

Improving Student's Understanding About Animal Metamorphosis through Ecoterm Media for Deaf Students

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Abstract

This study aims to improve the understanding of deaf students in class VII Junior High School at SLBN Cicendo on animal metamorphosis material through ecoterm media. The method used was classroom action research with five learners as subjects. The research instruments included interview guidelines, observations, and written objective test adapted to the independent phase D curriculum on animal metamorphosis material. In the pre-cycle stage, learning using conventional media (videos) only achieved classical completeness of 20%. After the application of ecoterm media, the completeness increased to 40% in cycle I and 100% in cycle II. The written test results also showed a gradual increase. The ecoterm media proved to be effective because it provided a concrete learning experience that involved various sensory modalities, making it easier to understand abstract concepts such as animal metamorphosis. This study concludes that ecoterm media can significantly improve deaf learners' understanding of animal metamorphosis learning materials, helping them achieve more optimal learning outcomes.

Keywords: *Animal Metamorphosis, Deaf student, Learning media*

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INTRODUCTION

Science learning emphasizes on critical thinking skills that provide direct experience so that students can remember, identify, and apply their knowledge scientifically. One of the materials in science learning is understanding the concept of the animal life cycle (Permana & Nourmavita, 2017). The life cycle in animals starts from eggs to adults and each animal has a different life cycle. The life cycle of a butterfly will be different from the life cycle of a dragonfly, frog, rabbit, and other animals. The process of changing the function and size of an animal's body that occurs during the life cycle is called metamorphosis. The process of animal metamorphosis is a cycle because it will return to the starting point. The animal's life cycle ends when the animal dies and starts again from the beginning, namely birth, then grows and develops until it finally dies (Kurniawati, 2021). Metamorphosis can be divided into two types, namely perfect and imperfect metamorphosis (Wiyanti, 2009 in (Kindangen et al., 2020). This material is very relevant to begin to introduce

students to the concepts of basic biology concepts such as growth development and adaptation of living things they will learn more deeply when they are in high school. Animal metamorphosis material is one of the important materials in the independent curriculum in natural science subjects, especially in phase D, namely students who are at the SMPLB level in grades 7, 8, and 9 (Badan Standar, Kurikulum, 2024)

Deaf children are individuals who experience obstacles in hearing which result in limitations in language skills (Cole & Flexer, 2020; Reagan et al., 2021). This has an impact on communication skills which affect daily life. As a result of language limitations, deaf children are often referred to as having low cognitive abilities. Deaf children are visual individuals who rely on vision as a means of obtaining information (Cole & Flexer, 2020). Learning for deaf children requires its own strategies that are tailored to the characteristics of the child. Visual media, such as pictures, diagrams, videos, and animations, can provide concrete representations of abstract concepts, helping deaf learners to observe scientific processes or phenomena that may be

difficult to understand through text or sign language alone, such as the concept of animal metamorphosis.

Science learning, especially about animal metamorphosis, often involves abstract and complex concepts and vocabulary that require deep understanding. In line with Pratiwi, Genesa, and Arie's research (2021) which found deaf students who had difficulty understanding animal metamorphosis material due to many abstract concepts. For deaf learners this challenge is even greater with their limitations in hearing which hinders their understanding of verbal instructions used in learning the animal life cycle. The concept of animal life cycles involves gradual changes and cannot be observed directly in everyday life (Kurniawati, 2021). Deaf learners may have difficulty imagining the stages of change from egg to larva to adult if they rely solely on text descriptions or still images. Deaf learners may also face challenges in understanding scientific terms used in explaining animal life cycle concepts. Terms such as "larva," "pupa," and "metamorphosis" are words that are rarely used in everyday language, so they require more detailed explanations and visualizations to be well understood. To overcome these challenges, it is crucial for educators to use interactive and dynamic visual media that depict the animal life cycle process in detail. According to Sadiman (in Rahmayanti & Istianah, 2018) the use of learning media is very helpful in student learning activities because something in students works because of a stimulus (media) sent by the teacher so that the use of appropriate media can make students better understand the material. Learning media will make abstract material more real. Creative use of media can facilitate and improve learning efficiency (Kurniawati, 2021) therefore the use of appropriate visual media and as needed can help deaf students overcome obstacles in understanding abstract concepts and allow them to more easily associate information with more concrete learning experiences.

