STATE UNIVERSITY OF MEDAN

THE EFFECT OF PROJECT BASED LEARNING MODEL ON STUDENTS LEARNING OUTCOMES AND ACTIVITIES IN LIVING THINGS CLASSIFICATION SUBTOPIC AT SMAN 1 TANJUNGBALAI

THESIS

Submitted to Fulfill The Requirements for
The Degree of Bachelor of Education

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MEDAN
DECEMBER 2024

MOTTO

"And be patient, indeed Allah's promise is true." -Q.S Ar Rum: 60 .

It's okay to be sad, emotional and complain, as long as you never give up.

Thesis:

The Effect of Project Based Learning Model on Students Learning Outcomes and Activities in Living Things Classification Subtopic at SMAN 1 Tanjungbalai

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BIOGRAPHY

The author of the thesis entitled The Effect of Project Based Learning Model on Students Learning Outcomes and Activities in Living Things Classification Subtopic at SMAN 1 Tanjungbalai has a full name Nindya Zayani Ekaputri**.** She was born in Medan, on December 9, 2001. The writer is the first child (of two siblings) of Sufri Eka Dharma (Father) and Endah Herawati (Mother). The author started her formal education at SDN 132402 Tanjungbalai in 2008 and graduated in 2014. After elementary school, the author continued his studies at SMP Negeri 1 Tanjungbalai and graduated in 2017. High school education, Science Department, was taken for 3 years from 2017 to 2020 at SMA Negeri 1 Tanjungbalai. In 2020, through the SNMPTN pathway, the author was accepted as one of the students in the Bilingual Biology Education Study Program, Faculty of Mathematics and Natural Sciences, Medan State University. In December 2024, the author is declared to have passed the thesis defense exam, and is entitled to use the Bachelor of Education (S.Pd.) degree. During her studies at Unimed, the author participated in various campus and national seminar activities, organizations, and joined laboratory assistant team for several courses from semesters 5 to 6. The author has also carried out KKN in Cempedak Lobang Village as a form of community service.

ABSTRACT

Nindya Zayani Ekaputri. 4201141010 (2024). The Effect of Project Based Learning Model on Students Learning Outcomes and Activities in Living Things Classification Subtopic at SMAN 1 Tanjungbalai.

Some students haven't implemented PjBL to develop cognitive, soft skills and character. PjBL is necessary implemented to shows a learning process where students are involved in working on a project where the results show that PjBL has more positive impact on students' academic results, such as students' learning outcomes (cognitive) and activities (psychomotor). This study aims to find out the effect of PjBL model to students learning outcomes and activities on living things classification subtopic in class X at SMAN 1 Tanjungbalai. This research method is quasi experimental. The population in this study were all class X Students of SMAN 1 Tanjungbalai in 2024/2025 academic year. The samples are class X-4 as an experimental class and class X-6 as a control class. The sampling technique was determined by purposive sampling. Data were obtained by interview, observation, and giving pretest and posttest each totaling 30 questions. The data analysis technique uses t-test statistical analysis. Data results were obtained the sig (2-tailed) value of 0.000 < 0.05. It was found that there is an effect of PjBL model on student learning outcomes and activities. Implementation of this learning can increase student activities as seen from a score of 77 with active criteria.

Keywords: PjBL, Learning Outcomes, Student Activities, Living Things Classification

FOREWORD

Alhamdulillah, praise to the presence of Allah SWT thanks to His taufik and guidance so that the author can complete the thesis entitled "The Effect of Project Based Learning Model on Students Learning Outcomes and Activities in Living Things Classification Subtopic at SMAN 1 Tanjungbalai". This thesis was prepared to fulfill some of the requirements needed to achieve a Bachelor of Education degree in the Biology Education Study Program, Faculty of Mathematics and Natural Sciences (FMIPA), Medan State University (Unimed).

The preparation of this thesis has gone through a long, tiring journey and various stages in accordance with the standard procedures that apply at FMIPA Unimed, starting from the stage of determining the research topic, preparing and seminar proposals, conducting research, preparing the thesis, and defending the thesis exam. There were many challenges that the author faced while completing this thesis, but Allah always helps and provide a solution for her.

In completing the writing of this thesis, the author received a lot of direction, guidance and assistance from many parties. Therefore, on this opportunity, the author would like to express his deepest thanks and appreciation to the honorable Ma'am Khairiza Lubis, S.Si., M.Sc., Ph.D., as a Thesis Supervisor, for his extraordinary guidance, motivation, and direction, so that all stages in the preparation of this thesis can be passed well until the end. Thanks to Prof. Dr. Masdiana Sinambela, M.Si., Prof. Dr. Tri Harsono, M.Si., and Widia Ningsih, S.Pd., M.Si., as an Examiner Lecturer, and also Dr. Ely Djulia, M.Pd. as an Academic Supervisor who has given a lot of criticism and suggestions for improvement starting from the proposal seminar to the exam stage to maintain the thesis, so that this thesis can be completed properly. Halim Simatupang, S.Pd., M.Pd., Hasruddin, M.Pd., and Rizal Mukra, M.Pd. for his invaluable assistance through the validation of research instruments. Deddi Anshari, S.Pd., M.Si., as the Principal and Eka Sari Wahyuni, S. Pd as a Biology Teacher at SMAN 1 Tanjungbalai, with his help, was willing to accept and give the author the flexibility to conduct research at the school. As well as for X-4 and X-6 class who are happy to be the author's research samples. Dear family, Mr. Sufri Eka

Dharma, Mrs. Endah Herawati, Quentin Hilmi Yasa, Ms. Sofhia Aini Lubis, Aunty Dewi, and Om Umar, who always give the author encouragement, prayers, and inspiration, therefore the writer can be at this stage until completing this thesis. May Allah always gives health and happiness in our life. My dear classmates, BESP 2020, especially Asnawi Saragih, Juwita Perdede, Trisnawaty br Lingga, Salamah Harahap, who have been with me from the beginning to the end of my education, hopefully what we hope can be achieved. My dear friends, Indah, Novira, Tommy, Mutiara, Novia, Wiyenti, Ajwadi, and Rizka, who has become my family overseas, who always helps, accompanies and gives encouragement to me, may good things always come to us and hopefully our matters will always run smoothly.

The author realizes that this thesis still has shortcomings and limitations, however, while expecting constructive criticism and suggestions, the author hopes that this thesis can be useful for related parties, especially the Unimed biology department. Greetings grow and develop.

Medan, 3 December 2024

Author,

Nindya Zayani Ekaputri

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CHAPTER I
INTRODUCTION

1.1. Background of Sudy

Education is a learning process in the form of teaching and learning activities that produce interaction between students and teachers. In the field of education, teachers become educators who guide students to develop knowledge and change students' attitudes from ignorance to knowledge. Education is considered one of the main determinants of economic growth by increasing the productivity of an educated workforce, and is also considered to play an important role in ensuring development and livelihoods of society. The quality of education is determined by two things, namely the quality of the process and the quality of the results. The quality of education is said to be high if effective and efficient learning takes place in all aspects of learning, such as learning objectives, teachers and students, learning topics, learning strategies and methods, learning tools and materials, and assessment. The success of providing education is influenced by many factors, one of which is the teacher's willingness to prepare students for learning activities (Sari & Angreni, 2018).

Indonesia has implemented several curriculums that have undergone various changes and improvements since 1947 until now. Kurikulum Merdeka, a newly introduced curriculum, is designed to create a learning environment where students can engage in education calmly, enjoyably, and without stress or pressure. It aims to allow students to express their natural talents. The concept of Merdeka Belajar emphasizes freedom and encourages creative thinking. PjBL is in line with the Kurikulum Merdeka because it emphasizes meaningful learning processes, process-based assessments, and the development of 21st century skills. The flexibility of PjBL is also in accordance with the principles of the Independent Curriculum, which provides space for teachers and students to adapt learning to their needs and interests. (Rahayu, 2022).

In senior high school, some students experience learning difficulties. One of the subjects experienced was biology. Biology is a subject that requires students to understand and master a biological concepts since class X. Biological

concepts means biology is related to how to find out and understand interactions of living things and nature systematically. If students have limited knowledge of biological concepts and principles from the start, it is difficult to expect real results from students in the following years. The author have done an interview with the biology teacher in grade X at SMAN 1 Tanjungbalai. Based on the interview, some problems are found. Some students in grade X get difficulties in studying biodiversity specifically in animal classification subtopic in distinguishing characteristics and taxonomy of living things. There are as many as 60% of students in grade X SMAN 1 Tanjungbalai who have achieved the Minimum Completeness Criteria (KKM) on the daily test scores, while another 40% of students have not achieved the KKM. It happened because there are some students were not focus on class. Students experience learning difficulties and get bad learning outcome not only These factors may stem from internal or from external sources. Internal factors include the student's health, intelligence, interests, and motivation. On the other hand, external factors encompass influences such as family, teachers, and the school environment (Tamba, *et.al*.,2020).

The biology teacher in Grade X SMAN 1 Tanjungbalai also told about the learning media. The teaching media used in learning the animal classification subtopic is not yet available, they only receive information from printed books and teacher’s PowerPoint. Insectarium is a learning media that has been used for a long time. Apart from its practical and economical use, the insectarium is considered the right solution because it can be taken anywhere, both in the classroom and in the laboratory. With the result, it would not be possible if in learning, for example, regarding insect topic, students were immediately sent into the field. Because apart from considering the allocation of limited learning time, student safety is also a primary consideration. The use of insectarium learning media is very necessary in the biology learning process (Susilo, 2015).

Helle et al. (2006) reported that the implementation of the Project Based Learning Model (PjBL) in student learning was mainly restricted to aspects like course scope, instructor requirements, and team size. PjBL's effects on student learning were observed in cognitive (e.g., knowledge), affective (e.g., motivation),

and psychomotor (e.g., activities) domains. Similarly, Ralph (2015) analyzed fourteen studies on the use of PjBL in STEM education and discovered that PjBL helped enhance students' knowledge and skills. It also promoted collaboration and negotiation within groups, though some students expressed a lack of motivation for teamwork.

Based on Law Number 20 of 2003, it is clear that the task of a teacher is not only to convey knowledge, but also teachers still have a lot of work, namely raising students to become perfect human beings, so it can be said that the task of teachers in 2003 is more difficult. A teacher is required to have various skills as a professional teacher in his field. A teacher must understand his role in order to achieve the expected learning objectives when delivering the subject and must have 4 basic teaching skills, namely: pedagogical skills, personal skills, professional skills and social competence. a pleasant and enjoyable learning atmosphere for students, so that learning objectives can be achieved well. To solve this reality, teachers must make improvements to their classes and learning practices, one of which is the use of the project-based learning model (PjBL). Project-based learning is learning where students are directly involved in creating a project (Sari & Angreni, 2018).

Helle et al. (2006) found that the implementation of the PjBL to achieve good learning outcomes, media plays a crucial role as a supporting factor in reaching educational goals. Utilizing suitable and diverse media in the learning process can enhance students' motivation and reduce their passivity (Hardianto, 2005). Furthermore, the use of learning media is not only needed in classroom learning, but also in experiments to sharpen skills. In carrying out experiments, teachers must have learning media that are expected to help students understand learning topic and obtain learning results. One of the learning media needed in experiments is insectarium to help studying animal classification.

