



THE EFFECT OF DISCOVERY LEARNING ON THE DEVELOPMENT AND STRENGTHENING OF UNDERSTANDING BASIC CONCEPTS IN BIOLOGY BASED ON STUDENTS' EXPERIENCES

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| ARTICLE INFO | ABSTRACT |
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| Article history | <i>The Indonesian government is currently implementing two types of curriculums, namely the 2013 curriculum and the 'Merdeka' curriculum which has been implemented for 2 years. Both of these differently named curriculums run together at different academic grades throughout Indonesia. Although they have different names, both curriculums have similarities in the application of their learning process, which is inquiry-based learning. This study aims to investigate how learning in discovery learning can improve student learning outcomes and basic skills or not? This research is a mixed method because there is no control class, because this study only consisted of 1 independent variable and dependent variable, and did not compare one independent variable with other independent variables. This research is only to see how the effect of the application of discovery learning on student learning outcomes and basic skills. the sample is designed with a one-group-pre-post test design. taking the population non-randomly. The data is generated from pre-test and post-test, distribution of questionnaires and observations during learning. The test results have an N-Gain of 14.33 and the results of the questionnaire search show all of the science process intellectual skills in the good category, such as find new concept, making prediction, and summarized based on experiences.</i> |
| Submission 2023-03-01 | |
| Revision 2023-03-20 | |
| Accepted 2023-04-12 | |
| Keywords: Discovery learning, Basic concepts, Student experience, Biology learning | |

INTRODUCTION

The 2013 curriculum was initiated by the Ministry of Education and Culture of the Republic of Indonesia to replace School-Based Curriculum (Indonesian: KTSP – Kurikulum Tingkat Satuan Pendidikan) to meet the demands of the 21st Century

competence needs, including scientific reasoning abilities. This is because scientific reasoning skills will help students deal with new problems and plan investigations to solve real-life scientific, engineering, and social problems (Bao, et al., 2009). Students who are used to being sensitive to problems and solving it with their knowledge are ready to face other problems. Shofiyah, et al. (2013) It is hoped that scientific reasoning can be developed and trained in students in schools as an effort to prepare students so that they are successful in facing the challenges of globalization and enable students to be able to handle real-world tasks in their future careers (Erlina, 2016).

One learning model that is in accordance with the essence of Natural Sciences (IPA) and in accordance with the guidelines stated in the 2013 curriculum is the inquiry learning model. In inquiry-based learning, student learning patterns that were previously passive changed to become active and creative, with students becoming the center of previously teacher-centered learning (Ministry of Education and Culture, 2017). The Indonesian government is currently implementing two types of curriculums, namely the 2013 curriculum and the 'Merdeka' curriculum which has been implemented for 2 years. Both of these differently named curriculums run together at different academic grades throughout Indonesia. Although they have different names, both curriculums have similarities in the application of their learning process, which is inquiry-based learning. Teachers can apply inquiry-based learning based on the guidelines specified in the curriculum or implement other inquiry-based learning methods, one of which is Wenning's levels of inquiry.

This research is deemed necessary, because discovery learning is a basic stage that must be properly trained to students as a preparation for carrying out learning activities in the next stage. In the hierarchical levels of inquiry, the higher the stage, the less the role of the teacher, and the more the role of the students increases. For this reason, this research needs to be carried out, so that students are ready to take part in learning with the LoI model and master all the intellectual skills of the science process well. Implementation of LOI on biology learning has an effect to increase scientific reasoning (Sopiyanti, 2019)

Students are ready to learn Biology, they are used to doing levels of inquiry learning and have high motivation to carry out their learning. Provides applicable recommendations regarding the levels of inquiry model which can be used as an effective

learning alternative and can increase students' higher-order thinking skills so that students can construct their knowledge independently.

The inquiry principles used in this research plan are those developed by Wenning (2005), namely a series of six-level oriented learning activities: discovery learning, interactive demonstrations, inquiry lessons, inquiry lab, real-world applications, and hypothetical inquiry. The application of levels of inquiry in inquiry learning involves a lot of student activity (Fatmawati & Utari, 2015) which allows students to learn meaningfully (meaningful learning), systematically, and comprehensively because at each stage different intellectual abilities are trained (Fatmawati & Utari, 2015).

Discovery learning is the most basic form of levels of inquiry. The principle of discovery learning is "I find". The main focus of discovery learning is to build basic meanings or concepts based on experience. Students have not reached the stage of finding equations or mathematical relationships. Discovery learning uses reflection as the key to understanding knowledge. (Wenning, 2004). Previous studies have examined a lot in physics subjects, and still biology has different types of learning objects but are contextual with problems around the student's environment, so that the skills of finding problems and building concepts need to be trained in biology learning.

This study aims to develop and strengthens the understanding of basic concepts in biology based on the student experience. This study investigates the impact of discovery learning on the development and strengthening of understanding basic concepts in biology, based on the experiences of students. The research aimed to explore the effectiveness of a discovery learning approach in enhancing students' comprehension and retention of fundamental biological principles. This study emphasizes the value of discovery learning as a powerful pedagogical approach for facilitating students' comprehension and mastery of basic concepts in biology."