Understanding the concept of animal life cycle is one of the important aspects in science learning, especially for seventh grade students. However, based on initial observations at SLBN Cicendo, it was found that many deaf students in grade VII still did not fully understand this concept. Some important terms in the animal life cycle, such as tadpole and nymph, were still unfamiliar to them. In addition, learners also showed difficulty in understanding and sequencing the stages in the animal life cycle,

which resulted in their understanding of this material being incomplete. In the written test of animal metamorphosis material, students only obtained an average score below 20%. The learning approach used previously was usually the reflective maternal method to Discovery Learning, although the application of the method varied but the learning media used in the classroom was still makeshift media, usually static text or images printed into sheets of material. The implementation of learning with this strategy proves to be less effective in delivering complex material such as animal metamorphosis to deaf learners. Learning media that is less interactive and not in accordance with the characteristics of the learning needs of deaf learners results in them not receiving full information, which leads to a lack of understanding related to animal metamorphosis.

Therefore, a more innovative solution is needed and in accordance with the needs of deaf learners to improve their understanding of this material. Providing contextualized learning experiences is one of them with the help of visual media. Deaf learners generally have visual learning style characteristics. This is in line with the opinion of Marschark, Paivio and Spencer (Marschark et al., 2017) deaf individuals rely more on vision than hearing, both in communication (for example, reading speech, sign language) and in processing information in the wider world. Students who have a visual learning type will benefit more when learning using visual media (Kristanto, 2016). According to Skyker (2023) visual media can improve the quality and quality of language, science, and math learning for all ages and groups of deaf students, including at the primary, secondary and tertiary levels, both with and without additional disabilities.

Diorama is one type of three-dimensional visual media that has a more real visual appearance formed with the same scale or smaller than the original form (Kristanto, 2016). The use of visual learning media that is made by having similarities with the original object can help learning activities (Manggala, 2022). Diorama media helps students to be able to see objects or objects that are being studied, which may not be able to be brought to the classroom directly (Prasetya & Maisaroh, 2023). The object can be presented realistically in the form of miniatures or models that represent objects or phenomena that are difficult to show directly. This makes it easier for students to better understand the

learning material in a more visual and interactive way, so that it can strengthen their understanding of the concepts taught. Diorama media can help the learning process because it can increase understanding and strengthen the memory of students. With diorama media, it allows students to experience more real, interactive and meaningful learning. Learners more easily connect abstract concepts with visual and tactile experiences, thus increasing their understanding of learning more .

Previous studies that are relevant to the application of diorama media in teaching science or natural science include the following. Research by Shinta, Rodhatul, and Nur (2023) developed diorama media for human respiratory system material for grade V elementary school students. Another study (Alfhandy et al., 2024) applied diorama media in learning about the interaction of living things with the environment to increase interest and learning outcomes in junior high school students. Research from Edward Misfud (2018) explores the application of dioramas for learning about ecosystems, by visualizing flora and fauna can strengthen ecological understanding in students. Furthermore, there are also studies that apply diorama media for science learning in children with special needs, namely learning highlands and lowlands for children with autism spectrum (Homdijah et al., 2022)

This research applies diorama media in the form of terrarium to visualize the metamorphosis cycle of various types of animals for deaf students in grade VII. This media material is made from used gallons so that researchers named it eco terrarium or ecoterm. The novelty of this research lies in the use of a diorama terrarium designed with miniature animal components that can be moved, allowing learners to interact directly with learning media. This provides a more in-depth and interactive learning experience, helping learners understand the types and sequence of animal life cycles more concretely.

In this study, the understanding of deaf students on animal metamorphosis material is the ability of students to understand the types of metamorphosis (perfect and imperfect), sequence the stages in the animal's life cycle and explain the changes that occur at each stage. According to Anderson and Krathwohl (2001) cognitive level of understanding includes the ability to capture or construct meaning from the material learned. It involves skills such as identifying,

explaining, classifying, inferring and comparing information. In the context of this research, understanding animal metamorphosis in deaf children involves the following indicators. 1) Explaining the stages of animal metamorphosis, 2) Classifying animal species based on their metamorphosis stages, and 3) Linking each stage of metamorphosis with the physical and functional changes that occur.

Different from previous studies that used dioramas for materials such as the human respiratory system, the interaction of living things with the environment, or natural appearances, this research specifically focuses on learning animal metamorphosis for children with special needs, especially deaf learners. This approach has not been widely applied, thus offering a new contribution in science learning media innovation. Based on these considerations. The purpose of this study is to test the effectiveness of the application of ecoterm media on improving understanding of animal metamorphosis learning material for deaf students in class VII at SLB Negeri Cicendo.