However, the goal of skill is not easy to achieve because traditional learning still applies a role where the teacher is the "transmitter of knowledge" while the student plays the role of "receiver of information". As a result, students may find it challenging to fully immerse themselves in educational activities, potentially leading to a superficial understanding of the subject. To change this

situation, it is recommended that students be given opportunities to participate in problem solving. In the Kurikulum Merdeka, students are asked to gather information with a scientific approach, develope skills and character, and have a flexible learning. One effective approach to achieving this goal is through project-based learning (PjBL). In this research, PjBL involves students in hands-on project work, and the results indicate that PjBL has a more positive impact on students' academic performance compared to traditional direct instruction methods (Guo, 2020).

On this basis, it is necessary to innovate the Project-Based Learning (PjBL) model so that these requirements can be met fulfilled, namely by integrating a process skills approach in the Project-Based Learning (PjBL) learning model to teach scientific skills and integrating models, approaches, methods or strategies in the Project-Based Learning (PjBL) learning model which can lead students to master the subject before entering process of scientific inquiry.

1.2. Problem Identification

Based on the background described above, the following problems have been identified:

1. Some students report that they were lack of motivation for teamwork in group assignment. Therefore, PjBL can be used to encourage the way they collaborate and negotiate in groups.
2. The students have not implemented PjBL to develop cognitive, soft skills and character in Kurikulum Merdeka.
3. The teaching media used in learning the animal classification subtopic at SMAN 1 Tanjungbalai in grade X is not yet available, they only receive information from printed books and teacher’s PowerPoint.
4. Some students in grade X at SMAN 1 Tanjungbalai get difficulties in studying animal subtopic in distinguishing characteristics and taxonomy of living things.

1.3. Scope of Study

Based on the background, the scope of this research is related to the effect of the Project-Based Learning (PjBL) model on student learning outcomes and activities in class X at SMAN 1 Tanjungbalai in biology learning living things classification subtopic to find out the extent of the implementation of the Project-Based Learning (PjBL) model in the Kurikulum Merdeka at that school.

1.4. Scope of Problem

Scope of problem of this research involve students in grade X at SMAN 1 Tanjungbalai as a research object using a Project-Based Learning (PjBL) model in biology subjects, with insectarium learning media, the assessment of student learning outcomes and activities focused on understanding the classification of animals, and the concept used is limited to the invertebrate of the phylum Arthropoda, class Insects.

1.5. Research Questions

Based on the identification and scope of research described above, the research questions to be studied are as follows:

1. What are the effects of Project-Based Learning (PjBL) model to students learning outcomes on living things classification subtopic in class X at SMAN 1 Tanjungbalai 2024/2025 school year?
2. What are the effects of Project-Based Learning (PjBL) model to students learning activities on living things classification subtopic in class X at SMAN 1 Tanjungbalai 2024/2025 school year?
3. Is a project increase students' learning outcomes with a Project-Based Learning (PjBL) model in Biology class X at SMAN 1 Tanjungbalai 2024/2025 school year?

1.6. Research Purposes

Related to the formulation of the problem that has been formulated, the research objectives are:

1. Find out the effects of Project-Based Learning (PjBL) model to students learning outcomes on an living things classification subtopic in class X at SMAN 1 Tanjungbalai 2024/2025 school year.

2. Find out the effects of Project-Based Learning (PjBL) model to students learning activities on an living things classification subtopic in class X at SMAN 1 Tanjungbalai 2024/2025 school year.
3. Increase students' learning outcomes with a Project-Based Learning (PjBL) Model in Biology class X at SMAN 1 Tanjungbalai 2024/2025 school year.

1.7. Research Benefits

This research has some benefits as follows:

1. As a reference and input in order to choose alternatives to be able to develop learning models creatively and optimally in improving student learning outcomes and activities.
2. Increasing an experience and understanding regarding the use of learning models as a guide in carrying out learning in the future.
3. As a learning platform, it facilitates students' comprehension of learning and experiences.

CHAPTER II
LITERATURE REVIEW

2.1. Learning Curriculum

In the world of education, curriculum plays a very important role. This cannot be separated from the role of the curriculum in providing direction, content and educational processes so that the desired goals can be achieved successfully. In accordance with the demands of the times which are always changing, the curriculum must also be dynamic and able to adapt to changes. Because of this, it is absolutely necessary to improve and perfect the curriculum from time to time, something that has become known as curriculum development.

Curriculum in education is a reference unit of teaching, which is planned, standardized and adapted to the conditions of a region. The curriculum has systemized components, one of which is the curriculum reference value, which is basically a set of beliefs, values and ideas that form the framework for thinking in curriculum planning, which underlies the actions and stages of curriculum development.

In the curriculum there is a development process, which generally consists of planning, implementation and evaluation. The development process aims to create an effective curriculum. There are several figures who formulate stages in curriculum development. However, the curriculum development process is influenced by several supporting factors, there are also several obstacles in curriculum development. In centralized curriculum development, teachers play an important role as developers and researchers, but in decentralized curriculum development, teachers play a decentralized role. It determines student teaching goals and materials, as well as methods and strategies and metrics developed to measure student success (Rejeki, 2022).

Based on the goals of education in Indonesia, the Minister of Education and Culture Nadiem Makarim has launched the "Freedom to Learn" movement, which prioritizes freedom of thought. The aim of the Merdeka Belajar movement is to create a pleasant atmosphere for teachers, students and parents. It is hoped that through this initiative, both teachers and students will feel the freedom to

think, so that it can encourage innovation in the delivery of material by teachers. Apart from that, students will also find it easier to innovate and be creative in their learning process.

2.1.1. Kurikulum Merdeka

Merdeka Belajar is an innovative policy introduced by the Minister of Education Nadiem Makarim, with the aim of restoring education management authority in the hands of school principals and local governments (Sutanto, 2020). This policy was born from the desire to make Indonesia an intelligent, just, wise and wise country, and create a better life for all its people. In this context, education must be prioritized to fulfill the aspirations and hopes of the Indonesian people.

Educational institutions are expected to be able to create a balance between education and current developments. Education, as we all know, aims to produce a generation that is intelligent and has noble character. Apart from that, education is also a driver of change for the better from generation to generation. It is hoped that education can give birth to innovation and creativity, and form a generation capable of bringing about more significant change. Education in Indonesia receives special attention because the Preamble to the 1945 Constitution explicitly states that making the nation's life intelligent is one of the state's responsibilities (Hutabarat, 2022).

In implementing the Kurikulum Merdeka, students are required to create or carry out a project. Through these project activities, students have the opportunity to develop their skills and potential in various fields. One of the project activities in the Kurikulum Merdeka is the implementation of P5. P5 activity is a project activity that aims to strengthen the profile of Pancasila students. P5 activities can be carried out in two stages, namely the conceptual stage and the contextual stage. In this P5 activity, students are given the freedom to study in a formal context, where the learning structure becomes more flexible and the school can adjust the distribution of time. This results in more active learning activities, because students are directly involved with the surrounding environment, which aims to strengthen various competencies in the Pancasila Student Profile.

The existence of an independent learning curriculum is one of the efforts to improve the quality of education in Indonesia to meet the needs of the times. An independent learning curriculum does not only make students intelligent. However, it is also marked by Pancasila values which are said to be a form of profile for strengthening Pancasila students. The profile of strengthening Pancasila students creates Indonesian students as lifelong learners with global competence and acting in accordance with Pancasila values (Armadani, 2023).

2.2. Learning Model

The learning model is a crucial element in the educational process to develop, create, select and use learning models, teachers must face the stages of measurement, evaluation and evaluation or reflection on learning models. Learning model is a conceptual and functional learning plan with names, characteristics, logical sequence, settings and facilities that are relevant to learning needs (Asyafah, 2019).

According to Arend (Mulyono, 2018) chose two important reasons underlying the term learning model. First, the term model has a broader meaning than approach, strategy, method and technique. Both models can serve as important means of communication, whether talking about classroom teaching or the practice of supervising children. A learning model is a conceptual framework that delineates systematic methods for structuring learning activities with the goal of achieving educational objectives or competencies. In other words, it serves as a blueprint for designing learning experiences to ensure that teaching and learning activities are engaging, comprehensible, and follow a coherent sequence for effective implementation (Octavia, 2020).

Learning models have a broader meaning than approaches, strategies, methods and techniques. A learning design or learning plan is said to use a learning model if it has four characteristics, namely; 1). A logical theoretical rationale developed by its creator; 2) The foundation for understanding what and how students learn (the learning goals to be achieved); 3) The behaviors necessary for the successful implementation of the model; and 4) The learning environment needed to achieve the learning objectives (Trianto, 2007).

The benefit of the learning model is as a guide for the design and implementation of learning. Therefore, the choice of model is greatly influenced by the nature of the topic to be studied, the objectives (competencies) to be achieved in the learning, and the level of students' abilities (Mulyono, 2018).

1. For teachers:
    a) It makes it easier to carry out learning tasks because the steps to be taken are in accordance with the time available, the goals to be achieved, the students' absorption capacity, and the availability of existing media.
    b) It can serve as a tool to promote student engagement in the learning process.
    c) It facilitates the analysis of student behavior both individually and in groups within a relatively short time frame.
    d) It simplifies the preparation of fundamental considerations when planning Classroom Action Research (PTK) aimed at enhancing or refining the quality of learning.
2. For students:
    a) As a broad opportunity to play an active role in learning activities.
    b) Makes learning easier. students to understand the subject
    c) Encourage enthusiasm for learning and interest in participating in learning fully.
    d) Can see or read personal abilities in the group objectively.

2.2.1. Project-Based Learning Model (PjBL)

According to the Ministry of Education and Culture (2013), students engage in research, evaluation, interpretation, synthesis, and application of knowledge to achieve diverse learning outcomes. Project-based learning is a teaching method that begins with problems as a means of acquiring new knowledge and integrates this knowledge through experiences rooted in real activities.

The project-based learning method is an enhancement of the problem-based learning approach. It is an educational strategy that emphasizes Contextual Teaching and Learning (CTL). CTL is a learning concept in which educators link

the subject matter to real-world situations, encouraging students to apply their knowledge and use it in their lives as active members of society.

Project-Based Learning is underpinned by constructivist learning theory, which posits that students build their own knowledge based on their experiences. This approach emphasizes the importance of exchanging ideas, listening to others' perspectives, and reflecting on one's own thoughts in relation to those of others, serving as a means of personal empowerment. Engaging with peers facilitates the knowledge construction process.

Constructivism is a school of thought that is based on gaining knowledge from concrete experience. Experience is formed from direct activities so that it forms knowledge. The PjBL model has identical characteristics to the aims and objectives of constructivist philosophy. This study focuses on the position of constructivist philosophy in the PjBL model. Biology subjects make it possible to connect theory with practice in a way that builds students' knowledge (constructivist) of the surrounding environment (Mones, 2023).