MATERIALS AND METHODS

This research used mixed method and design used a one-group pretest-posttest design. One group is measured before and after treatment, with the reason that this research is not to compare one model with another but to find out how the discovery learning method influences the understanding of biological concepts in the food digestive

system. The population in this study consisted of 32 high school 11th grade students. The sample is determined through non-random sampling technique. The technique of collecting data is by giving a pre-test and post-test, then looking for improvements. In this discovery learning model, there are 3 questions given to measure students' basic skills. Before learning students get a pretest, after learning with the discovery learning method, students get a posttest. In addition to quantitative data, researchers also collected quantitative data by distributing questionnaires to find out students' responses about their basic intellectual abilities in science processes, then the data were processed to find out what percentage of basic skills were mastered in Biology learning on human digestive system material has been experienced by students since elementary school and junior high school so that with the knowledge students have about the digestive system, teachers can develop student knowledge in learning in high school. At the beginning of learning the digestive system in the levels of inquiry model, it starts with the lowest levels, namely discovery learning. At this stage, the teacher arranges learning activities that can train students to have the skills of observing, formulating concepts, estimating, making conclusions, communicating results, and classifying results.

The learning activities prepared by the teacher are learning with demonstration methods which involve students involved in observing the results of demonstrations, the teacher builds and formulating concepts based on the results of demonstration activities, and the teacher inviting students to be able to predict the relationship between the results of demonstration activities and learning objectives and helps students to be able to make conclusions based on the results of their observations, the teacher asks students to explain the results of their observations and the teacher helps to make groupings based on observations during learning.

RESULTS AND DISCUSSION

The results of the pre-test and post-test are shown in Table 1, showing an increase of 14.33%, this shows that there is a good understanding after learning with discovery learning because children learn more meaningfully, learning about the digestive system of food given to eleventh-grade students majoring in science in the fourth semester. The discovery learning stage was carried out in 1 meeting with a duration of 90 minutes.

Learning the digestive system in humans begins with the discovery learning stage of a series of stages of levels of inquiry. Learning begins with trigger questions given by the teacher to measure students' understanding of the material to be taught. The teacher wrote down the questions asked by students on the blackboard and gave other students the opportunity to answer questions. The teacher did not give a response to whether the answers were right or wrong until the results of the activities carried out by students are obtained.

Table 1. Pre-post Test Result

| Pre-test | Pos-test | n-Gain |
|----------|----------|--------|
| 67 | 81.3 | 14.33 |

Learning about the digestive system of food is given to eleventh-grade students majoring in science in the fourth semester. The discovery learning stage is carried out in 1 meeting with a duration of 90 minutes. Learning the digestive system in humans begins with the discovery learning stage of a series of stages of levels of inquiry. Learning begins with trigger questions given by the teacher to measure students' understanding of the material to be taught. The teacher writes down the questions asked by students on the blackboard and gives other students the opportunity to answer questions. The teacher does not give a response to whether the answers are right or wrong until the results of the activities carried out by students are obtained. A series of discovery learning activities are presented in Table 2.

Table 2. Discovery Learning Learning Activities.

| Discovery Learning | |
|--|---|
| What teachers do... | What students do... |
| 1. The teacher shows the students a few grains of rice in the petri dish and asks the students to drop 1 drop of Lugol's solution on the rice. | 1. Observe the color of the rice based on the sequence of activities requested by the teacher and record the results in the observation table |
| 2. The teacher asks about the color of the rice after adding Lugol's solution. | 2. Answer the questions asked by the teacher about the results of observing the treatment demonstrated by the teacher. |
| 3. The teacher asks the students to mash the rice using a mortar, then drops 1 drop of Lugol's solution. | 3. Grind the rice with a mortar, and drip 1 drop of Lugol's solution |
| 4. The teacher asks about the color of the rice that was mashed when Lugol's solution was dropped. | 4. Observe the color of the rice and record the results in the observation table |
| 5. The teacher asks whether there are similarities or differences between the two treatments. | 5. Distinguish the results of the two treatments |

