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Enhancing Scientific Communication in Junior High School Students on Ecological Interactions through Diorama Media and Guided Inquiry

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Abstract

This study investigates the limited use of textbook-based media by 7th grade science teachers and the need for three-dimensional diorama media to improve students' scientific communication skills. The study aims to: 1) assess the validity of diorama media, 2) evaluate the practicability of diorama media in the classroom, and 3) examine the effect of guided inquiry-based diorama media on enhancing students' scientific communication. The study utilized a research and development design following the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation). A total of 80 students participated, with 24 in the control group (using lecture-based learning) and 56 in the experimental group (using diorama media). Data were collected using structured observation sheets, a Likert scale questionnaire to assess students' engagement and communication, and cognitive tests designed to evaluate scientific communication skills before and after the intervention. Statistical analysis using SPSS software revealed that the diorama media's validity was 89.9% and its practicality was 86%. A significant improvement in scientific communication was observed in the experimental group, with a pre-test and post-test difference of 28.54 points (p-value = 0.000 < 0.05). The N-gain score of 65% indicates moderate effectiveness. These findings confirm that guided inquiry-based three-dimensional diorama media is a highly effective tool for enhancing scientific communication in the context of ecological interactions.

Keywords: Diorama; Guided-Inquiry; Scientific communication;

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INTRODUCTION

The evolution of science is characterized by the development of "scientific methods," which are realized via a range of "working scientifically," "scientific attitudes," and aspirations (Ozkan & Umdu Topsakal, 2021; Yanti, 2023). Science education aims to equip students with the skills necessary to think critically, creatively, rationally, and independently, enabling them to tackle the complex social challenges arising from scientific and technological advancements (Izzatina & Rosdiana, 2024; Meidelina et al., 2023; Sonia et al., 2024). This approach helps students develop the ability to analyze and address issues that impact society. In this context, the integration of innovative teaching methods, such as the use of diorama media, plays a crucial role. While traditional media, like textbook pictures, are commonly used in science classrooms, they often fail to engage students or foster deep understanding (Kussudarto & Rosdiana, 2024; Lindiani et al., 2020; Naufal, 2021; Smyth & MacKinnon, 2021). In junior high school, the emphasis is on direct learning experiences via the application and development of process skills and scientific mindsets. Participatory learning that helps students to realize their own potential (Amaliyah & Fajar, 2024; Mukarromah & Agustina, 2021; Qiroah & Lestari, 2024).

In the era of globalization, science education plays a crucial role in helping students adapt to and address the challenges posed by advancements in information and communication technology (Annovasho et al., 2025; Ningrum & Purnomo, 2024; Sweet & Michaelsen, 2023; Tracy, 2024). Applied learning in science refers to the development of educational objectives that align with cognitive aspects (remembering, comprehending, applying, analyzing, evaluating, and generating) and knowledge dimensions (factual, conceptual, procedural, and metacognitive). Scientific communication has an impact on science learning outcomes. Effective scientific communication significantly influences science learning outcomes by enhancing students' engagement and understanding of the material, thereby improving their ability to achieve the learning objectives (Andrews & Shapiro, 2021; Cameron et al., 2020; Pollett & Rivers, 2020; Zhu et al., 2024).

Students with strong scientific communication skills will find the learning process easier and get the greatest results. Communication, according to Ilah Amaral, (2024), is the process of producing information, sending it, and indicating it. Communication is the capacity to convey your thoughts and feelings to others vocally and in writing. Scientific thinking and the ability to graphically represent research findings are two abilities that aid in scientific communication (Kolev et al., 2020; Macháček, 2023; Zhu et al., 2024). According to Ummah, (2022), a variety of elements such as the instructor, the students, the facilities and infrastructure (media), and the surroundings may all have an impact on how well a class runs. Junior high school science education is often perceived as difficult for students to understand. The lack of effective scientific communication in teaching these topics leads to decreased student engagement, resulting in lower enthusiasm and passivity in the learning process (Bowker, 2023; da Silva et al., 2020; Neira et al., 2023; Plo-Alastrué & Corona, 2023). Students struggle to understand the fundamental notion since the information in scientific studies has become rote. The 2013 curriculum at Junior high school / Madrasah Tsanawiyah (MTs) Maslakul Huda requires that information regarding the interaction of living things with the environment be covered in class VII even semester. Students just memorize the facts on how living things interact with their surroundings; they do not understand the concept. This will have an impact on students' scientific communication abilities.

According to Tsai et al., (2023), instructors face challenges in integrating innovative teaching methods that can help students discover and expand their knowledge. One significant obstacle in teaching complex topics like ecosystems is the difficulty in visualizing remote environments, such as tundras, deserts, and seas. This makes it challenging for teachers to effectively convey information about how living organisms interact with their surroundings. The complexity of understanding bioticabiotic components, food webs, energy cycles, symbiosis, and ecosystems further complicates the learning process. As Kangas & Rasi, (2021) noted, successful learning aids can ignite students' interest and facilitate their understanding of the subject matter. Three-dimensional dioramas, in particular, have been shown to be highly effective in science education. Studies by Humaira & Ninawati, (2023) suggest that the hands-on, visual nature of dioramas allows students to engage more deeply with abstract concepts, making complex topics like ecosystems more tangible and accessible. These interactive tools enhance student engagement and support the development of scientific communication skills, making them an essential part of modern science education (Septaria et al., 2020; Septaria, 2023; Septaria et al., 2023).