According to John (2008), project-based learning is learning that focuses more on solving authentic problematic that occur every day through direct learning experiences in the community. Meanwhile, Gijbels (2005) states that project-based learning is used in a number of contextual approaches in education which often involve learning and teaching in concrete ways. Focusing on a particular problem at the beginning of the learning process is the main definition of project-based learning (Murniarti, 2016).

It is concluded that project-based learning model is a learning process that leads to the practice of real-world problems that are done alone through specific assignments or projects. As a learning method, what is important is to focus on the problems discussed in the project.

2.2.2. Characteristics of Project-Based Learning Model (PjBL)

Project-Based Learning (PjBL) is an inquiry-based learning approach that engages students in constructing knowledge by having them work on meaningful projects and create real-world products. According to Krajcik and Shin (2014), PjBL is characterized by six key features: 1). Encouraging questions; 2). Focus on learning objectives; 3). Participation in educational activities; 4). Collaboration

between students; 5). Using scaffolding technology; and 6). Creation of real artifacts.

Among all these characteristics, the creation of artifacts that address authentic problems is the most complex aspect, setting PjBL apart from other student-centered pedagogies, such as problem-based learning. This process requires students to collaborate in order to develop solutions to real-world challenges.

2.2.3. Steps of Implementing Project-Based Learning Model (PjBL)

The steps (syntax) of the project-based learning model as developed by The George Lucas Educational Foundation can be explained through the following flow chart in Figure 2.1.

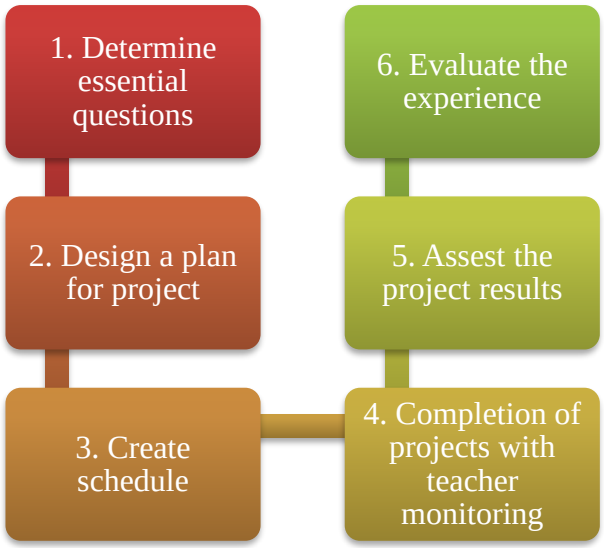

Figure 2.1. Project-Based Learning Steps

a. Determine Essential Questions

In this step, students decide on the topic of their project based on the topic provided by the teacher. Students have the possibility to choose and decide which project to work on, either as a group or individually, as long as they do not deviate from the activities marked by the teacher.

b. Design a Plan for Project

In this step, students design a process for completing a project from start to finish. This project design process includes regulations for implementing project

activities, selecting activities that can support project activities, including alternative ways to complete project activities, and collaboration between group members.

c. Create Schedule

Students plan all their activities under the guidance of their teacher. Like how long it will take to complete a project step by step.

d. Completion of projects with teacher monitoring

This step consists of implementing the project design created. Activities carried out during the project include reading, researching, observing, interviewing, writing, creating artwork, visiting project subject and accessing the internet. The teacher is responsible for monitoring student performance during the project. In monitoring activities, teachers create a checked rubric to record student performance as they complete project activities.

e. Assest the Project Results

The results of the project in the form of a product, whether written work, art, technology or crafts, are presented or published to other students, teachers or the public in the form of a presentation of learning results.

f. Evaluate the Experience

At the end of the learning activity, teachers and students reflect on the activities and results of project work. The process of reflecting on project activities can be carried out individually or in groups. At the evaluation stage, students have the opportunity to share experiences while completing project work, and develop through discussions to improve the work. This section also provides feedback on the process and products produced (Mujiburrahman, 2022).

2.2.4. Strengths and Weaknesses of Project-Based Learning Model (PjBL)

If implemented well, Project-Based Learning can equip students with valuable skills. Success in project-based learning occurs when students have high motivation, are able to learn, and achieve high-quality work results. The strengths of a Project-Based Learning model include:

1) Provide motivation to students by involving themselves in learning, learning according to their interests, answering questions and determining study time.

2) Provide learning opportunities in various fields.
3) Help students connect with the world outside school, face the real world and develop skills.
4) Unique opportunity for educators to build relationships with students as teachers, mentors, and learning partners.
5) Provide opportunities to build relationships with the wider community.
6) Make students more active and successful in solving complex problems.
7) Encourage students to develop and practice their communication skills.
8) Provide students with learning experiences and practice in planning projects and allocating time and other resources, such as tools, to complete assignments.
9) Provide learning experiences that involve students in challenging real-world developments.
10) Create a pleasant learning environment so that students and teachers can enjoy the learning process.

Apart from explaining some of the strengths of the project-based learning model above, it turns out that this model also has weaknesses, including:

1) It takes a lot of time to solve the problem
2) It costs a lot of money to create a project
3) Requires many tools to be provided
4) Students who are weak in testing and gathering information experience difficulties
5) Some students may be less active in group activities
6) If the topics given to each group are different, it is feared that students will not be able to understand the topic as a whole (Murniarti, 2016).

2.3. Learning Media

The word media comes from Latin which is the plural form of “medium”. The boundaries of the definition of media are very broad, but we limit it to learning media, namely media used as tools and materials in educational activities. The word media comes from the Latin medius which literally means intermediary, intermediary or leader. More specifically, media in the teaching and

learning process is often defined as graphic, photographic, or electronic tools used to capture, process, and reconstruct visual or verbal information.

Learning media is an important part of learning. Media is a tool that helps to understand learning concepts or topics. When studying biology, scientific concepts are applied and scientific process skills are developed. Students can gain science process skills through direct observation of objects, which includes various student activities inside and outside the classroom (Hano'e & Kamaluddin, 2022).

Ardiani (2008) explains that learning media is a vital component of the educational process that significantly influences teaching and learning activities. The use of media must be a part that teachers and supervisors must pay attention to in all learning. Therefore, facilitators must learn how to determine learning media in order to achieve effective learning goals in the teaching and learning process.

Asyhar (2011) divides types of learning media into four parts, namely (1) visual media, (2) audio media, (3) audio-visual media, (4) and multimedia.

2.3.1. Insectarium

According to Istiqomah (2014), the use of preserved plant and animal specimens in biology learning helps increase students' interest in the existence of living things and increases cooperation between students during learning and increases learning completion. Preserved plant and animal specimens can be prepared by teachers in school laboratories and purchased from practical science supply and equipment stores.

An insectarium is a storage medium for a collection of preserved insect specimens, both wet and dry. The insectarium includes preserving insects in a container with a preservative content of 70% alcohol and 5% formalin. The use of preserved animal specimens in biology learning helps increase students' interest in the existence of living creatures and increases cooperation during learning and increases learning completeness.

The following are exemples of insectarium media (Figure 2.2.) :

Figure 2. 2. Insectarium Media

Source: http://bit.ly/3T1FsrD

https://bit.ly/3IfJeZo

2.4. Learning Outcomes

Learning outcomes are the abilities that students have after receiving learning. Learning outcomes consist of skills, attitudes and abilities that students acquire after receiving treatment given by the teacher so that they are able to apply their knowledge in everyday life. Learning outcomes are also influenced by learning experiences with the physical world and environment. Learning outcomes are said to be good if student achievement indicators are met.

School activities are the core activities of the entire teaching and learning process, meaning that the success or failure of achieving educational goals really depends on how the teaching and learning process takes place. At the end of the teaching and learning process, an evaluation must be carried out, so that the results of the teaching and learning implementation can be seen. Based on the implementation of this assessment, information is obtained regarding the learning outcomes achieved, where learning outcomes cannot be separated from teaching and learning activities which are a process of successful learning (Harnila, 2016).

2.4.1. Factors Influencing Learning Outcomes

Achieving positive learning outcomes is influenced by various factors. According to Slameto, these factors can be categorized into two groups: internal factors, which are those within the individual, and external factors, which originate from outside the individual.

2.4.1.1.Internal Factors

Internal factors, namely factors that arise from within the individual himself, are one of the factors that determine a student's academic success. Internal factors include for example:

1) Physiological aspects. General physical condition, which shows the condition of the body's organs, can influence students' enthusiasm and identity during learning. The poor condition of the body's organs can reduce the quality of the cognitive domain so that the topic studied becomes inadequate and greatly affects students' ability to obtain knowledge and information in class.

2) Psychological Aspects. Psychological aspects can influence the quantity and quality of a student's learning. Psychological factors in general are as follows:
   a) Intelligence

      Intelligence level (IQ) greatly determines student academic achievement. The higher a student's IQ, the greater his or her chances of success. Conversely, the weaker a student's intelligence, the smaller their chances of success. Learning ability is largely determined by the level of intelligence. Normal intelligence always shows abilities that correspond to the level of development of peers.
   b) Student Talent

      Talent refers to an individual's inherent potential to succeed in the future. It is characterized as the ability to perform tasks effectively with minimal reliance on formal education and training.
   c) Student Motivation

      Learning motivation is an important factor because it is a condition that motivates students to learn. The main topic of learning motivation is how to organize so that motivation can be increased. Likewise, students will be successful in teaching and learning activities if they are motivated to learn

2.4.1.2. External Factors

External factors are those influences that originate from outside the individual, where children carry out an activity only if there is external motivation, so that they can influence students to obtain good academic results, for example:

1) Family conditions

   The family is the first and most important educational institution. A healthy family is very important for a small education, but it is very determining in the big dimension, namely the education of the nation, state and world.

2) School environment

A good school environment can encourage more active learning, including teaching methods, curriculum, teacher-student relationships, student-student relationships, school discipline, teaching aids, school time and teaching methods.

2.4.2. Taxonomy Bloom

In 1956, Benjamin Samuel Bloom *et.al* introduced a new concept in the world of education, namely the conceptual framework of thinking in the form of a competency level structure. In humans, operational intelligence can be described through three dimensions. Bloom's Taxonomy has three domains, including 1) cognitive domain, which involves memory or recognition of certain facts, procedures and concepts that enable the development of intellectual skills and abilities, 2) affective domain, which is related to the development of emotions, attitudes, values and feelings, and 3) psychomotor domain, areas related to manipulative activities or motor skills (Magdalena, 2020).

Bloom's taxonomy in the cognitive domain is one of the basic frameworks for categorizing educational goals, preparing tests and curricula throughout the world. Student knowledge in the cognitive domain is student behavior expressed through intellectual factors such as knowledge and reasoning skills. Students' knowledge and skills are reflected in the development of their thinking concepts and memory, which allows them to store the new information they receive (Ulfah, 2023). The framework of the work of Benjamin Bloom et al. contains six main categories in order starting from the lowest level to the highest level, namely: (1) knowledge; (2) understanding; (3) application; (4) analysis; (5) synthesis; and (6) evaluation

1) C1-Knowledge

Knowledge involves the process of recalling specific or general things, recalling methods and processes, or recalling patterns and structures. The way of treating basic things is called knowledge of ways to organize, study, assess and criticize.

