in still relied heavily on textbooks, with very minimal use of multimedia. This has led 44.4% of students to perceive that the multimedia resources currently used by teachers do little to aid their understanding of the material.

In an effort to find an appropriate solution, the results of the preference survey indicate a very positive trend toward the use of three-dimensional media (Hurwanani et al., 2025). total of 83.3% of students chose dioramas as the learning medium they most desired for studying IPAS. This high percentage of selection sends a strong signal that elementary school aged students who, in terms of cognitive development theory, are at the concrete operational stage crave a learning experience that is far more visual and interactive (Fadhil & Subiyantoro, 2025).

The use of dioramas provides a visual alternative that far exceeds the limitations of conventional two dimensional images in the classroom (Hurwanani et al., 2025). As a tangible three-dimensional physical representation, this teaching aid is capable of breaking down the complexity of the anatomical structure of the human senses into something vivid and lifelike, closely resembling their actual forms (Amaliyah et al., 2023). As is often the case in practice, the concept of the body's structure frequently presents as a puzzle that is too theoretical, abstract, and confusing for the reasoning of elementary aged children. However, through this miniature model, such complexity is successfully translated into a more down to earth visual language. Students are no longer left to grope in the dark or merely imagine theories from textbooks. They are now invited to observe, visually dissect, and directly explore the concrete forms of each body organ. It is this intense engagement with real objects that plays a crucial role in children's neurological mechanisms. The sharp visual stimuli from the contours and shapes of the dioramas are believed to gradually carve out highly vivid memory traces within the brain's neural networks (Sandi, 2021). Ultimately, this process of information encoding prevents the material from simply evaporating as short term memory; instead, it guides it to settle, be stored, and become permanently embedded in the students' long term memory.

To measure the success of students' long term memory retention, structured and comprehensive

assessment indicators are required. The first indicator is recall, which refers to students' ability to independently retrieve and reproduce information stored in their cognitive structures (Assa'diyah & Fitrianingtyas, 2025). At this stage, students are able to state facts, definitions, or anatomical concepts without requiring external cues or prompts, indicating the formation of a strong, pure memory trace within long term memory (Nurazizah et al., 2025). This recall process involves a high level retrieval stage that requires the brain to track down old information and bring it back into full consciousness. The second indicator is recognition, which refers to students' capacity to identify and recognize academic information they have previously learned when that information is presented to them again (Manurung & Fernandes, 2023). Unlike recall, the cognitive process involved in recognition is relatively less demanding because the brain only needs to match the presented stimulus with data already stored in memory. This indicator is typically assessed using objective evaluation instruments such as multiple choice questions, where students' memories are triggered upon seeing the correct answer options (Ramadani & Handayani, 2024).

The third indicator is restating, which reflects a deeper level of conceptual understanding and internalization of information (Fauziah et al., 2022). A person is said to have successfully reached the restating stage if they are able to explain the mechanisms of how the body's organs function using their own sentence structure, language, and paraphrasing without altering the essence of the original meaning of the taught material. This ability demonstrates that students are not merely mechanically memorizing words verbatim but have undergone a process of mature translation and interpretation of information within the brain's coordination system (Purwati, 2021). The final indicator is transfer of learning, or the application of material, which represents the most functional level of retention (Khusna & Masturi, 2021). At this stage, memory retention is considered highly effective because the stored knowledge is not static; rather, students can connect, adapt, and apply it to solve problems in new situations or practical real life contexts.

The importance of isolating these four retention indicators is further reinforced by the theoretical framework and a review of relevant prior studies. Regarding the direct reproduction of information through recall and recognition, several experts in cognitive developmental psychology emphasize that the strength of an information trace depends heavily on how a message is encoded at the outset of learning. Furthermore, in the context of internalizing understanding through restating, previous studies indicate that students' failure to grasp the meaning of a subject is directly proportional to their low long term academic performance (Baidhawi, 2025). Meanwhile, regarding the aspect of transfer of learning, the mechanism of generalizing learning to new situations is considered the pinnacle of optimizing students' brain function. By integrating these four components of retention into the diorama based assessment, the evaluation of students' cognitive success no longer focuses solely on temporary memorization but is able to measure the overall retention of information.