The learning about science observation sheet for class VII revealed to the researcher that, while the teacher delivered the topic in line with the RPP during the learning process, the instructor only used her own book for explanations while the students utilized the LKS. Students pay attention when the teacher explains the content, but they are usually unable to react when the teacher asks questions. Instead, they merely comply with the teacher's request to come to the front of the class and write down the answers, but they are unable to explain or connect with their peers. They are unable to express the meaning of the topic using their own understanding when asked to share the findings of the group discussion. This argument is supported by findings from science teacher interviews performed after class VII at MTs Maslakul Huda. According to the findings of the interviews, the learning techniques used were lectures, assignments, and questions and answers. The medium used has less diversity. To display the material, just the media in the book, basic illustration media, are employed. Students can communicate orally and in writing, but they can only comprehend what they are thinking. This is due to the fact that poor scientific communication leads to low evaluations for learning outcomes.

Depending on the findings of the investigation's conversation with the class VII science teacher, the PTS (midterm assessment) score for the odd semester of the 2022-2023 academic year has surpassed the Minimum Completeness Criteria (KKM) of 75; however, only 5 out of 29 pupils, or 1.45% of students in class VII Ar, have grades above the KKM of 75. The students' bad PTS (mid-semester assessment) scores for the odd semester of the 2022-2023 academic year are due to the instructor's lack of appropriate teaching tactics used with the course material. Traditional education is used as a learning approach, and it primarily focuses on the lecture style and the instructor as a source of knowledge. Because learning mediums are not exploited to their full capacity, learning is predominantly verbal.

To improve the scientific learning process and foster better communication skills in students, various media types are essential, especially in the teaching of science subjects that involve complex natural phenomena. This research focuses on the development and utilization of three-dimensional diorama media to enhance students' understanding of the interactions between living organisms and their environment. Specifically, the research seeks to answer the following questions: 1) How valid is the three-dimensional diorama media for teaching science? 2) How practical is the diorama media in real classroom settings? 3) What is the impact of guided inquiry-based three-dimensional diorama media on students' scientific communication skills? These questions aim to address the need for more interactive and engaging learning tools in science education, particularly for improving communication skills, a critical aspect of scientific literacy.

On the basis of Farikhatin et al., (2024) investigation, diorama media can be an alternative issue solution since dioramas are suitable for science fields that include a wide range of natural occurrences. By employing 3-dimensional models to create dioramas that closely mimic the actual thing, we can give students firsthand experience studying and witnessing natural phenomena. By mixing media with guided inquiry learning approaches, students' curiosity and passion will be increased (Aiman & Hasyda, 2020). The guided inquiry strategy is a collection of instructional activities designed to help students to utilize critical and analytical thinking to identify and solve issues. Students are asked to undertake research and develop their own knowledge in order to better comprehend the topics in the course content (Septaria & Dewanti, 2019; Septaria & Rismayanti, 2022; Zhu et al., 2024). The author performed study in class VII on the production of three-dimensional diorama media on the interaction of living things with the environment in order to assess the influence of scientific communication on pupils. The position of components as objects in the diorama media was indicated by directional instructions in the form of arrows on these media. This research can help a range of groups by improving instructor knowledge and abilities, improving student communication, and enthusing students about scientific learning. In terms of using media and raising the level of education in schools

METHOD

The research approach used is research and development. This research approach is used because the major purpose of this study is to evaluate the efficacy, feasibility, and influence of learning media in the form of three-dimensional media on scientific communication. The ADDIE research paradigm was used in the research and development phase of this project to build instructional media products (Indriyani et al., 2022; Septaria, 2023; soewarno warno et al., 2020). The phases in this research are guided by the ADDIE development paradigm, which covers the procedures of (1) analysis, (2) design, (3) development, (4) implementation, and (5) evaluation (Dianti et al., 2022). Figure 1 represents the flow of the processes in the ADDIE development framework.

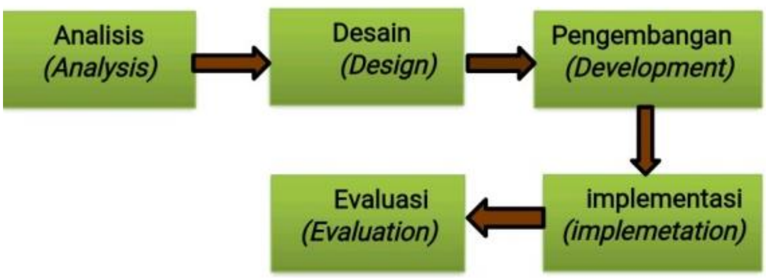

Figure 1. ADDIE development model steps (Rahmawati et al., 2021).