Keywords: Define, list, name, state, identify, know, mention, outline, underline, describe, match, choose.

2) C2-Understanding

It represents a level of understanding that enables an individual to comprehend the communicated message and utilize the material or ideas presented without needing to connect them to other topics. It is an ability to understand instructions/ problems, interpret and restate them in your own words.

Keywords: Explain, describe, differentiate, interpret, formulate, estimate, predict, generalize, translate, change, give an example, expand, restate, analogize, summarize.

3) C3-Application

Application is the ability to apply ideas, procedures, methods, formulas, theories, principles in various situations. It is an ability to use concepts in new practices or situations.

Keywords: Apply, change, calculate, complete, discover. prove, use, demonstrate, manipulate, modify, adapt, demonstrate, operate, prepare, provide, produce.

4) C4-Analysis

Analysis is resolving the content of communication into elements so that the hierarchy of ideas becomes clear. It is the ability to deconstruct a concept into its various components to achieve a deeper understanding of how those components affect the concept as a whole.

Keywords: Analyze, discriminate, create schemes/diagrams, differentiate, compare, contrast, separate, divide, connect.

5) C5-Synthesis

Synthesis is combining elements to form a whole. Synthesis is concerned with the arrangement of elements so that they form a whole or unity that was previously not clearly visible. It is an ability to assemble or rearrange components in order to create new meaning/understanding/structure.

Keywords: Categorize, combine, arrange, modify, design, integrate, organize, compile, compose, create, rearrange, rewrite, design, assemble, revise, connect, reconstruct, conclude, pattern.

6) C6-Evaluation

Evaluation is determining the value of subjects and methods for certain purposes, also called the ability to evaluate and judge something based on norms, references or criteria. Evaluation is concerned with quantitative or qualitative determination of the value of subjects or methods for a purpose by meeting certain criteria. The keywords are review, compare, conclude, criticize, contrast, contradict, justify, defend, evaluate, prove, calculate, produce, adjust, correct, complement, discover.

2.5. Learning Subject

Biology has developed since the 21st Century. As a science, biology has experienced very rapid development in this century and influences many aspects of human life. Various technological breakthroughs in the field of biology have raised awareness of biology education itself. Biology provides information about various useful organisms grouped based on taxonomic and systematic approaches. This is then packaged and descriptions of bioactivity, biodevelopment and biotechnology are added. Biology education can provide skills, knowledge and understanding that are also based on ethics in handling biological resources and the environment. Biology is delivered to students in schools through formal teaching institutions. Biology learning in schools is based on the applicable curriculum, which is the basis of learning (Pratiwi, 2019). Currently, education regarding biodiversity in Indonesia is included in the SMA/MA curriculum. In the Kurikulum Merdeka, living things classification subtopic is found in Chapter 1 concerning the diversity of living things.

2.5.1. Living Things Classification

2.5.1.1. History of Classification

In biology, grouping living things is called classification, and the branch of science that studies classification is called taxonomy. Classification is the grouping of living things based on differences and similarities in their characteristics. The grouping is applied on several different grounds, ranging from morphological characteristics, anatomy, physiology to evolutionary history (phylogeny).

In a classification system, grouping is done based on the similarities and differences in the characteristics of each living things. Living things that have

similar characteristics are combined into one group, and living things that have different characteristics form another group. If there are still differences, they are grouped back into smaller groups to form a group structure called a taxon.

The classification system was introduced by Carolus Linnaeus in the 18th century. He grouped living things based on similar characteristics and names them using the binomial nomenclature system. Carolus Linnaeus created 7 categories of grouping of living things, namely kingdom, phylum (large family), class, order (nation), family (tribe), genus, and species (kind). As it goes up, the number of taxon members increases. The further it goes down, the similarities are more exist between them. It can be described through the Figure 2.3.

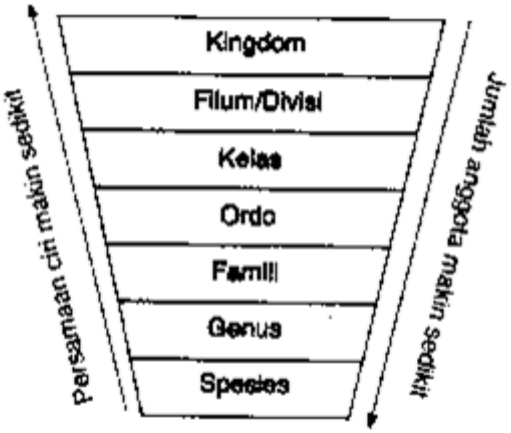

Figure 2. 3. Level of Category of Grouping Living Things

Source: bit.ly/tingkat_takson

2.4.1.2. Various Types of Living Things Classification Systems

As science develops, several organism classification systems have emerged that have been put forward by scientists to date, for example, 2 kingdom classification, 3 kingdom classification, 4 kingdom classification, 5 kingdom classification, 6 kingdom classification, and 3 domain classification.

a) 2 Kingdom Classification

A scientist named Aristoteles was the first scientist to introduce a classification system. He differentiated all organisms on earth into two large groups/kingdoms, namely the plant kingdom (kingdom Plantae) and the animal kingdom (kingdom Animalia). Kingdom Plantae includes all living things that do not move and kingdom Animalia includes all living things that move. However, this 2 kingdom classification system still has many shortcomings, so that this system is no longer used in its development.

b) 3 Kingdom Classification

The scientist who introduced the three kingdom classification was Ernst Haeckel from German. The three kingdoms classification system divided organisms into three large groups, namely the kingdoms Protista, Plantae, and Animalia. The organisms that are not included in the categories of plants and animals, such as Euglena and slime molds, are put into a separate kingdom called Protista.

c) 4 Kingdom Classification

The 4 kingdom classification system emerged after the discovery of the electron microscope. The scientist who introduced the four kingdom classification was Copeland (1938). The results of cell research using an electron microscope show that there are organisms whose cells that make up their body do not have a nuclear membrane (prokaryotes) and some that have a nuclear membrane (eukaryotes). Therefore, organisms that do not have a nuclear membrane (prokaryotes) such as bacteria are grouped into a new kingdom, namely the kingdom Monera.

d) 5 Kingdom Classification

Robert H. Whittaker, was a scientist who first proposed a classification system of five kingdoms which included, Monera, Protista, Fungi, Plantae, and Animalia. He stated that fungi should be removed from the kingdom Plantae and grouped into a separate kingdom. This is because fungi cannot produce their own food or photosynthesize and obtain food by absorbing nutrients from other organisms. Apart from that, fungi also differ from plants in several ways, such as cell wall components and how they reproduce.

e) 6 Kingdom Classification

A scientist named Carl Woese in 1977 divided the kingdom Monera into two groups, namely Eubacteria and Archaea. This division is based on differences in cell wall components and RNA in ribosomes. Therefore, the classification of the six kingdoms consists of Archaea, Eubacteria, Protista, Fungi, Plantae, and Animalia.

f) 3 Domain Classification

The three-domain classification system developed as a result of the rapid growth of molecular research and biological classification systems at the end of the twentieth century. The three domain classification divides organisms into three basic groups, namely 2 domains of prokaryotes called Eubacteria and Archaea and one domain of eukaryotes called Eukaryota. The Eubacteria and Archaea domains differ in a number of important biochemical and functional structures. The Eukaryote domain is divided into several kingdoms. The summary of various classification systems can we see in Table 2.1.

Table 2.1. Various Types of Living Things Classification Systems

<table>
<tr><th>1735
Aristoteles</th><th>1866
Haeckel</th><th>1938
Copeland</th><th>1969
Whittaker</th><th>1990
Woese</th><th>1997
Woese</th></tr>
<tr><td>2 Kingdom</td><td>3 Kingdom</td><td>4 Kingdom</td><td>5Kingdom</td><td>3 Domain</td><td>6 Kingdom</td></tr>
<tr><td rowspan="4">Plantae</td><td rowspan="2">Protista</td><td rowspan="2">Monera</td><td rowspan="2">Monera</td><td>Eubacteria</td><td>Eubacteria</td></tr>
<tr><td>Archaea</td><td>Archaea</td></tr>
<tr><td>Protista</td><td>Protista</td><td rowspan="4">Eucariota</td><td>Protista</td></tr>
<tr><td rowspan="2">Plantae</td><td rowspan="2">Plantae</td><td>Fungi</td><td>Fungi</td></tr>
<tr><td>Plantae</td><td>Plantae</td></tr>
<tr><td>Animalia</td><td>Animalia</td><td>Animalia</td><td>Animalia</td><td>Animalia</td></tr>
</table>

Source: (Djubaedah, 2017)

2.4.1.3. Scientific Name Addition

In the classification system for living things, the highest taxon level is Kingdom (if using a domain system, then domain is a taxon level that is placed above kingdom). Then, the kingdom is further divided into lower levels, namely division/phylum, classes, ordo, family, genus, and species.

Giving a scientific name to each type of organism is important. The name used today is the scientific name developed by Carolus Linnaeus, namely

binomial nomenclature. Binomial nomenclature is naming organisms using two Latin words, namely the first word indicates the genus name and the second word indicates the species name. For example, the scientific name of banana is *Musa paradisiaca*, this shows that Musa is the genus name and paradisiaca is the species name. The next rule is that the letters in the first syllable of a scientific name must be written in capital letters and the name must be italicized (*Musa paradisiaca*) or underlined per word (Musa paradisiaca).

2.4.1.4. Simple Determination Key

In the process of classifying a type of animal or plant, it is necessary to determine the specific characteristics of the animal or plant. The goal is so that the name of the animal or plant can be determined correctly. The determination key is a key used to identify living things. This key contains information about the characteristics of living things which will make it easier for you to identify them, because identification is a basic activity in taxonomy.

There are three stages that must be carried out in the classification of living things, namely scanning, grouping, and giving a taxon name. Scanning is the activity of describing the characteristics of a living creature that will be classified. When scanning living things that have just been recognized or discovered, a comparison tool is needed so that the results are more accurate. The comparison tool can be in the form of a picture, a specimen of an animal or plant whose name is already known, or finally an identification key. The identification key is also known as the determination key. The scientist who first introduced the key to determination was Carolus Linnaeus.

2.5.2. Animal Classification

The animal kingdom is divided into two major categories: invertebrates, which are animals without backbones and vertebrates, which are animals with backbones.