Various previous studies have examined the use of dioramas in education, but most have focused on improving general cognitive learning outcomes or have been limited to the affective domain, such as creativity and student engagement (Kustadiyono, 2020). This leaves a significant research gap regarding how this spatial medium specifically influences long-term memory retention (Kisma et al., 2020). Previous studies have not thoroughly explored the use of dioramas in facilitating dual coding to prevent memory decay regarding abstract concepts of human anatomy (Zumrudah et al., 2025) (Bali & Zahroh, 2023). Retention ability is a research construct that is entirely distinct from conventional learning outcomes. Learning outcomes often measure only mastery of the material immediately after the intervention is completed, whereas retention measures the durability and capacity of memory to store and retrieve information after a certain period of time has elapsed. Therefore, this study aims to fill this gap by focusing on measuring long-term memory retention through the innovative "Interactive Five Senses Park" media.

Based on Cognitive Load Theory, human working memory capacity is highly susceptible to overload when processing complex and abstract anatomical information (Sweller et al., 2019). The use of three-dimensional dioramas in this study is believed to reduce extraneous cognitive load through concrete visual simplification. More specifically, the three-dimensional visualization on the main board helps students process the actual shapes of organs without overloading their working memory. Furthermore, interactive manipulation and kinesthetic activities such as matching and inserting image sticks into sockets create motor connections that facilitate dual encoding. These physical and tactile experiences reinforce the organization of information during the storage phase in long term memory and create spatial memory traces that facilitate information retrieval and the transfer of knowledge to new problem-solving situations.

METHODS

This study uses a quantitative approach with quasi-experimental design. The design used is the Nonequivalent Control Group Design, where the grouping of research subjects into experimental groups and control groups is not done randomly (randomization), but uses classes that have already been formed (Abraham & Supriyati, 2022). The stages in this study include the implementation of a pre-test to measure initial ability, the provision of treatment or intervention, and ending with a post-test. The research design is presented in the following table.

Tabel 1. Research Design (Nonequivalent Control Group Design)

Group	Pre-test	Treatment	Post-test
Experimental (Class III-B)	O_1	X	O_2
Control (Class III-A)	O_3	-	O_4

Notes:
O_1 : Pre-test for the experimental class to measure retention ability before the treatment..
O_3 : Pre-test for the control class to measure initial retention ability.
X : Administration of the treatment using the "Interactive Five Senses Garden" diorama.
- : Conventional instruction without the diorama medium (using only textbooks).
O_2 : Post-test for the experimental class after the treatment and a specific time interval.
O_4 : Post-test for the control class after conventional instruction and a specific time interval.

The study was conducted at MI Roudlotul Khuffadz in Sorong Regency, with the instructional material focusing on the IPAS topic "Human Senses." The population for this study consisted of all 31 third-grade students. The sample was not selected randomly but rather through a non-probability sampling technique, specifically purposive sampling. The criteria for determining the sample were based on two main factors: first, the suitability of the students' characteristics, as they are theoretically at the concrete operational stage of cognitive development and therefore have a strong need for real-world visual aids; second, a relatively balanced baseline of basic academic abilities between the two classes based on previous formative assessment data. Based on these considerations, the sample was divided into two intact groups: Class III-B (15 students) was designated as the experimental class, and Class III-A (16 students) was designated as the control class (Jumriani et al., 2025).

The experimental class was taught material on the five senses using an innovative diorama medium based on the concept of an "Interactive Five Senses Garden." This medium was designed in detail, presenting anatomical objects in three dimensions using layering techniques to create a three-dimensional effect, and was supplemented with kinesthetic activities such as picture sticks (interactive labels) or stick insertion. Meanwhile, the control class received conventional instruction that relied on textbooks and a blackboard without the use of dioramas.

Data were collected using a retention test instrument consisting of multiple-choice and short-answer questions. This instrument was comprehensively developed through the creation of a detailed test blueprint that aligned the learning outcomes of the elementary-level curriculum with four indicators of memory retention. The test blueprint was broken down into a total of 15 test items with the following distribution as presented in Table 2:

Tabel 2. Distribution of Test Blueprint Items

No.	Indicator	Description
1.	Recall Indicator	Asking students to write the names of the sensory organs without visual cues.
2.	Recognition Indicator	Multiple-choice questions to identify the functions of eye parts from several options.
3.	Restating Indicator	Fill-in-the-blank questions requiring students to describe the process of hearing.
4.	Transfer of Learning Indicator	Application of concepts to a case study on maintaining sensory hygiene.

Before being used in the study, this instrument underwent a rigorous content validity testing procedure (expert judgment) by two experts in elementary education. The experts evaluated the substantive alignment of the material with the test blueprint, the construction of the test items, and the readability of the language to ensure it was appropriate for third-grade students. After being validated by

the experts, an empirical pilot test was conducted on a group of students outside the research sample to measure the instrument's statistical reliability. The test results yielded a Cronbach's Alpha reliability coefficient of 0,82. This value indicates that the test instrument falls into the category of highly reliable and consistent for use as an objective measure of memory retention.