Development Mechanism

On September 15 and October 15 2022, the researcher took observations during science learning and conducted interviews with one of the scientific subject instructors and many students in class VII Junior High School Maslakul Huda Dengok Paciran Lamongan. Based on the findings of the researcher's observations, the analysis is based on teacher and student needs variables, which include:

Analysis of Teacher Needs

Table 1. Analysis of teacher needs

No.	Research Observation Results	Analysis
1.	Teacher learning tools	Teachers have learning tools
2.	In the preceding paragraph, scientific communication is defined as the relationship of living organisms with their surroundings.	Not yet measurable, not planned to be improved
3.	Media availability	Limited to physics and chemistry material available in school laboratories

Analysis of Student Needs

Table 2. Analysis of Student Needs

No.	Researcher 's Observation Results	Analysis
1.	Learning methods used	My method is smart
2.	Material sources and learning media	Using only material from the LKS does not use other additional media
3	Student grades are limited to KKM	There is no KKI measurement yet, so the teacher proposes to measure students' scientific communication

Based on an investigation of instructor requirements elements and pupil requirements issues, the researcher attempted to give a solution for class VII science learning, semester 2, associating the interaction of living things with the environment. Researchers discovered that media that supplements the science learning process is required to assist students build their scientific communication abilities. One sort of media that may be utilized in this material is three-dimensional dioramas portraying the interactions of living organisms with their surroundings. Then, as the learning technique for the material on how living things interact with their surroundings, select the guided inquiry approach. The diorama format developed by researchers exploring three-dimensional dioramas has the benefit of being semi-open and closed, which means it can be opened if necessary to add arrows or replicas of things and then closed again to make it safe to use and simple to store. Another advantage is that the materials are sturdy and not easily broken. The product should be economically priced, easy to purchase, and swiftly created, according to the principle of innovation.

The afterwards design phase attempts to provide the appropriate design as well as the proper test technique. The developer is now working on developing a three-dimensional diorama media design to involve engaged students in the scientific learning process on the interaction of live creatures with the environment. Researchers prove feasibility and validate three-dimensional instructional tools. The media appropriateness determination is evaluated using specially created instruments such as media expert and material expert validation tools. Other than supervisors, lecturers validate media specialists. Figure 2 displays a media design for a three-dimensional diorama that depicts how live animals interact with the environment they are in.

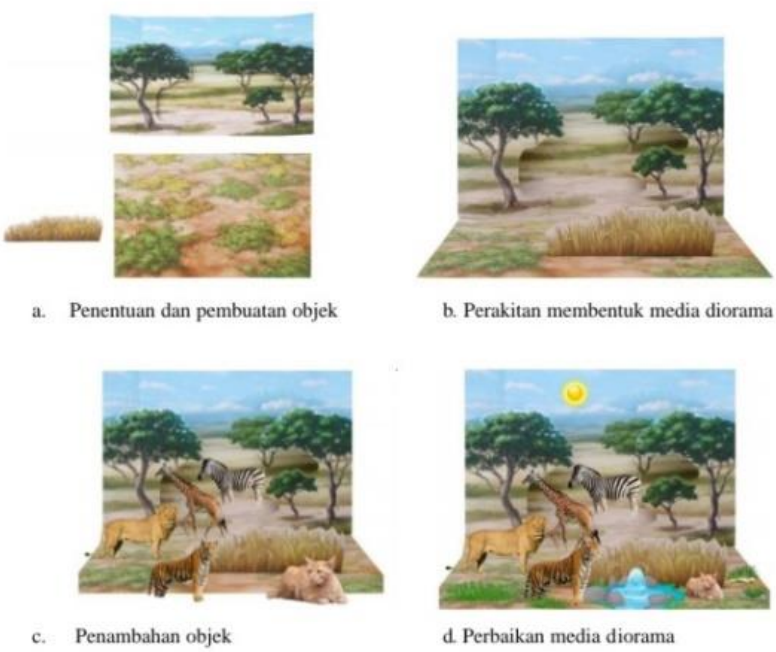

Figure 2 . Three-dimensional diorama media design

In continuing with the advancement of the stage, this instance calls for the creation of guided inquiry-based diorama media on the theme of interactions between living organisms and their surroundings. The purpose of the development phase is to generate and validate the instructional resources that will be necessary throughout that period. The next step of implementation tries to set up the classroom and include the students. The major tasks that are typically associated with the Implementation stage include preparing teachers and students. The final purpose of the assessment step is to assess the quality of the product and the training process both before and after deployment. Based on the validation results, one lecturer with knowledge in media and one with expertise in materials completed the evaluation Maulana et al., (2022).