2.5.2.1. Invertebrate Classification

Invertebrate animals show an evolutionary journey that reflects the diversity of body structures and adaptation to various environments. This group is the earliest to appear in the history of life, starting from the phylum Porifera (sponges), which are the most primitive multicellular animals with simple bodies without true tissue. Furthermore, Cnidarians, such as jellyfish and sea anemones,

evolved rudimentary tissues and radial symmetry. The phylum Platyhelminthes (flatworms) introduces bilateral symmetry, followed by the groups Nematoda (roundworms) and Annelida (roundworms) which have segmented bodies. Molluscs, such as snails, clams, and octopuses, show the evolution of more complex body organs, including an advanced nervous system in octopuses. Arthropods, the largest group of invertebrates, evolved exoskeletons and segmented bodies, allowing them to dominate land, sea, and air. This group includes insects, spiders and crustaceans. Echinoderms, such as starfish and sea urchins, evolved secondary radial symmetry and water vascular systems for locomotion. The evolution of invertebrates shows remarkable adaptation to various environments and is the basis for the emergence of vertebrate groups in the phylum Chordata (Hickman, 2020). Invertebrates are animals that do not have backbones. This group includes various phyla, including:

1. **Porifera**, aquatic animals whose bodies have many pores, such as sponges.
    - Class Calcarea: Sponges with spicules of calcium carbonate.
    - Class Hexactinellida: Glass sponges with spicules of silica.
    - Class Demospongiae: Soft sponges composed of spongin and/or silica fibers.
2. **Cnidarians**, animals that have stinging cells, such as jellyfish and sea anemones.

    Class Hydrozoa: Hydra, Obelia.
    - Order Anthoathecata Order Leptothecata

    Class Scyphozoa: True jellyfish.
    - Order Semaeostomeae
    - Order Rhizostomeae

    Class Cubozoa: Box jellyfish.
    - Order Carybdeida
    - Order Chirodropida

    Class Anthozoa: Sea anemones, corals.
    - Order Scleractinia (Hard corals)
    - Order Actiniaria (Sea anemones)

- Order Alcyonacea (Soft corals)

3. **Platyhelminthes**, (flatworms) introduces bilateral symmetry.

   Class Turbellaria: Planaria.

   - Order Tricladida

   Class Trematoda: Heartworms.

   - Order Plagiorchiida

   Class Cestoda: Tapeworms.

   - Order Cyclophyllidea

4. **Nematodes,** cylindrical, non-segmented, with a cuticle-covered body, digestive system.

   - Order Rhabditida (Earth nematode worms)
   - Order Strongylida (Parasitic worms in vertebrates)
   - Order Ascaridida (Roundworms)

5. **Annelida**, segmented worms, such as earthworms and leeches.

   Class Polychaeta: Sea worms.

   - Order Phyllodocida
   - Order Sabellida

   Class Oligochaeta: Earthworms.

   - Order Haplotaxida

   Class Hirudinea: Leeches.

   - Order Rhynchobdellida

6. **Mollusca**, animals with soft bodies, often protected by shells.

   Class Gastropod: Snails.

   - Order Stylommatophora
   - Order Patellogastropoda

   Class Bivalves: Clams, mussels.

   - Order Mytilida
   - Order Venerida

   Class Cephalopods: Octopus, squid.

   - Order Octopoda Order Teuthida

   Class Polyplacophora: Chiton.

- Order Neoloricata

7. **Arthropods**, the largest group that includes insects, arachnids (spiders), and crustaceans (crabs, shrimp).

   Subphylum Crustacea (Crustfish):

   - Order Decapoda (Shrimp, crabs)
   - Order Isopoda (Woodlice)

   Subphylum Myriapoda:

   - Order Diplopoda (Centipedes)
   - Order Chilopoda (Centipedes)

   Subphylum Hexapoda (Insects):

   - Order Coleoptera (Beetles)
   - Order Lepidoptera (Butterflies butterfly)
   - Order Hymenoptera (Bees, ants)

   Subphylum Chelicerata:

   - Order Araneae (Spiders)
   - Order Scorpiones (Scorpions)

8. **Echinoderms**, marine animals with spiny skin, such as starfish and sea urchins.

   Class Asteroidea: Starfish.

   - Order Forcipulatida
   - Order Velatida

   Class Echinoidea: Sea urchins, sand dollars.

   - Order Clypeasteroida
   - Order Echinoida

   Class Holothuroidea: Sea cucumbers.

   - Order Dendrochirotida
   - Order Apodida

Source: (Pechenik, 2018).

2.5.2.2. Vertebrate Classification

Vertebrate animals can be classified based on their evolution which reflects the development of body structure and adaptation to the environment. Vertebrates come from the phylum Chordata, which evolved from invertebrate ancestors more than 500 million years ago in the Paleozoic era. Evolution began with jawless fish (Agnatha), such as lampreys, which are the most primitive vertebrates. Then, jawed fish (Gnathostomata) appeared, which developed into two main groups: cartilaginous fish (Chondrichthyes), such as sharks and rays, and hard-boned fish (Osteichthyes), such as goldfish and salmon. Subsequently, vertebrates exited the aquatic environment with the emergence of amphibians, indicating early adaptations to life on land. Reptiles later evolved scaly skin and shelled eggs to reduce dependence on water. Aves evolved from theropod dinosaurs with special adaptations such as feathers and the ability to fly. Mammals, which are the most advanced group of vertebrates, evolved from reptilian ancestors through the development of mammary glands and the ability to maintain body temperature. This evolutionary pattern shows an increase in the complexity of body structure, respiratory systems, and reproductive mechanisms to adapt to increasingly varied habitats (Kardong, 2019). Vertebrates are animals that have backbones. This group is divided into five main classes:

1. **Pisces**, animals that live in water, breathe with gills, and move using fins. They are generally cold-blooded and reproduce by laying eggs.

   Superclass Agnatha (Jawless Fish):

   - Order Myxiniformes (Hag Fish)
   - Order Petromyzontiformes (Lampreys)

   Superclass Gnathostomata (Jawless Fish):

   Class Chondrichthyes (Cartilaginous Fish):

   - Order Carcharhiniformes (Deep Water Sharks)
   - Order Rajiformes (Rays)
   - Order Squaliformes (Sharks Dog)

   Class Osteichthyes (Bony Fish Hard):

   - Order Cypriniformes (Carp, Catfish)

- Order Perciformes (Snapper, Gourami)
- Order Siluriformes (Catfish)
- Order Salmoniformes (Salmon)

2. **Amphibians**, animals that can live in two habitats, namely land and water. They breathe through their lungs and skin, and are cold-blooded.
   - Order Anura (Toads and Frogs)
   - Order Caudata (Salamanders and Tritons)
   - Order Gymnophiona (Caecilians or Legless Salamanders)
3. **Reptiles**, cold-blooded animals with scaly skin covering their bodies. They breathe with lungs and reproduce by laying eggs.

   Subclass Anapsida:
   - Order Testudines (Turtles and Turtles)

   Subclass Lepidosauria:
   - Order Squamata (Lizards, Snakes)
   - Order Rhynchocephalia (Tuatara)

   Subclass Archosauria:
   - Order Crocodilia (Crocodiles, Alligators)
4. **Aves**, animals that have feathers and wings, most of which can fly. They breathe with lungs and are warm-blooded.
   - Order Passeriformes (passerine birds, such as pigeons, magpies)
   - Order Falconiformes (birds of prey, such as eagles and eagles)
   - Order Strigiformes (owls) Order Anseriformes (ducks and geese)
   - Order Galliformes (chickens and quail)
   - Order Psittaciformes (parrots and cockatoos)
5. **Mammalia**, warm-blooded animals that have mammary glands to suckle their young. They breathe with their lungs and mostly give birth to their young.

   Subclass Prototheria (Egg-laying Mammals):
   - Order Monotremata (Platypus and Echidna)

   Subclass Metatheria (Suppental Mammals):
   - Order Diprotodontia (Koalas and Kangaroos)

- Order Dasyuromorphia (Tasmanian Devil)

Subclass Eutheria (Placental Mammals):

- Order Primates (Humans, Apes)
- Order Carnivora (Tigers, Dogs)
- Order Cetacea (Whales, Dolphins)
- Order Artiodactyla (Cows, Goats, Giraffes)
- Order Perissodactyla (Horses, Rhinos)
- Order Chiroptera (Bats)
- Order Rodentia (Rats, Squirrels)

Source: (Campbell, 2018)

2.6. Differianted Learning

Students have varying skills from one student to another. Some students look smart and stand out in arithmetic. Some students like and are very passionate about sports, and some students really like talking and debating. But there are also students whose conditions make it very difficult to be able to speak and find it difficult to convey their ideas or ideas orally, on the other hand, these students are able to be creative through animation and video. This condition is no longer uncommon to encounter in the learning process in the classroom, at school, perhaps even in a family with siblings, these differences can arise. As a teacher, this can be a consideration in choosing and implementing learning strategies that suit the diversity of students. This is very important so that the learning strategies used by teachers in learning are able to accommodate students' learning needs and maximize student potential (Swandewi, 2021).

Differentiated instruction is a teaching philosophy or process that aims to provide effective education by offering various approaches to help all students understand new information within their diverse classroom environments. This includes different methods for acquiring content, processing and reasoning through ideas, developing learning products, and implementing assessment measures, ensuring that all students, regardless of their diverse ability levels, can learn effectively. Through differentiated learning, students will not only be able to

maximize their potential, but also students will be able to learn about various important life values.

2.6.1. Differentiated Learning Strategy

There are three differentiated learning strategies, namely content differentiation, process differentiation and product differentiation.

1) Content Differentiation

Relates to what is taught to students by considering the mapping of student learning needs which includes aspects of learning readiness, aspects of student interests, aspects of student learning profiles or a combination of the three.

a. Student learning readiness is not about intellectual level (IQ). This is more about information about whether the knowledge or skills that students currently have are in accordance with the new skills or knowledge that will be taught.

b. Interest serves as a crucial motivator for students to actively engage in the learning process. Each student may exhibit interest in different topics, and the concept of differentiating instruction based on these interests aims to "hook" students into the lesson, thereby sustaining their engagement. By fostering a high level of interest, it is anticipated that student performance will improve, particularly considering that each student has a unique learning style.

c. Mapping student learning needs according to their learning profiles aims to create opportunities for students to learn in a natural and effective manner. Consequently, teachers must diversify their teaching methods and approaches to meet these varied needs.

2) Process Differentiation

The process differentiation method is as follows:

a. Tiered activities mean that all students work to build the same understanding, but do so with different supports, challenges and complexities.

b. Providing guiding questions or challenges through angles of interest will thereby encourage students to explore a variety of subjects being studied.

c. Develop individualized agendas for students by having the teacher create a task list that includes general assignments applicable to all classes, along with a separate list of tasks tailored to each student's specific needs.

d. Facilitate the length of time students can take to complete assignments. In this case to provide support for students who are experiencing difficulties or conversely encourage fast students to pursue topics in more depth.

e. Develop varied activities that accommodate visual, auditory and kinesthetic learning styles.

f. Use flexible groupings that suit student readiness, abilities, and interests

3) Product Differentiation

Products are the outcomes of students' work or performance that must be presented to the teacher. A product can take various forms, including essays, written assignments, test results, performances, presentations, speeches, recordings, diagrams, and more. The key aspect is that these products should reflect students' understanding in relation to the expected learning objectives. Differentiating products can be achieved in multiple ways by first considering students' individual learning needs before assigning tasks. Product assignments should enable students, either individually or in groups, to redefine or expand upon what they have learned over a specific time period, such as a semester or a year.