Data analysis was carried out using descriptive and inferential statistical methods at a significance level of 0,05. Before the hypothesis test, a prerequisite test was carried out, namely a normality test using the Shapiro-Wilk technique (N=31) and a homogeneity test using Levene's Test. Once the data were confirmed to be normally distributed and had a homogeneous variance, hypothesis testing was performed using the Independent Samples T-Test to determine the significance of the difference between the experimental class and the control class (Saputra et al., 2026). In addition, the N-Gain test was also applied to measure how effective the improvement of students' memory retention skills was, which was classified into high, medium, and low categories.

RESULTS AND DISCUSSION

Results

The research was carried out during the Natural and Social Sciences (IPAS) learning process in the experimental class (III-B) and the control class (III-A). The experimental class used a diorama-media-assisted learning model with the concept of "Interactive Sensory Park", while the control class used conventional learning in the form of material explanations from textbooks and assignments without three-dimensional visual media. It is important to note that the post-test for both groups is specifically carried out after the entire implementation of learning the five senses material (both with dioramas and conventional) is completed in its entirety, accompanied by a predetermined time gap to accurately measure the students' long-term retention (memory) ability.

After the learning is completed, data is collected through retention ability tests (pretest and posttest) and student response questionnaire sheets. Test data were analyzed using statistical software to perform descriptive tests, normality tests, homogeneity tests, independent sample t-tests, and N-Gain tests. The results of the descriptive analysis in the form of minimum, maximum, average, and standard deviation values in both classes are presented in Table 3.

Table 3. Descriptive Statistics of Retention Ability

Data	Classes	N	Min	Max	Mean	Std. Deviation
Retention Capabilities	Pretest Experiment	15	9	80	40,13	23,877
	Posttest Experiment	15	44	100	79,20	15,776
	Pretest Control	16	20	77	51,19	16,849
	Posttest Control	16	27	74	52,50	14,019

Based on Table 3, there is a difference in the mean pretest scores between the experimental group (40,13) and the control group (51,19). This difference in initial ability levels is a natural characteristic of quasi-experimental designs, in which subjects are not assigned to groups at random (non-random assignment). Given this fairly significant baseline difference, the application of an independent samples t-test accompanied by an N-Gain analysis is considered appropriate. The N-Gain analysis was chosen because its formula proportionally normalizes the increase in scores based on the maximum score that each test subject can achieve, thereby effectively minimizing bias arising from differences in students' initial ability levels.

To ascertain the significance of these differences, a prerequisite test for analysis was carried out in the form of a normality test (Shapiro-Wilk) and a homogeneity test (Levene's test). The results of the prerequisite test are presented in Table 4 and Table 5.

Table 4. Normality Test

Normality Test	Classes	Shapiro-Wilk Statistic	Df.	Say.
Retention Capabilities	Pretest Experiment	0,936	15	0,339
	Posttest Experiment	0,896	15	0,082
	Pretest Control	0,930	16	0,240
	Posttest Control	0,928	16	0,228

Based on the results of the analysis in Table 4, all retention ability data have significance values > 0,05, indicating that the data are normally distributed. Once the normality assumption is met, the next step is to test for equality of variances across groups using the homogeneity test presented in Table 5 below.

Table 5. Homogeneity Test

Test of Homogeneity of Variance	Levene Statistic	df1	df2	Say.
Final Data Retention Capability (Based on Mean)	0,024	1	29	0,879

Based on Table 5, the significance value for homogeneity of 0,879 (> 0,05) indicates that the variances of the two groups are homogeneous. Since this assumption is met, the analysis continues using an independent-samples t-test.

Table 6. Hypothesis Test (Independent Sample T-Test)

Variabel	Assumptions	Levene's Test (F)	Say.	t	df	Sig (2-Tailed)	Mean Diff
Retention Capabilities	Equal Variances Assumed	0,024	0,879	4,988	29	0,000	26,700

Based on Table 6, the results of the t-test show that the significance value (Sig. 2-Tailed) is 0,000 < 0,05. This means that Ha is accepted, which confirms that there is a very significant difference in influence between the experimental class and the control class on the ability of students' memory retention.

In addition to relying on statistical significance values, this study also measured the magnitude of the practical impact of the intervention using effect size analysis. Based on calculations using Cohen's formula d on the post-test score data of the two groups, a d value of 1,79 was obtained. This value far exceeds the threshold of 0,80, which indicates that the use of diorama media has a large effect on improving students' retention skills.

Furthermore, the effectiveness of the media was measured using N-Gain analysis as presented in Table 7.