Location, Time of Research and Research Subjects

The research investigation was carried out in Junior High School Maslakul Huda in Dengok Village, Paciran District, Lamongan Regency. The researcher picked Junior High School Maslahul Huda as the research site because it satisfied the research requirements, specifically that it has never employed guided inquiry-based diorama scientific learning media as a learning medium. This research will be carried out in January 2023 (data collecting). This study's population comprised of 100 class VII Junior High School students from Maslahul Huda Dengok Village, Paciran District, and Lamongan Regency. During the school year 2022-2023, there were four courses—three ordinary classes and one bilingual class. This study used simple random sampling, which indicates that the sample was picked at random without regard for sampling differences since it was assumed to be homogenous and had the same opportunity (Adah, 2023; Nursiwan & Hanri, 2023). This strategy is used at Junior High School Maslakul Huda since the class VII average grades are all the same and fall inside the KKM limit. Aslan & Celik, (2022) estimated that the sample size for basic experimental research with an experimental and control group should be between 10 and 20 students for each group. The sample size in this study was 80, with a population of 100 and a margin of error of 5%. Because there were four courses, the Isaac and Mihcael formulae had to be employed to calculate the sample size for each. The researcher gathered class samples from three classes totalling 24 individuals for a sample size of 20, and one class including 28 students for a sample size of 23. As suggested by Sugiyono (2021), if there are many sample groups, the researcher uses the most samples to identify class VII Ar, totalling 28, as the experimental class and class VII Ave, totalling 24, as the control class.

Data Collection Techniques and Data Analysis Techniques

Observation approaches are one method of acquiring data in which a researcher analyzes the symptoms in issue and records their interpretation (Romero Ariza et al., 2024). First observations were done as part of this study in order to understand the status of the school, its infrastructure and facilities, the teaching and learning process carried out by the instructor, and the condition of the population that would serve as a sample. The second way of data collection for this project entails delivering questionnaires to professionals in order to validate the scientific learning materials being developed. The third way of data collection is to provide cognitive exams to pupils in the form of a Pretest and Posttest. The pretest, consisting of 15 multiple-choice questions, is used to identify students' starting abilities prior to therapy, and the posttest, consisting of 15 multiple-choice questions, is used to examine the growth in students' scientific communication following treatment. The following experiment includes recording how often students utilize LKPD to communicate scientifically after making observations. A pre-test should be given prior to a session to assess students' prior knowledge, and a post-test should be given afterward to assess how much the teacher's lectures have improved students' skills (Septaria & Dewanti, 2019; Wardah et al., 2022).

Data interpretation is the methodical search and compilation of data from techniques of data collection based on field instruments such as observation, questionnaires, and tests. The material is then organized such that it is easy to understand and transmit to others (Iqbal et al., 2024; Yennita et al., 2023; Zein & Maielfi, 2020). Various types of data analysis were used in this investigation. First Validation data from media experts and material professionals are analyzed by complete tools modified by researchers from previous research. The instrument is made up of indicators and scoring criteria, which range from 1 to 5. The same may be said about how beneficial diorama media are. When completing the evaluation, use the Checklist mark () to indicate the appropriate column score. After the instrument has been filled, the analyses are computed. This instrument's formula was adapted from Sujanah Dian Saputri's study, and the findings are then based on the qualifying conditions. Researchers analyzed the criteria for the practicality of the learning medium that were being produced using percentage numbers, and then they examined the criteria. These criteria were developed with the help of Zulkilfi's 2020 research.

To examine the influence of diorama media on scientific communication, the test data/observation of students' growth in scientific communication, as well as the test cognition (pre-test and post-test) student results, were employed. The data was then examined for normality, homogeneity, and sample Paired T test using the SPSS (Statistical Programme for Social Science) version 24 application, which is a computer application program package for analyzing statistical data. The experimental and control classes' pre- and post-test data processing correspond to the paired-sample group of fewer than 100, which is why the sample Paired T test is utilized. Because this is a parametric statistical test, it is carried out utilizing a paired-sample T-test. The collection and analysis of data aims to find variances between pre-test and post-test learning outcomes in order to determine which learning outcomes are worthy of therapy. The average learning outcomes of the experimental group, which learned using three-dimensional diorama media based on guided inquiry on how living things interact with their environment, were then compared to the learning outcomes of the control group, which learned solely using LKS media with the lecture method.

RESULTS AND DISCUSSION

Development Procedure

Analysis Stage

Analysis of Teacher Needs

Science teachers have comprehensive teaching materials. The instructor sticks to the lesson plans and only utilizes the science and worksheet package books as additional material. Many students are not paying attention to what the teacher is teaching, so when the teacher asks the students questions, only a few of them can reply. The sentences in the textbooks and workbooks correspond perfectly to the replies supplied by the students to the teacher. It can be deduced if pupils are unable to understand the material presented by the teacher.

Analysis of Student Needs

Creative approaches to instruction must be employed to alleviate student fatigue caused by repetitious learning. Students will be more engaged if learning materials on the interactions of living things with the environment contain learning media. Class VII science courses focus on how living things interact with their surroundings, but the teacher largely utilizes textbooks and worksheets to explain the topics, and the students show little interest in reading and memory. Because of the intricacy of the instructor's explanations while using the lecture style, students are less able to absorb and retain the information provided by the teacher. As a result, students are unable to converse with one another or with the teacher in their native language.