Products are very important because they represent understanding and application in a broad form. Products are also curriculum elements that students can directly own. Product differentiation includes two things, namely providing challenge or variety and giving students choices in how they can express their desired learning.

2.7. Student Activities

According to Sardiman (2008), learning activities are all knowledge that must be obtained through one's own observation, one's own investigation, by working alone both spiritually and technically. In learning there must be activity, without activity the learning process is impossible. Learning activities include learning to write, take notes, look, read, remember, think, exercise or practice and so on. Apart from that, within students there is an active principle and the desire to act and work on their own. This active principle controls student behavior. Student activity refers to the engagement of students through their attitudes,

thoughts, attention, and actions during the learning process, all of which contribute to the overall success of that process.

Student activities during the learning process are one indicator of students' desire to learn. These activities lead to the learning process, such as asking questions, offering opinions, doing assignments, and answering the teacher's questions well. All these behavioral characteristics can be viewed from two aspects, namely in terms of process and in terms of results. The activities that arise from students are divided into knowledge and skills that will lead to increased achievement. Student activities in learning can cause learning at school to become more lively like activities in life in society because students are active in learning (seeking experience) and directly experience learning activities themselves.

There are two types of learning activities that students do when studying, namely Off Task and On Task. Off Task is a student activity that is not relevant to learning activities. Meanwhile, On Task is a student activity that is relevant to learning activities. Learning activities in this research are all learning activities carried out by students that are relevant to the learning process. Rusman (2015) mentions several characteristics of learning activities, namely as follows: 1) Occurs consciously 2) Is functional; 3) Positive and active; 4) Not temporary; 5) Purposeful and directed; and 6) Covers all aspects of behavior.

2.8. Thinking Framework

Based on the literature review above, a thinking framework has been formulated which states that biology education in schools, especially in high schools, must take place in accordance with the educational objectives determined according to the educational process in the Law on National Education Objectives Number 20 of 2003, which states that the process Learning aims to make students actively develop their potential. So that, the learning outcomes achieved are also good if students have developed personal potential dan and creativity, one of them is using an insectarium project-based learning model.

Real assessment can be used in overall learning (using authentic assessment) in the sense that the assessment is aimed at students as a whole, with the aim of assessing all aspects of students, whether cognitive, affective or

psychomotor. Teachers as facilitators need to study and guide students in order to effectively achieve learning objectives in the teaching and learning process.

The model used to influence learning outcomes and student activities is the Project-based Learning model. This model requires students to be active in learning and cooperate and collaborate in groups to complete project assignments in the form of figures given by the teacher which are based on a problem question given by the teacher. Students are trained to solve a problem question using the steps in the learning model, with the final result being a project that can be presented.

Based on this description, the framework for this research can be seen in Figure 2.4.

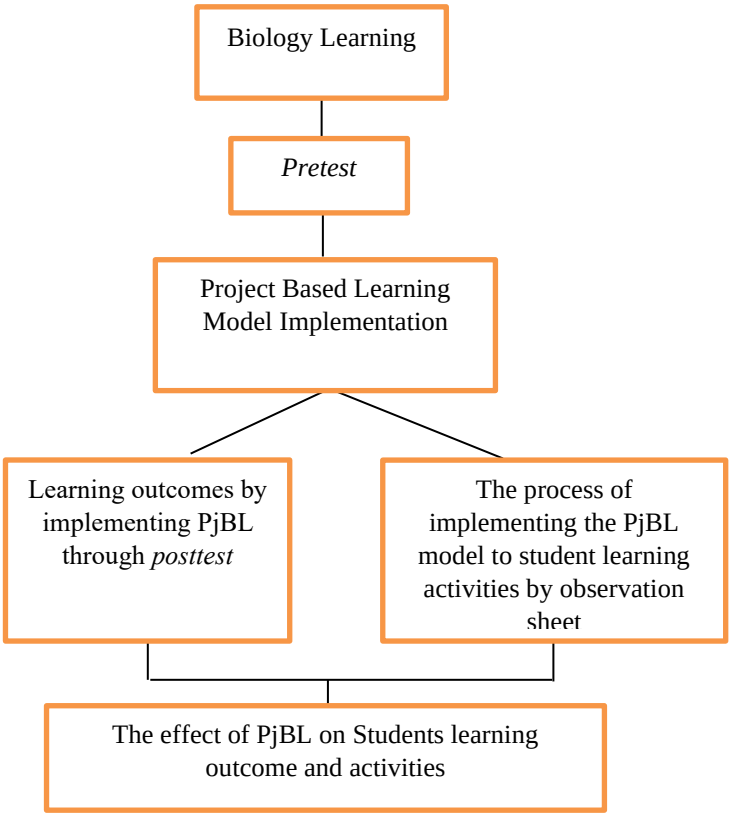

Figure 2.4. Research Thinking Framework

2.8. Hypothesis

To make it easier for the writer to draw conclusions, it is necessary to create a hypothesis. The hypothesis that is used in the research is:

1. **The Effect of PjBL Model on Students Learning Outcomes**

   Initial Hypothesis (H_0): The use of project-based learning model does not increase the value of student learning outcomes.

   Alternative Hypothesis (H_a): The use of project-based learning model increases the value of student learning outcomes.

   Statistic Hypothesis

   $H_0 : \mu_{PjBL} = \mu_{Conventional}$

   $Ha : \mu_{PjBL} \neq \mu_{Conventional}$

2. **The Effect of PjBL Model on Students Learning Activities**

   Initial Hypothesis (H_0): The use of project-based learning model does not increase the value of student learning activities.

   Alternative Hypothesis (H_a): The use of project-based learning model increases the value of student learning activities.

   Statistic Hypothesis

   $H_0 : \mu_{Activities\_PjBL} = \mu_{Activities\_Conventional}$

   $Ha : \mu_{Activities\_PjBL} \neq \mu_{Activities\_Conventional}$

CHAPTER III
RESEARCH METHODS

3.1. Research Location and Time

This research was carried out at SMAN 1 Tanjungbalai which is located on Jalan MT. Haryono No.10, Perwira Village, South Tanjungbalai District, Tanjungbalai City, North Sumatra 21312. This research was carried out on August, 2024.

3.2. Population and Sample

3.2.1. Population

The population in this study was the entire class X of SMAN 1 Tanjungbalai which was divided into 8 classes with a total of 288 students as described in the Table 3.1.

Table 3. 1. Data Table on the number of class X students at SMAN 1 Tanjungbalai

No	Class	Students
1	X-1	36
2	X-2	36
3	X-3	36
4	X-4	36
5	X-5	36
6	X-6	36
7	X-7	36
8	X-8	36
Total		288

3.2.2. Sample

The sampling technique used in this research was determined by purposive sampling. Purposive sampling means a technique for sampling data sources with certain criteria. The purposive sampling technique selects a group of subjects based on certain characteristics that each class has been tested using T-Test of Pretest showed that the results of both classes are the same. This research uses samples class X-6 as a control class using direct learning and class X-4 as an experimental class using an PjBL model as described in the Table 3.2.

Table 3. 2. Data Table on The Number of Experimental and Control Classes

No	Class	Students
1.	X-4 (Experimental)	36
2.	X-6 (Control)	36
Total		72

3.3. Research Design and Variables

3.3.1. Research Design

The type of research carried out is experimental research using the Quasi Experimental method, which shows that group selection cannot be chosen randomly. According to Sugiono, Quasi Experiment is a type of research that has a control group but cannot fully function in controlling external variables that influence the implementation of the experiment (Sugiono, 2019)

The research design is Matching Only Pretest-Posttest Control Group Design because it aims to seek influence. This research uses two groups each selected randomly, namely control and experimental groups. The control group does not need to be given special treatment, meanwhile the experimental class uses the Project-Based Learning (PjBL) learning model. Using different treatment in the two classes, differences in student learning outcomes in the cognitive domain and students activities can be seen. The following Table 3.3. is a research design for the matching only Pretest-Posttest control group design:

Table 3. 3. Quasi Experimental Research Design

Group	Pre-test	Treatment	Post-test
Control (Conventional)	O_1	-	O_2
Experiment (PjBL)	O_1	X_1	O_2

Source: (Sukardi, 2003)

Information:

O_1 = Pre-test

O_2 = Post-test

X_1 = Treatment using the PjBL model through making insectarium.

3.3.2. Variables

- Independent (free) variables are variables in research that are selected by researchers to assess their possible impact on one or more other variables. In this research, the independent variable is Project-based Learning model.
- Dependent (dependent) variable is a variable that is considered to be influenced by the independent variable. In this research, the dependent variable is student learning outcomes and activities in the living things classification subtopic.

3.4. Operational Definition

1. The Project-based Learning (PjBL) model is a learning process that leads to practice in real-world problems carried out independently through certain assignments or projects. What author mean by PjBL is a learning model that uses projects that follow the guidelines of the LKPD as the core of learning to show the influence on student learning outcomes.
2. Learning medias are forms and tools used as media to convey messages, stimulate students' thoughts, feelings and readiness, and encourage communication between teachers and students to guide and manage effective learning. It is used to help finding the effect of PjBL to students' learning outcomes.
3. Learning outcomes are evaluations which aim to see the achievement of learning objectives and then find out to what extent the learning objectives have been achieved. The learning outcomes in this research are referred to the results of students' abilities after receiving learning experience in answering the 30 multiple choices of pretest and posttest given.
4. Student activity is students' active participation during the learning process is observed through student activity observation sheets.

3.5. Research Instrument

To make data collection and data analysis easier, the author used the following research instruments:

3.5.1. Test Questions

The test questions in this research were 30 multiple choice questions. The multiple choices test used were tested for validity. The test devices used are pretest and posttest to see students' mastery of concepts in their learning. This instrument is used to measure students' cognitive domains in the form of student learning outcomes. The test content grid can be seen in the Table 3.4.