METHOD

This type of research is classroom action research, which is to solve learning problems in the classroom. Classroom action research provides an overview of the application of a technique or media and how the desired results can be achieved in learning. the end result of action research will produce a concept or procedure of action that is better than the previous concept or procedure (Fahmi et al., 2021). This research seeks to improve the understanding of animal metamorphosis material in five deaf students in class VII at SLBN Cicendo with the action of applying terrarium diorama media. It is expected that the use of this media will provide a concrete learning experience, thus increasing learners' interest in learning and, in turn, deepening their understanding of animal metamorphosis.

This research was carried out in two improvement cycles, namely at the pre-cycle stage, cycle I and improvement ended in cycle II. Each cycle goes through four stages, namely a) Planning, b) Action, c) Observation and d) Reflect. The data collection techniques were carried out through observation, interviews and written tests to test students' understanding of animal metamorphosis material.

The indicator of success in this class action research is by looking at individual achievement

and classical achievement. Individual achievement, namely the action is said to be successful if students individually reach the learning objective achievement criteria value, namely $\geq 66\%$. The classical achievement is that a class is said to have completed its learning, if in the class there are $\geq 75\%$ of students who have completed their learning from the criteria for achieving the learning objectives that have been determined (Panjaitan et al., 2020)

The description of ecoterm media used is diorama media in the form of terrarium.

Terrarium is a glass or plastic container used to grow small plants or small animals in a controlled environment. Terrarium often resembles a mini ecosystem where plants or animals can grow and develop with conditions similar to their natural habitat (Manurung et al., 2023). This media is made from used gallons and contains miniatures of various animals that show their life cycle process. With an interesting visual experience, as well as the support of previously applied learning strategies, deaf learners can understand animal metamorphosis material more deeply.



Figure 1. Ecoterm media

RESULT AND DISCUSSION

The hearing impairment experienced by deaf learners greatly affects the development of their language skills, which in turn has a direct impact on academic performance (Alothman, 2021). Limited access to spoken language, as well as a lack of adequate sign language acquisition, often leads to difficulties in understanding abstract concepts, including in science materials. One of the main challenges deaf learners face is understanding the various terms in animal metamorphosis material, as well as understanding the exact sequence of the metamorphosis cycle. To address this, they need effective, interactive, and visually engaging teaching strategies that bridge the gap between abstract concepts and their understanding. Media like eco terrarium (ecoterm) can play a crucial role in this process.

This research was conducted in several cycles designed with improvement steps based on the evaluation results at each stage. The research began with the pre-cycle stage, where learning was still using conventional media, followed by the application of ecoterm media in cycles I and II. A significant increase can be seen from the results of students' learning completeness, both individually and classically, as well as from

observations of their activeness in the learning process.

Pre-cycle

Before taking action in the pre-cycle, researchers carried out planning activities, namely designing learning modules for animal metamorphosis material with conventional learning media and methods that had previously been used in class, namely learning videos with discovery learning methods, as well as research instruments in the form of observation guidelines and objective tests on animal metamorphosis material.

In the pre-cycle action. Initially, students seemed enthusiastic about listening to material about animal metamorphosis. However, when given a triggering question, students were still unable to answer correctly. Their understanding of the concept of metamorphosis is still less than optimal. This can be seen from the results of the pre-cycle test, where only one out of five learners achieved completeness based on the value of the learning objective completeness criteria, with an average classical completeness of only 20%.

Table 1. Learning outcomes at the pre-cycle

No	Student Name	Value	Completeness
1.	DN	35	Not complete
2.	LU	45	Not complete
3.	MO	60	Not complete
4.	RE	70	Completed
5.	TA	55	Not complete

Based on the observation of the pre-cycle action, the researcher reflected that the main weakness found at this stage was the lack of learner interaction during the learning process, learners only watched videos without understanding the material presented. Learning media in the form of videos only provide visual and audio experiences, which are less effective for deaf learners who also need more tactile stimulation in addition to visuals to understand concepts. According to Anderson (1987 in Yuanta, 2020) the shortcomings of video media lie in its one-way communication nature, so that students are less able to interact with learning materials.