Design Stage

Researchers were interested in developing three-dimensional diorama media for science learning by creating miniature natural scenes that display all aspects of simple ecosystems. The duplicates of things that will be placed on three-dimensional diorama medium must be identical to the original. Researchers developed a design idea for three-dimensional diorama media, including how big it should be and where copies should be placed. Researchers began accumulating materials in order to create three-dimensional diorama media. As soon as the relevant components are ready, begin assembling them to form an ecosystem. The three-dimensional diorama media included objects based on components such as various animal varieties, and advancements were then made by correcting the three-dimensional diorama media's design problems, notably the sun and water pools. The researcher's three-dimensional diorama media design may be seen in Figure 3 below.

Figure 3. Three-dimensional diorama media design

The three-dimensional diorama media product seen in Figure 3 above, the diorama media created by the researcher and measuring 30 x 28 cm, may be utilized for group learning in both big and small groups. The diorama medium is not fixed and may be opened and closed. Both the guided inquiry learning technique and the researcher's product are easy to use. Teachers use LKPD tools to lead students through the several stages of problem-solving (problem formulation, hypothesis, planning, implementation, data analysis, and conclusion). According to Humaira & Ninawati, (2023) this medium may be employed for observation or the smaller-scale display of material that seems identical to the original in order to spark the viewer's imagination. Students are able to develop after watching and investigating three-dimensional diorama material. When the instructor invites students to notice the pattern of food chains and food webs, the teacher instructs them to connect arrows to things that are producers, consumers, and composters. Researchers construct instruments in order to gain validation and make diorama media useable. In response to requests, instruments for media expert validation sheets and material expert validation sheets were designed (Putri, 2021; Septaria et al., 2022; Septaria & Fatharani, 2022).

Development Stage

Material Expert Assessment

According to the comments provided by specialist lecturers, the appropriateness value of three-dimensional diorama media is 94.2%. Material expert evaluation using the material expert validation sheet questions. The three-dimensional diorama media generated by researchers, according to material specialists, is particularly ideal for studying material on the interactions of living things, yet there are still critiques and ideas in the notes column or proposals for development. The material expert instructor proposed adding directions or arrows to the three-dimensional diorama media for each object, as well as other more comprehensive components, to define the position of each thing's components.

Media Expert Assessment

Based on the replies of media specialist lecturers, three-dimensional diorama media have an 85.7% appropriateness value. According to media experts based on the assessment questionnaire above, the three-dimensional diorama media developed by researchers is very suitable for use in science learning material on the interaction of living things, but there are still criticisms and suggestions in the note's column or suggestions for improvement. Experts in the media have suggested or commented that additional instructions be included in the diorama to demonstrate the food chain and its interactions, as well as the inclusion of species in ponds or other bodies of water to create an ecosystem and demonstrate the function of decomposers. Figure 4 depicts the three-dimensional diorama media picture after various enhancements.

Figure 4. Three-dimensional diorama media after revision

Overall Rating

The average of the evaluation findings of material expert lecturers and media expert lecturers is computed to get an overall validation score, as shown in table 5.

Table 3. Recap of the Assessment Results of Media Experts and Material Experts

Validation value	Score	P (%)	Note
Material expert	66	94.2%	Very worth it
Media expert	60	85.7%	Very worth it
Average	**63**	**89.95%**	**Very worth it**

As indicated in table 3, the total validation value is 89.95%, and after several repairs and revisions from material expert lecturers and media expert lecturers, the value is included in the highly practical criterion**.**

Implementation Stage

According to the examination of the remarks of the class VII Ar students, three-dimensional diorama media provide an 86% practical advantage in understanding how living things interact. Two students gave low grades for media usage signals because they had difficulty putting arrows on the components of three-dimensional diorama media, in their opinion. Then, in the learning component using student response indicators, four students scored moderately because they still wanted an exact duplication of their thoughts. For example, while creating a food chain, students wanted known plants or animals to serve as producers, consumers one, consumers two, and consumers three. Meanwhile, 28 students on average awarded the content an excellent rating, which included evaluations of information presentation and application. As a result, students may more easily comprehend the notion of the material while using diorama media to study content about living species in the environment.

Evaluation Stage

Analyzing the teacher's response, which was 86%, the science instructor indicated that he highly agreed with the use of three-dimensional diorama media in the content on the interaction of living beings with the environment. According to the results of the students' responses and the response assessment questionnaire filled out by the science subject teacher for class VII Ar during the product test, the researchers' three-dimensional diorama media was interesting and useful for use in science learning regarding the interaction of living things with the environment. However, when it comes to the substance, the indicators for how the information should be provided are in line with the characteristics of the students. . For the reason each student in class VII Ar has unique characteristics, it is difficult to modify them individually, and the instructor presented reasonable answers. The science instructor then provided advise and feedback, recommending that researchers construct larger three-dimensional diorama materials that can be utilized with more students and preserved in the lab for scientific learning materials on how living things interact with their surroundings. The ease with which students learn using guided inquiry-based three-dimensional diorama media is also impacted by the teacher's attitude toward them. Because educators construct, administer, and assess learning at the same time, their abilities have a substantial influence on how well students learn (Septaria et al, 2022).