Table 3. 4. Learning Outcomes Test Grid

No	Indicators	Cognitive Domain						Amount
		C1	C2	C3	C4	C5	C6	
1.	Analysis the principes of classification systems for living things				5, 12, 28			3
2.	Determine the habitat and way of life of living things				8, 11, 16, 23, 24			5
3.	Identify the characteristics of organisms based on their classification groups	3	1, 6, 15, 30					5
4.	Describe the structure and function of the body of living things	10	9, 21	19, 27				5
5.	Evaluate how to give scientific names in living things					2, 4, 7, 14, 20, 29		6
6.	Apply simple key determinations			13, 17, 25, 26				4
7.	Develope phylogenetic aspects in life classification						18, 22	2
Total								30

3.5.1.1. Validity Test

The instrument validity test is used to determine whether the instrument used by the researcher is suitable or not to be given to students. It can be said to be valid if the calculated t value is greater (>) than the t-Table. The formula used is:

$$r_{xy} = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{\{N\sum X^2 - (\sum X)^2\}\{N\sum Y^2 - (\sum Y)^2\}}}$$

Information:

r_{xy}: The "t" product moment correlation index number

N: Number of students

ΣXY: The number of products between score X and score Y

ΣX : The sum of all X scores (research subject answers)

ΣY : The sum of all Y scores

Table 3.5. The Category of Validity Tset

Score r_{xy}	**Category**
0,81-1,00	Very high
0,61-0,80	High
0,41-0,60	Enough
0,21-0,40	Low
0,00-0,20	Very low

(Arikunto, 2013)

3.5.1.2. ReliabilityTest

Reliability is a measure to show that the instrument is quite trustworthy. To test the reliability of the test questions, use the alpha formula. The alpha formula is used to find the reliability of instruments whose scores are 1 or 0, for example questionnaires or essay questions. The Alpha Formula is

$$r_{11} = \left(\frac{k}{k-1}\right)\left(1 - \frac{\sum \sigma b^2}{\sigma t^2}\right)$$

Information:

r_{11}: Test reliability coefficient

k: Number of questions or number of questions

$\Sigma\sigma b^2$: Total item variance

$\Sigma\sigma t^2$: Total variance

Table 3.6. The Category of Reliability Index

Reliability Index	**Category**
0,91-1,00	Very high
0,71-0,90	High
0,41-0,70	Enough
0,21-0,40	Low
r11 less than 0,20	Very low or unreliable

(Arikunto, 2013)

3.5.1.3.Dificulty Index

Learning outcome test items can be stated as good items, if the item items are neither too difficult nor too easy, in other words the degree of difficulty of the item is moderate or sufficient. The item difficulty index number can be obtained using a formula:

$$P= \frac{B}{JS}$$

Information:

P: Item difficulty index number

B: Number of students who answered the test questions correctly

JS: Total number of students taking the test.

Table 3.7. The Category of Dificulty Index

Difficulty Index (P)	**Category**
0,0-0,03	Difficult
0,31-0,70	Medium
0,71-1,00	Easy

(Arikunto,2013)

3.5.1.4.Discrimination Index

Discriminating power is the level of ability of the instrument (questions) to differentiate between students with high ability and students with low ability. To determine the differentiating power of each research instrument item is as follows:

$$P= \frac{BA}{JA} - \frac{BB}{JB} = P_A - P_B$$

Information:

J: Number of test participants

JA: Number of participants in the upper group

JB: Number of participants in the lower group.

BA: Many of the upper group answered correctly

BB: Many of the lower group answered incorrectly.

P_A: The proportion of upper group participants who answered correctly on each question item.

P_B: Proportion of lower group participants who answered incorrectly on each question item.

Table 3.8. The Category of Discrimination Index

Discrimination Index	**Category**
0,0-0,20	Bad
0,21-0,40	Medium
0,41-0,70	Good
0,71-1,00	Very Good

3.5.2. Student Activites Observation Sheet

Student activities are assessed based on six aspects and eighteen indicators. The aspects are based on understanding of the purpose of observation and key elements of the learning process. These aspects should reflect the objectives of the research or evaluation as well as relevant educational theories, they are: 1). Student readiness to receive lesson; 2). Student enthusiasm in participating in group discussion activities; 3). Student activity in group discussion activities; 4). Student activities in solving problems; 5). Student activity in working on practice questions; and 6). Student participation in closing learning activities. This instrument is validated by an Expert.

3.6. Data Collection Technique

The data collection techniques used in this research are as follows:

1) Interview

Interviews are used to find out the learning process that occurs in class regarding the curriculum, subjects, application of learning strategies, learning media, and the condition of students in the teaching and learning process. The interview was done in September, 2023. Interview results were obtained from a

Biology class X teacher at SMA Negeri 1 Tanjungbalai during pre-observation using interview sheet.

2) Observation

The observation carried out during the research process that was closed observations by taking data from respondents. The respondents were the students in grade X at SMAN 1 Tanjungbalai. The data observed included data on the number of students and profiles of SMAN 1 Tanjungbalai obtained from the school, as well as initial data on the results of the students' pretest and posttest on the living things classification subtopic and also students activities with an observation sheet.

3) Test

The test used in this research is a written test with 30 multiple choice questions. The test was given to students in class X-4 and X-6 at SMAN 1 Tanjungbalai. The multiple choices test used were tested for validity. The test device created is used for pretest and posttest to see students' mastery of concepts in their learning outcomes in living thing classification subtopic.

4) Documentation

Documentation is in the form of fact or data that is already stored. This research uses documentation data in the form pf photos of interview, students collecting assignments given by teachers and so on.

3.7. Research Procedure

1. Preparation Stage
   a) Complete a school permission letter to conduct research.
   b) Conduct pre-observations at related schools and search for research literature reviews to develop learning plans.
   c) Designing a learning plan (RPP).
   d) Discuss the research procedures with the school and class X Biology subject teachers.

e) Develop research instruments in the form of creative thinking skills tests.
f) Developing a questionnaire on student responses to the PjBL model through making insectarium.
g) Carry out test instrument trials.
h) Process the data from instrument testing results then determine the questions that were used in the research.

2. Implementation Stage

a) Select two classes using purposive sampling techniques to be used as research samples.
b) Divide two research classes into control class and experimental class.
c) Carrying out learning in the control class and experimental class.
d) Give posttest to research subjects.
e) Providing a student response questionnaire regarding the implementation of the PjBL model through making insectarium.

3. Final Stage

a) Processing data and converting description test result data into grades.
b) Process data with statistical analysis.
c) Analyze the research results contained in the discussion.
d) Make a conclusion

3.8. Data Analysis Technique

3.8.1. Learning Outcomes

This analysis aims to determine whether there is an increase in student learning outcomes through the application of the Project Based Learning model (PjBL) with the following data processing steps:

1) Give scores to students' pretest and posttest answer sheets
2) Calculate student pretest and posttest answer scores using formula:

$$\text{Score} = \frac{Number\ of\ correct\ answers}{Total\ score} x100$$

3) Calculate the average overall test score for students both the experimental and control classes using formula:

$$\text{Average} = \frac{Student's\ total\ score\ (\sum)}{The\ number\ of\ students(N)}$$

4) Determine the level of student concept mastery by comparing the percentage of average test scores based on Table 3.9.

Table 3. 9. Category of Student Concept Mastery

Score (%)	Category
0-20	Very less
21-40	Less
41-60	Enough
61-80	Good
81-100	Very good

Source: (Arikunto, 2013)

3.8.2. Students Activities

To determine the percentage of student learning activities used the formula is as follows:

$$P=\frac{Total\ of\ activity\ score\ achieved}{Maximum\ score\ obtained\ from\ student\ activity\ assessments}\ x\ 100$$

The results are entered into predetermined criteria. According to Novika (2016), activity criteria Student learning after the learning process is as in Table 3.10.

Table 3.10. The Category of Student Learning Activites

Score	Category
81-100	Very active
61-80	Active
41-60	Quite active
21-40	Less Active
0-20	Very less active

Source: (Novika, 2016)

3.8.3. Prerequisite Test

After the data is obtained, the data was processed using data analysis techniques using the *Ms. Excel* and *IBM SPSS 26 Statistics For* Windows computer program. Prerequisite test data analysis techniques can be carried out through the following steps:

a. Normality Test

The normality test aims to see whether the data is normally distributed or not, normality testing can use the Kolmogorov-Smirnov technique (Sugiyono, 2019). The level of significance used is 0.05 (95% confidence level) on the basis

of decision making if the significance or probability value is > 0.05 then H_0 is accepted, meaning the data is normally distributed.

H_0: data is normally distributed f

H_a: data is not normally distributed

b. Homogeneity test

The homogeneity test is used to determine the condition of the initial data for the two samples, whether the two samples meet the requirements for conducting research. With the help of the Homogeneity of Variance test on One-way Anova via *SPSS*. The hypothesis homogeneity test tested is:

H_0: There is no significant difference in the two data distributions

H_a: There are significant differences in the two data distributions.

The significance level used is $\alpha = 0.05$. If the significant level of data produces data that is greater than 0.05, then the data group variance is homogeneous and H_0 is accepted. On the other hand, if the data significance level produces data that is smaller than 0.05, then the variance of the data group is not homogeneous and H_0 is rejected.

c. Hypothesis Testing (T Test)

Hypothesis testing is a statistical test which is the basis for decision making in a research carried out. Hypothesis testing in this research uses the T test. The T test is used to see whether there is a difference in the influence of two treatments in two classes.

The test criterias are if the Sig value is > 0.05 then H_0 is accepted and H_a is rejected or vice versa if the Sig value is < 0.05 then H_0 is rejected and H_a is accepted. All datas in this study were analyzed using the Ms. Excel and SPSS For Windows data processing program.

d. N-gain

In this data analysis, it is used to find out the average of the pretests and posttest given to students. The N-gain score is a value obtained based on an increase or difference in score which is the difference between the pretest score and the posttest score. The results of the N-gain score data analysis show the achievement of increasing students' abilities by paying attention to their initial abilities. Thus, it can be used to analyze written tests to calculate students' final grades in class. The evaluation value was analyzed therefore it can be known the increase of students learning outcomes on the Living Things Classification subtopic in Biology. Analysis using N-gain score can be done with the following formula:

$$\text{N-Gain}=\frac{Posttest\ Score-Pretest\ Score}{Maximum\ Score-Pretest\ Score}$$

After that, data analysis was carried out using the N-Gain value category Table 3.11. and Table 3.12.

Table 3.11. Data Analysis Using N-gain Value Categories

Score N-gain	**Category**
g > 0.7	High
0,3 ≤ g ≥ 0,7	Medium
g < 0.3	Low

Source: (Syahfitri, 2008)

Table 3.12. Category Interpretation of N-gain Effectiveness

Percentage (%)	**Category**
<40	Ineffective
40-55	Less effective
56-75	Quite effective
>75	Efective

Source: (Hake, 2016)

CHAPTER IV
RESULT AND DISCUSSION

4.1. Research Result

The instruments used by the researcher have been tested for validity by experts. In addition to expert validation, the researcher also conducted empirical validation. Empirical validation was conducted by testing the question instrument to students who had received the classification of living things subtopic and were not selected as samples. In the trial of the question items, the researcher selected 36 students from class XI-4 (Appendix 18). The results of the trial of the learning outcome and student learning activity instruments can be seen in Appendix 13 and 14. After conducting the validity test, it was concluded that the instruments were suitable for use with minor improvements. Furthermore, research was conducted so that various data were obtained which will be detailed as follows.

4.1.1. Description of Student Learning Outcomes

Data on student learning outcomes were obtained through pretests and posttests carried out in control classes using conventional models and experimental classes using the PjBL learning model on living things classification subtopic. Data on student learning outcomes can be seen in Table 4.1.