Table 7. N-Gain Analysis

Variabel	Classes	Pretest	Posttest	N-Gain Score	Effectiveness Category	N-Gain Percent
Retention Capabilities	Eksperimen	40,13	79,20	0,65	Medium	65%
	Control	51,19	52,50	-0,06	Low	6%

The N-Gain value in the experimental class was in the medium category (0,65) which indicates that the diorama media was quite effective in increasing retention, while the control class was in the low category (-0,06) or classified as ineffective.

In addition to quantitative data from the written test, this study also measured the level of interest and functional effectiveness of the media through the student response questionnaire instrument in class 3B after the use of diorama. The results of the questionnaire showed a very positive response. In the statement about the feeling of pleasure learning Pancaindra material using dioramas, as many as 12 students (75%) answered "Strongly Agree", 2 students (12,5%) answered "Agree", and 2 students (12,5%) answered "Quite Agree". In addition, dioramas have been proven to be very helpful in the work process of students' visual memory; It is evident that of the 15 students who responded to the statement related to the ease of remembering the names of the Pancaindra section, as many as 9 students (60%) stated "Strongly Agreed" and 5 students (33,3%) stated "Agreed". Visualization in the form of colors and shapes on diorama media is also considered dominant, helping students to continue to be interested in the lesson and making it easier for them to remember the working mechanism of the five senses.

Discussion

Significant Improvement in Long-Term Memory Retention

The main findings of this study confirm that the use of the three-dimensional diorama medium "Interactive Five Senses Park" has a positive and highly significant effect on improving long-term memory retention in elementary school students compared to conventional learning. The significant improvement in retention ability in the experimental class (N-Gain of 0,65, classified as "Moderate," compared to the

control class's -0,06) demonstrates that dioramas do more than simply provide aesthetic variety; they fundamentally alter how the brain processes and stores academic information.

A deeper analysis of these findings can be seen in the details of students' performance on the four retention indicators that were tested (see the subsection on retention ability). First, regarding the recall and recognition indicators, students in the experimental class demonstrated far superior ability to recall the names of the anatomical parts of the five senses without the aid of direct visual cues during the post-test. Second, regarding the restating indicator, the sensory engagement from the activity of inserting picture sticks enabled students to restate functional explanations of the organs using their own words, rather than merely engaging in rote learning. Third, at the highest level transfer of learning the spatial memory traces left by the diorama medium were shown to help students solve case studies related to the hygiene of sensory organs. This stands in stark contrast to the control class, where a negative N-Gain score (-0.06) confirms rapid memory decay due to high cognitive load when processing abstract anatomical material solely through two-dimensional textbooks.

Facilitation of Dual Coding and Cognitive Load Reduction

These findings critically expand and refine previous literature reviews. Earlier studies by (Kustadiyono, 2020) and (Kisma et al., 2020) had indeed demonstrated the effectiveness of dioramas, but their findings were limited to improvements in general cognitive learning outcomes at that specific time (short-term). Meanwhile, the study by (Bali & Zahroh, 2023) focused solely on dioramas as a stimulus for creativity in the affective domain. This study does not merely confirm those findings but develops a new paradigm by demonstrating that dioramas directly facilitate dual coding. When three-dimensional visual stimuli are combined with kinesthetic activities, synchronization occurs between visual and motor memory. It is this multisensory stimulation that strongly imprints memory traces in the brain's neural networks, preventing information from fading and ensuring the retention of material in long-term memory.

This is consistent with the views of (Putra et al., 2023) regarding memory system management, in which concrete visualization can reduce cognitive load on material that is considered difficult and not immediately visible in its entirety. When students observe the three-dimensional form of an organ while simultaneously performing fine motor activities (inserting sticks into a functional diagram), synchronization occurs between visual and kinesthetic memory. It is this dual sensory stimulation that effectively carves a memory trace in the brain's neural networks, enabling students to sustain conceptual understanding over time and achieve higher levels of restatement and transfer of learning—rather than merely verbal memorization.

This success is fully consistent with the concept of Cognitive Load Theory as presented in the literature review, which states that the cognitive load associated with presenting complex human anatomy material can be reduced through three-dimensional visualization (Putra et al., 2023). Third-grade students, who theoretically are still in the concrete operational stage, were found to benefit significantly from the dioramas. This was directly confirmed by the results of a student questionnaire, which indicated that the majority of students (over 90% cumulatively) felt that the colors, shapes, and visual aids provided by the dioramas made it easier for them to commit the sequence of sensory mechanisms to memory.