Discussion

The Validity and Applicability of Media Diorama

There are various issues that need to be solved in the three-dimensional diorama media produced by researchers, but it has been deemed legitimate and extremely acceptable for usage based on the evaluation of answers from material expert validators and media specialists. According to Melinda & Ariyani, (2024), diorama media highlights the message content of the diorama media's character components. According to Al-faruq, (2023), the criteria for declaring media to be extremely practical is 81% x 100%, whereas the value of student and instructor answers is 86%. This leads to the conclusion that the diorama media produced by researchers is extremely practical. Considering the disadvantages of diorama media, Rahma et al., (2025) states that not all students are creative, the aim can only be achieved in a set size, and producing it requires both time and money. This shortage, however, had not yet materialized at the time of the research. This is a serious problem, especially given how engaged, imaginative, and passionate children are when learning about the interactions of living things with their surroundings through dioramas. Participants' originality and talents are enhanced by the character of interested pupils. The researcher's three-dimensional diorama medium elicited an active reaction from class VII Ar. The LKPD findings show that the average student score is higher than the KKM, at 85%.

To ensure the reliability of the instruments used in this study, we conducted a reliability test on the instruments, including the pre-test and post-test, as well as the questionnaire used to measure students' scientific communication. The reliability test results indicated that the instruments had a Cronbach's Alpha value of 0.85, demonstrating excellent internal consistency. Furthermore, stability testing using the test-retest method produced a correlation coefficient of 0.79, indicating that the instruments yielded consistent results over time. Therefore, the reliability of the instruments used in this study can be accounted for and supports the validity of the obtained data.

The researchers' worksheet (LKPD) takes a scientific communication skills approach by integrating KKI indicators such as information retrieval, scientific writing, listening and watching, information representation, and knowledge presentation. Students are divided into seven groups of four students each to study using a three-dimensional diorama media. For each group, each of the five indicators of scientific communication abilities was rated independently. The capacity of students to reply to LKPD questions is what provides the knowledge presentation indicator the highest score, while the data gathering approach gives the information retrieval indicator the lowest score. Students struggle to understand the distinctions between animals classified as consumers I, consumers II, and consumers III.

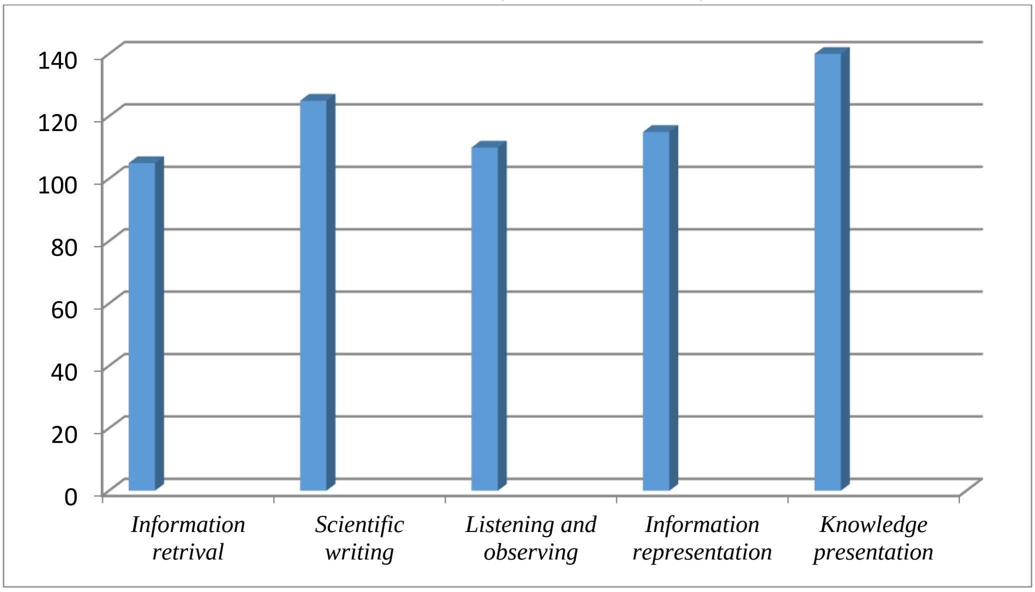

Figure 5. Graph of assessment scores for each KKI indicator in the LKPD

The figure above demonstrates how students in guided inquiry-based learning acquired the value of each indication from the worksheet. There are disparities in each indication because pupils' talents in each indicator varies. The knowledge presentation indication appears to have seen the greatest rise in scientific communication, with scientific writing coming in second, information representation coming in third, listening and observing coming in fourth, and information retrieval coming in last. Aside from the KKI method to LKPD, when creating diorama media, researchers pay close attention to the material idea and appearance of each component in order for it to seem appealing. According to Sari & Silalahi, (2022), while developing diorama media, bear in mind that the scene should not be too crowded and that the objectives should be related to the lesson being taught. According to Fitria, (2023), another issue with diorama media is that the size must correlate to the number of students who will utilize the learning medium. This is consistent with educator suggestions, which said that researchers should construct three-dimensional diorama materials in larger sizes or increase the quantity of diorama materials to meet the number of students (Farikhatin et al., 2024).