Based on these weaknesses, then in the next cycle it is necessary to improve the action. Namely by using learning media that allows students to listen to learning material while interacting directly with the media so that in addition to creating learning conditions with more interactive communication, students also get a deeper understanding of learning about animal metamorphosis material.

Cycle 1

Based on the results of reflection on pre-cycle actions, researchers carried out planning activities for cycle I actions, namely by making learning modules and preparing ecoterm learning media that enabled students to learn more interactively and concretely. In addition, researchers also prepared research instruments in the form of observation guidelines and student worksheets for objective written tests on animal metamorphosis material.

Further action was taken in cycle I with ecoterm media. This media succeeded in attracting the attention of students, seen from their enthusiasm when they wanted to touch the miniature animals on the media. According to Wartini and Nia (2018), children will learn better if learning materials are presented through various sensory modalities, namely vision (visual), hearing (auditory), touch (tactile), and

movement (kinesthetic). This opinion in line with Basam and Sulfansyah (2018)) who state that children can learn optimally if the teaching materials involve various modalities of the sensory organs. By using this media, students can learn more optimally because ecoterm media provides learning experiences that involve various sensory modalities simultaneously. Learners not only see the miniature animals in the diorama (visual), but also can touch and feel the texture of the miniature (tactile), and actively involved in learning through interactive activities. As a result, learners' understanding of animal metamorphosis material increased compared to the pre-cycle. Classical completeness increased from 20% in the pre-class to 40% in cycle I, with two learners who reached the criteria for achieving learning objectives.

Table 2. Learning outcomes at cycle stage I

No	Student Initial	Value	Completeness
1.	DN	45	Not complete
2.	LU	65	Not complete
3.	MO	65	Not complete
4.	RE	85	Completed
5.	TA	75	Completed

Based on observations during the action in cycle I, only one learner was more active in answering the lighter question correctly, while the other two learners gave inappropriate answers and the rest were passive during learning. In addition, ecoterm media was more often used by teachers than learners. Only learners demonstrated the use of the media due to limited time, while other learners only listened without the opportunity to interact directly with the media, as a result, learning was still less interactive, and the learning material on animal metamorphosis was not fully understood by all learners.

Therefore, the researchers reflected that although there was an increase in learning outcomes, cycle I learning had not yet achieved classical graduation. There are still some weaknesses that need to be improved. In the next cycle all students should have the opportunity to use ecoterm media in turn, students are divided into small groups and collaboratively demonstrate the use of ecoterm media. Teachers need to reduce dominance in the use of media and act more as facilitators. Through this strategy, it is expected that learning will become more

participatory and students' understanding of the material can increase significantly in the next cycle.

Cycle II

Based on the results of the reflection in cycle I, the researcher developed an action plan for cycle II by revising the learning strategy and supporting tools. Shortcomings in cycle I, such as the lack of active involvement of students and teacher dominance in learning, became the main concern in this planning. The researcher developed a revised teaching module to better support collaborative learning. In addition, the learning strategy was designed to encourage interaction between learners through group work, where they took turns using the ecoterm media to demonstrate their understanding of the stages of metamorphosis

In cycle II action, learning took place more interactively compared to the previous cycle. Learners as a whole get the opportunity to interact directly with ecoterm media. Learners listened to the explanation of the material from the teacher while the teacher facilitated learners to collaborate with each other to demonstrate the use of ecoterm media, starting from attaching the types of animal metamorphosis to sorting miniature animals according to the stages of metamorphosis. This activity provides a deeper understanding of the material because students not only listen, but also actively use the media and interact with their groupmates.

Table. 3 Learning outcomes at cycle stages II

No	Student Initial	Value	Completeness
1.	DN	85	Completed
2.	LU	90	Completed
3.	MO	95	Completed
4.	RE	100	Completed
5.	TA	95	Completed

Furthermore, researchers reflect that the increase in understanding of animal metamorphosis material in deaf students can occur due to several factors, namely. The use of ecoterm media provides a multisensory learning experience, in addition to seeing students also touch and move components on the media. Furthermore, learning in groups allows students to discuss with each other and practice directly the understanding they get. In addition, the teacher's role as a facilitator helps to create a supportive learning atmosphere, learners are more active participants during the learning process. Representation of information through various methods and experiences can strengthen students' memories because the information is stored in various locations in the brain (Easterbrook, 2020). The ecoterm media supports this by providing diverse learning experiences, involving visualization, hands-on manipulation and discussion creating opportunities for learners to connect abstract concepts of the stages of metamorphosis into tangible forms that are easier to understand.