Emotional Engagement and Students' Positive Responses

The dynamics of learning in the experimental classroom reached their peak when students were directly involved in a hands-on activity involving the placement of interactive sticks on a diorama display board. The learning process was no longer one-sided but transformed into a vibrant space for exploration. Based on direct observations in the field, the children showed extraordinary enthusiasm when it was their turn to hold the functional image sticks and analyze the correct placement of organs on the three-dimensional board. The tactile and fine motor engagement involved in holding, directing, and inserting these interactive sticks broke down the wall of boredom that typically surrounds science lessons at the elementary level. Students feel as though they are both playing and completing a small scientific mission, which indirectly helps alleviate their academic anxiety.

The joy and emotional satisfaction evident during the stick-insertion activity were quantitatively confirmed through the students' response sheets. A total of 75% of the students strongly agreed that they felt very happy learning about the five senses through this diorama. Referring to previous cognitive neuroscience literature, positive emotions such as joy and deep visual engagement can theoretically be associated with the optimization of neurotransmitter function such as dopamine within the brain. Based

on prior literature reviews, this biological mechanism is assumed to act as a synaptic enhancer that facilitates the formation of new memory traces. Therefore, although these hormonal releases and brain activities were not empirically measured within the scope of this study, it can be explained through this theoretical framework that physical activity specifically, the "stick-insertion" task can stimulate students' memory more effectively by engaging specific organ functions.

This emotional connection and visual appeal are also supported by the aesthetic structure of the diorama itself. The combination of contrasting colors and the shapes of the replicas, which resemble the actual organs, kept the children's attention fully focused on the teacher's explanation. This explains why the majority of students (60% strongly agreed and 33.3% agreed) found it much easier to recall the names of the parts of the five senses and the sequence of their mechanisms after interacting with the media board. The sensory experience they gained while inserting the interactive sticks served as a memory aid that helped them answer the evaluation questions during the post-test (Dania & Novziransyah, 2021).

The conditions in the experimental class were drastically the opposite of what occurred in the control class, which was a unique and crucial finding in this study. The N-Gain test results showed a significant increase in retention in the experimental class (0,65 / Moderate category), while the control class actually experienced a decline with a negative value (-0,06 / Low category). The negative value in the control class indicates memory decay over time. This occurs because conventional learning, dominated by two-dimensional textbooks, forces students into rote learning. Without concrete media, the process of encoding information in the brain is slow and static. Students' short-term memory fails to be transferred to long-term memory due to the high cognitive load (extraneous load) involved in processing abstract material on the anatomy of the five senses.

Conversely, the effectiveness observed in the experimental group supports the principles of Cognitive Load Theory. The "Interactive Five Senses Garden" diorama intervention successfully facilitated dual coding. When three-dimensional visual stimuli (observing the contours and actual locations of organs) are combined with kinesthetic activities (inserting picture sticks), the brain does not have to work too hard to grasp the concepts. It is this multisensory stimulation that strongly carves out memory traces and prevents information from fading away. This finding offers novelty while complementing previous research, such as the studies by (Kustadiyono, 2020) and (Kisma et al., 2020), which previously only demonstrated the effectiveness of dioramas in the realm of short-term cognitive learning outcomes. This study confirms that the use of dioramas not only impacts mastery of the material at the end of a lesson but is fundamentally capable of influencing how the neural structures in the brains of elementary-aged children store, retain, and retrieve information over a longer period of time.

Although these findings offer significant new insights, this study has a number of methodological limitations that must be acknowledged. The quasi-experimental design used, with purposive sampling (class assignment without full randomization), allows for confounding variables arising from the internal dynamics of each class that are beyond the researchers' control. Furthermore, the limited sample size of 31 students at a single institution calls for caution when generalizing these findings. Therefore, follow-up research using a larger-scale randomized controlled trial (RCT) design is highly recommended to validate these findings across various demographics.

CONCLUSION

Based on the research findings, the use of the three-dimensional diorama medium "Interactive Five Senses Park" was proven to be significantly effective in improving third-grade students' long-term memory retention of IPAS material ($p < 0,05$, N-Gain for the experimental class = 0,65). This study reinforces the literature on Cognitive Load Theory and Dual Coding Theory by providing empirical evidence that the use of spatial and interactive media can reduce cognitive barriers (extraneous load) in abstract anatomical concepts. Multisensory engagement (visual and kinesthetic) has been shown to prevent memory decay and facilitate the internalization of information, transforming it from mere short-term memorization into permanent long-term memory. This study has direct implications for elementary school educators, offering a blueprint for designing affordable, concrete, and practical learning media. The "Interactive Five Senses Park" media can be adopted and developed by teachers as a pedagogical solution to address students' poor retention of complex science material.

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