The Effect of Guided Inquiry Based Diorama Media on Scientific Communication

Analysis of Scientific Communication Test

The data was determined to be normally distributed, with a significance value of 0.058 > 0.05 for Pretest_Experiment, 0.85 > 0.05 for Posttest_Experiment, 0.058 > 0.05 for Pre_Test_Control, and 0.062 > 0.05 for Post_Test_Control. The quantity of data above and below the average, as well as the standard deviation, are said to create a normal distribution. It may be deduced that if the data is more than 0.05, it has a normal distribution with a 5% error rate (Jannah et al., 2020; Wardah et al., 2022). Because the pretest and posttest data are > 0.05, there is a substantial difference, and it may be stated that the pretest and posttest data are homogenous. According to Wardah et al., (2022), if the data is more than 0.05, the data is homogenous with a 5% error rate. Because the normality and homogeneity tests met the requirements, the data used by researchers can be continued for the next stage of data processing, namely the paired sample T test, which aims to determine the differences in learning outcomes between the experimental and control classes.According to the paired sample T test findings, there was a significant difference between the experimental class's pre-test and post-test learning outcomes and the control class's pre-test and post-test learning outcomes, as shown in table 7.

Table 4. Differences in the pre-test post- test of the experimental class and the control class

		Paired Differences							
		Means	std. Deviation	std. Error Means	95% Confidence Interval of the Difference Lower	Upper	Q	Df	Sig. (2-tailed)
Pair 1	Preetest_Eksprimen - Postest_Eksperimen	***-28.53571***	***13.45082***	***2.54197***	***-33.75140***	***-23.32003***	***-11.226***	***27***	***.000***
Pair 2	Preetest_Kontrol - Postest_Kontrol	***-15.00000***	***9.39473***	***1.91769***	***-18.96704***	***-11.03296***	***-7.822***	***23***	***.000***

In table 4, it is stated that the Sig (2-tailed) value in pair 1 Preetest_Eksprimen-Postest_Eksperimen is 0.000 0.05, indicating that there is a significant difference between the learning results of the pre-test and post-test in the experimental class, namely learning using three-dimensional diorama media. In pair 2, the Sig value is 0.00 0.05 (2-tailed), indicating that there is a significant difference between the pre-test and post-test learning outcomes in the control class. According to Sugiyono (2021), if the estimated t value in the paired sample T test is 0.05, there is a substantial difference between the data, specifically pre-test data and post-test data.

Table 5. shows the average difference in learning results between the experimental and control groups.

		Means	*N*	*std. Deviation*	*std. Error Means*
Pair 1	Pretest_Exprime	57.4286	28	13.55764	2.56215
	Postest_Experiment	85.9643	28	9.18325	1.73547
Pair 2	Pretest_Control	50.6250	24	10.47902	2.13902
	Posttest_Control	65.6250	24	15.49982	3.16389

Table 5 shows that in pair 1, the average learning outcomes for Pretest_Experiment were 57.4286 and Posttest_Experiment were 85.9643, indicating that the learning outcome value increased by 28.5357 after being exposed to three-dimensional diorama media based on guided inquiry. While the Pretest_Control pair 2 value was 50.6250 and the Posttest_Control value was 65.6250, the learning outcome value grew by 15,000, but not as much as in the experimental class. This suggests that there is a real association between learning outcomes utilizing guided inquiry and three-dimensional diorama media and learning outcomes using LKS media and the lecture approach, with an average difference of 20.3393. Only one scientific communication indicator, knowledge presentation, is employed in both the pre-test and post-test. There are 15 multiple-choice questions. Students demonstrate scientific communication abilities on the knowledge presentation indication if they can answer every question correctly. The data analysis undertaken by researchers examining the pre-test and post-test findings revealed an increase in scientific communication.

The results of the experimental class N gain score test averaged 0.65, which is in the middle category or 65%, indicating that it is fairly successful. According to the N test findings, the gain score for the experimental class averaged 0.27 in the less group, or 27%, indicating that it was ineffective. Thus, three-dimensional diorama media based on guided inquiry can be used quite effectively in class VII to train scientific communication regarding the interaction of living things with the environment, because learning science by providing direct learning experiences can improve scientific attitudes and scientific communication skills (Cormier & Langlois, 2022; Dakopolos et al., 2024; Esplugas, 2023; Nulhakim et al., 2022)

This study was based on several previous research references on the development of three-dimensional diorama media, research conducted by Umah et al., (2020), where this study focused solely on the creation of three-dimensional diorama media to see if it was reliable, doable, and useful to use as a science learning medium for content on how living things interact with their surroundings. This researcher's study looked at the influence on class VII students' scientific communication as well as the study's validity and applicability. Researchers innovated scientific teaching by using guided inquiry-based three-dimensional diorama media to explore how living things interact with their surroundings.