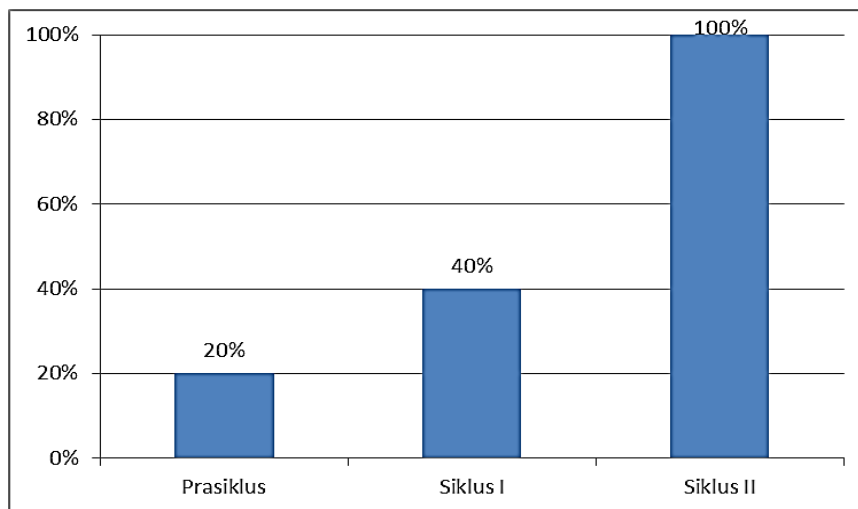


Figure 2. Comparison of classical completion rate in each cycle

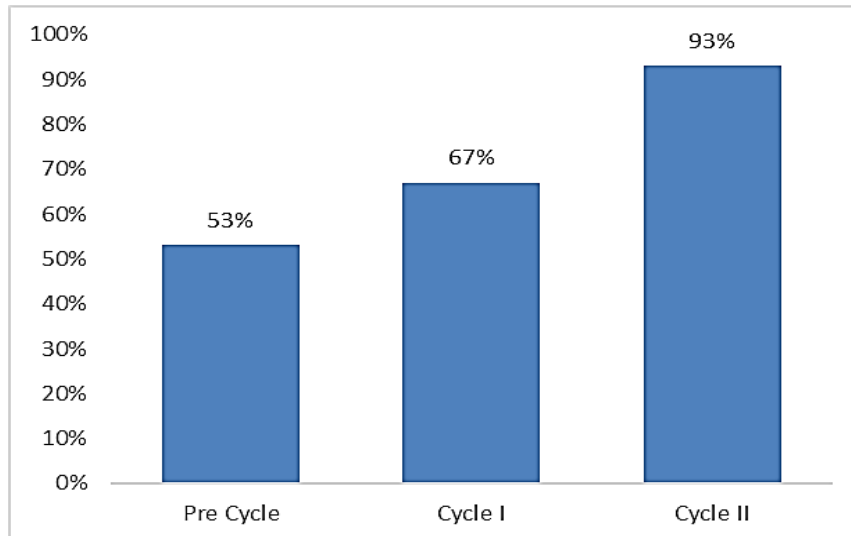


Figure 3. Comparison of average levels in each cycle

CONCLUSION

Based on the results of the classroom action research that has been conducted, it can be concluded that the use of Ecoterm media has a significant impact in improving deaf student understanding of animal metamorphosis material. In the pre-classroom stage, learning still used conventional media such as pictures and videos, which although useful, were not fully able to convey the concept of metamorphosis optimally to deaf learners. The lack of direct interaction with the media caused learners' understanding to not be maximized, which was reflected in the low level of classical completeness of 20%. However, with the introduction of Ecoterm media in cycle I and optimizing its use in cycle II, there was a significant increase in classical completeness, from 40% in cycle I to 100% in cycle II. The average written test results also increased gradually.

So that a better solution to combine the use of Ecoterm media with conventional media that visual media such as videos can successfully provide a more concrete and interactive learning experience, which is needed by deaf learners. Collaboration between artificial media such as Ecoterm and visual media such as videos can complement each other in strengthening the understanding of abstract concepts, such as metamorphosis, of animals by involving various modalities of the sensory organs, thus creating a more comprehensive learning experience for deaf student.

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