Discovery Learning

| What teachers do... | What students do... |
|---|--|
| <ol style="list-style-type: none"> 1. The teacher asks if saliva is added to the rice and Lugol's solution is dropped, will the color be the same? 2. The teacher asks students to add saliva with rice in a petri dish and then drops Lugol's solution. 3. The teacher asks how the color of the rice is when it is mashed and added saliva and drops of Lugol's solution, 4. The teacher asks the students to mash the rice by chewing it until it is smooth and adding drops of Lugol's solution. 5. The teacher asks students to record the results of observations in the observation table 1. The teacher asks questions to discuss results, identify relationships, draw conclusions, and build understanding based on observations. <ol style="list-style-type: none"> a. Does the purpose of the food have to be mashed before adding Lugol's solution? b. Why is food added to saliva? c. What happens when food enters and is chewed in the mouth? d. What is the role of the teeth when the food is chewed? e. What is the role of the tongue when the food is chewed? f. What happens when food is swallowed? 2. The teacher conducts questions and answers to bring up the concept of chemical digestion based on changes in the color of starch from the experimental results 1. Asking the question of why food must undergo digestion 2. Ask questions about the concepts of chemical digestion and mechanical digestion 3. Delivering the results of the starch trial 4. Determine which foods contain starch and which do not contain starch | <ol style="list-style-type: none"> 1. Answer questions asked by the teacher about the treatment demonstrated by the teacher 2. Storing rice in a petri dish 3. Dripping saliva into the rice 4. Drizzle Lugol's solution into the rice 5. Record the results of observations 6. Answer the teacher's question about how the color of the rice will be if it is mashed and added saliva and drops of Lugol's solution, 7. Chew rice until smooth 8. Store the chewed rice in a petri dish and drip Lugol's solution 9. Record the results of observations into the table of observations 1. Answer the questions posed by the teacher regarding the results of observations with the aim of why food must be mashed before adding Lugol's solution. 2. Drawing conclusions based on observations about how the role of saliva when food is in the mouth. 3. Draw conclusions based on observations about how the role of the teeth and tongue when food is in the mouth. 4. Based on the results of the discussion, students get the concept that polysaccharides are converted into maltose by amylase enzymes in the oral cavity. 1. Answering questions asked by the teacher about why food must undergo a digestive process in the body, 2. Make conclusions about the differences between mechanical digestion and chemical digestion 3. Delivering the results of the starch trial 4. Determine which foods contain starch and which do not contain starch |

Learning the Digestive System in Humans designed and implemented by the teacher in the classroom involves students so that they can have basic skills to work in the laboratory because during learning students are involved in doing hands-on activities in teacher-guided demonstration activities. Some of the activities that involve students

are dropping substances, and identifying colors in the observations. The teacher observes how students carry out activities during demonstrations, and if they find students who do it incorrectly, the role of the teacher as a facilitator is to provide instructions and examples of how to do it properly.

During the learning process, the teacher involved in building basic concepts about the material being taught through productive questions, providing opportunities for students to ask questions, explaining findings during learning as well as opportunities for discussion in their respective groups, as well as discussions involving all students guided by the teacher. Teachers should refrain from answering questions posed by students, and teachers should direct and relate the findings of the experiment to answers to student questions. this is done so that students can answer their questions by connecting what they got during the experiment with the knowledge they had before.

Inquiry learning at the discovery learning stage provided an opportunity for teachers to observe students' scientific attitudes. Teachers could observe students who are often involved in working in the laboratory, often carried out activities in the laboratory, and had no experience working in the laboratory so that the teacher can provide training and knowledge on how students can carry out activities in the laboratory. Figure 1. Show the basic skills student achievement in discovery learning.

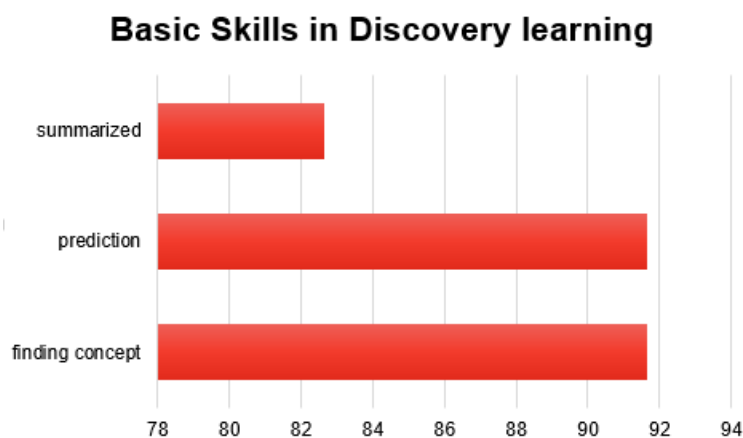


Figure 1. Basic Skills in Discovery Learning

The figure showed that the picture shows that the skills of finding concepts, predicting, and making conclusions are in the good category, this shows that students have learned some of the most basic learning experiences from the intellectual science processes well. Teachers as facilitators are expected to have a good preparation before carrying out learning with the discovery learning model. The teacher must prepare a good

conceptual understanding of the material to be taught. Teachers must have the skills to ask and manage discussions with students to build concepts related to the material being taught. During learning the teacher must be ready to accept student answers and relate them to the material being taught into concept constructions to build student understanding.

CONCLUSION

Learning biology with discovery learning can improve students' abilities and train their basic scientific skills, and it is hoped that they will be ready to face the next levels of levels of inquiry. Discovery learning empowers students to actively participate in learning, construct their own understanding, and develop a deeper and more meaningful comprehension of basic concepts. By engaging in hands-on exploration, making connections, and applying knowledge in authentic contexts, students can build a solid foundation of understanding that extends beyond rote memorization.

ACKNOWLEDGMENT

I would like to express my deepest appreciation to my supervisors, who provided me with a lot of new knowledge. I could not have undertaken this journey without my very supportive family and their precious feedback and motivation. I am also thankful to all my friends for keeping my spirit high and providing emotional support.

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