Analysis of Scientific Communication Non-Test

The progress of scientific communication skills may be seen based on how the students performed at the previous conference. Students' scientific communication abilities are evaluated from a range of perspectives, including information retrieval, scientific writing, listening and observing, information representation, and knowledge presentation. The highest possible score is five, while the lowest possible score is one. The data gathered is quantitative data that is descriptively analyzed using percentages. Science communication abilities were assessed to be 84.4% of those who were not evaluated. According to Pullu & Gömleksiz, (2021), a student with a score of >85 is deemed to have highly strong scientific communication abilities. Students in experimental class VII Ar earned a non-test score of 84.4%. As a result, it is classified as a criteria of scientific communication skill. This suggests that, on average, students are capable of communicating scientifically about the interconnections of living things using learning resources such as three-dimensional diorama media and guided inquiry learning approaches. Scientific communication talents, according to Pamungkas & Azmi, (2021) and Prasetyaningsih et al., (2024), improve students' understanding, allowing them to increase the importance of their learning results.

Many students, on average, awarded threes to the information retrieval and knowledge presentation indicators (two of the five employed). This was owing to the fact that these students had difficulty finding information on the three-dimensional diorama media provided by the researcher, as well as forming deductions. They typically keep silent while studying because they are embarrassed to ask the teacher questions. According to Septaria et al., (2024), the capacity of students to ask questions might influence the outcomes of cognitive learning. Students' cognitive learning outcomes improve as their capacity to ask questions improves. Some of these students' difficulties are caused by their status as special education students, while others are just disinterested in learning. Students had a high reaction in other measures, such as scientific writing, listening and watching, and information representation, ranking between 4-5. As a result, it can be concluded that there was an increase in scientific communication following the teacher's guidance and counsel that assisted students in overcoming their obstacles.

According to Aregehagn et al., (2022), the capacity of students to express scientific concepts has a significant influence on their scientific communication abilities. This is demonstrated by the fact that more students are actively seeking extra knowledge or resources from other sources, such as the internet and libraries. The LKPD results show that students can reply to LKPD questions based on their comprehension of observations made on three-dimensional diorama media, as indicated by the arrows students related to each component. Almost all of them accurately answered the questions. Students can also present their observations' conclusions to their classmates in front of the class in line with their particular writings, allowing each group's presentation to be unique. A particular organization, for example, may employ grass as a producer, but another group may use plants or maoni trees as producers and components. Some clients like zebras, while others prefer giraffes. Students can present in front of the class since the teacher plays an important role in offering instructions. According to Yasir & Khoiriyah, (2024), scientific educators must acquire argumentation or presentation abilities in order to subsequently aid students in developing knowledge and skills in giving arguments or presentations. According to the KKI indications, students in class VII AR as an experimental class experienced an increase in scientific communication on the knowledge presentation indication from their capacity to react to questions in LKPD and related the post exam. The improvement in science communication indicators may be attributed to students' abilities, which have always been of high quality.

CONCLUSION

The diorama media was reported to be incredibly legitimate and highly practical, thus the class VII science teacher acknowledged that the three-dimensional diorama media could be utilized as a learning medium employing worksheet (LKPD) with a scientific communication indication method. On the indication of knowledge presentation, there appears to be a rise in scientific communication. As evidenced by the rise in post test results of 20.3393, there is a meaningful effect between learning outcomes utilizing three-dimensional diorama media based on guided inquiry. The N-gain percent test result is 65%, indicating that it is highly successful, and three-dimensional diorama media may be utilized to educate scientific communication addressing the interaction of living beings with the environment in class VII.

RECOMMENDATION

Based on the findings of this study, it is recommended that educators incorporate three-dimensional diorama media into their science lessons, particularly in teaching topics such as the interaction of living organisms with their environment. Given the positive impact on students' scientific communication skills, teachers are encouraged to adopt guided inquiry-based learning methods combined with such media to enhance student engagement and understanding. Furthermore, future research could explore the long-term effects of using diorama media on students' critical thinking and problem-solving abilities. It is also suggested that the media be adapted to cater to different learning environments, such as larger classrooms, by scaling up the diorama models or developing digital versions. Additionally, further studies could focus on evaluating the effectiveness of three-dimensional diorama media in other science subjects and its integration with other innovative teaching methods.

Author Contributions

The conceptualization of the study was conducted by Yunis Sho'idah, Kiki Septaria, and Siska Ayu Wulandari. The methodology was designed by Yunis Sho'idah and Kiki Septaria, while Siska Ayu Wulandari contributed to the development of the study materials and instruments. Data collection and analysis were carried out by Kiki Septaria and Siska Ayu Wulandari. Yunis Sho'idah supervised the project and provided critical feedback during the development and implementation phases. The original draft of the manuscript was written by Kiki Septaria, with revisions and editing provided by Yunis Sho'idah and Siska Ayu Wulandari. All authors read and approved the final manuscript.

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Conflict of interests

The authors declare that there is no conflict of interest regarding the publication of this manuscript. The research was conducted impartially, and no financial or personal relationships influenced the results or interpretation of the data..

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