Table 4.1. Students Learning Outcomes Data

Descriptive Statistics					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Pre_Control	36	40.00	77.00	55.25	8.23
Pre_Experiment	36	37.00	67.00	51.08	8.42
Post_Control	36	67.00	87.00	74.61	6.11
Post_Experiment	36	77.00	93.00	83.83	5.29
Valid N (listwise)	36				

Based on Table 4.1. the results of the T test on the pretest scores (See Appendix 28), it shows that the scores from the control class and experimental class are not significantly different. The pretest results at the beginning of the lesson in the control class has higher score 77 and lowest score 40. The mean 55,25 with standard deviation 8,23. While, experiment class has highest score 67

and lowest score 37. The mean is 51,08 with a standard deviation 8,42. From both of the samples, the mean in control class is higher than experiment class. It means that control group already has a higher level of knowledge or ability compared to the experiment group. After learning activities by using PjBL model, posttest was held with the result 87 as the highest score and lowest score is 67 in the control class. The mean is 74,61 with a standard deviation 6,10. While the highest and lowest score in experiment class is 93 and 77. The mean is 51,08 with a standard deviation 8,42. It said that the average learning outcomes score in experiment class was higher than control class.

For each question indicator starting from C1-C6 for the control class, there was a significant increase. And for each indicator starting from C1-C6 for the experimental class, there was a much more significant increase compared to the control class. The results of the percentage of achievement of indicators starting from C1 to C6 for the control class can be seen in Figure 4.1. and for the experimental class in Figure 4.2.

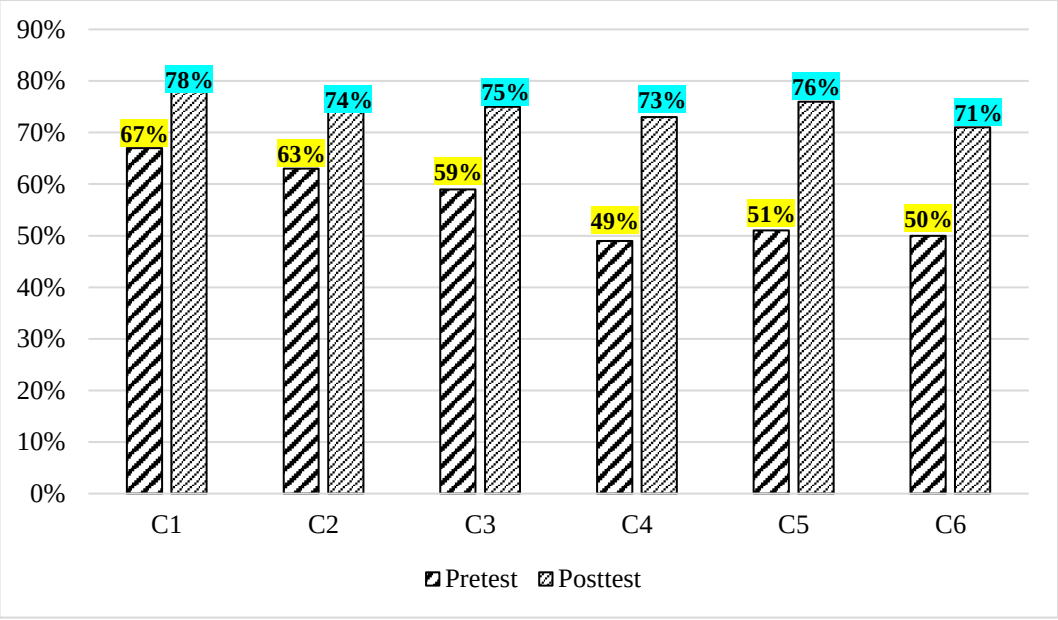

Figure 4.1. Indicators Achievement Chart of Control Class

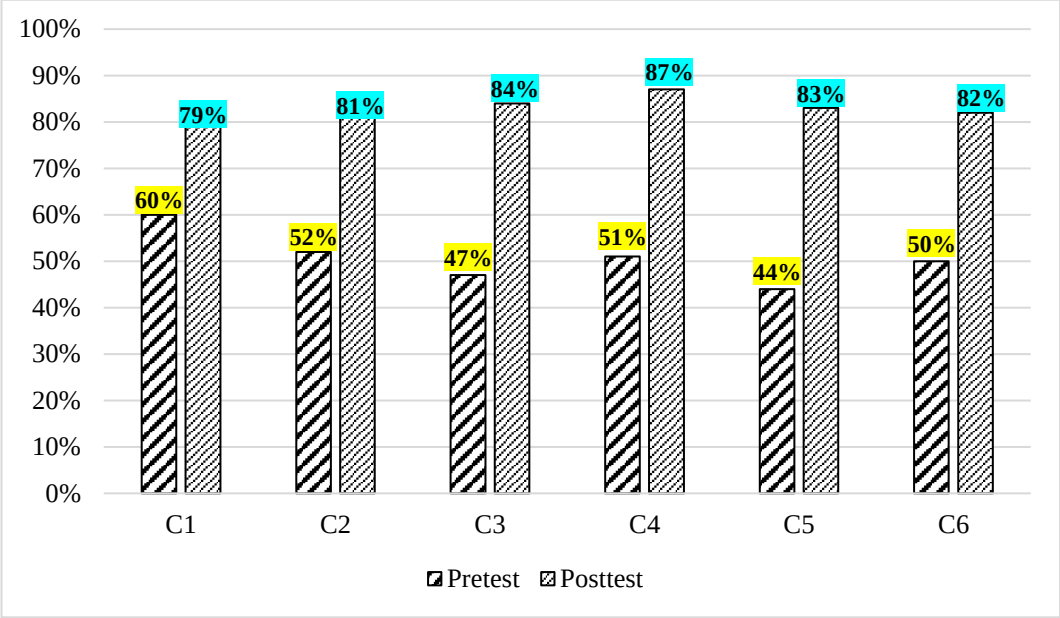

Figure 4.2. Indicators Achievement Chart of Experimental Class

The difference in the chart of posttest and pretest scores in the control class describe that avarage value of questions experienced an increase of around 11% - 25%, while Figure 4.2. shows the charts have experienced a significant improvement around 19% - 39%. PjBL encourages students to learn through real projects that require analysis, problem solving, and creativity. Therefore, the PjBL model is supportive of improving cognitive skills. This means that insectarium projects created by students can improve learning outcomes.

4.1.2. Description of Student Learning Activities

Data on students' learning activities observation sheet based on some indicators of students activities in learning process that attached in Appendix 11 using Project-Based Learning Model with insectarium on living things classification subtopic and using conventional learning can be seen in Table 4.2.

Table 4.2. Students Learning Activities Data

Descriptive Statistics					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Activites_Control	36	50	89	65.33	10.20
Activities_Experiment	36	51	89	77.00	8.04
Valid N (listwise)	36				

The Table 4.2. shows that the student activities in control class learning process has highest score 89 and lowest score 50. The mean is 65,33 with a standard deviation 10,20. While, student activities in the experiment class has highest score 89 and lowest score 51. The mean 77 with standard deviation 8,04. From both of the samples, the mean in experiment class is higher than control class. This indicates that experiment group has a higher level of success in achieving educational goals in the teaching and learning process compared to the control group. The average value of student activities per indicators in the control and experimental classes is interpreted in graphical form in Figure 4.3.

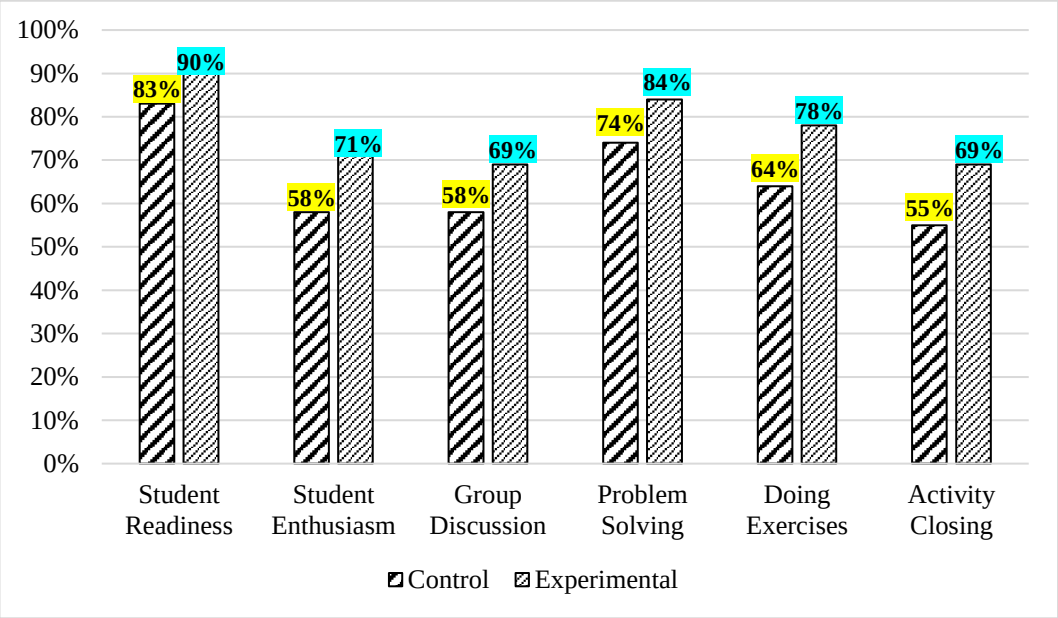

Figure 4.3. The Average Value Chart of Student activities

- **Student readiness to receive lesson material**

  In this indicator, students show readiness through punctual attendance, bringing complete learning tools, and showing an enthusiastic attitude when receiving the teacher's explanation regarding the project. This shows that student readiness will support a more conducive learning process from the start. The percentage of average scores in the control and experimental classes is not much different. There were only a few students who arrived late at the attendance check and did not bring project equipment.

- **Students' enthusiasm in participating in group discussion activities**

  Students' enthusiasm can be seen when they appear enthusiastic about participating in group discussions. Students listen to teacher’s information, respond to friends'

ideas, and ask questions. The PjBL model encourages student enthusiasm because they feel involved in real and meaningful activities. There are 71% of students' activities score from PjBL model class that complete this indicator.

- **Student activities in group discussion**

  In this indicator, students participate actively in conveying their ideas, solving group problems, and dividing tasks fairly. This activity shows that PjBL has succeeded in facilitating collaboration and interaction between students to achieve common goals in discussions. The control class showed an average score of 58% in terms of being interested in group discussions to determine the project creation schedule while the experimental class showed 69%.

- **Student activities in solving problems**

  Students actively seek solutions to problems that arise in the project. This process involves critical, logical and creative thinking. PjBL encourages students to become independent problem solvers. The difference in average value is 10% and the experimental class has a higher average value than the control class, meaning that the PjBL model influences student activity in solving problems.

- **Student activities in working on practice questions**

  Students show seriousness in working on practice questions related to project material. This activity helps measure students' understanding of the concepts they have learned and trains their applicable skills. In PjBL model, training is often linked to the project being worked on so that it is more contextual.

- **Student participation in closing learning activities**

  Students were active in the closing session by providing feedback regarding the project they were working on. They convey conclusions, share experiences, and provide reflections on the activities carried out. This participation shows that PjBL helps students connect learning with their understanding and fosters a sense of responsibility for the learning process.

4.1.3. Prerequisite Test

Analysis prerequisite tests are tests conducted before conducting data analysis to determine whether data analysis can be continued or not and whether the data meets the requirements for using a particular technique or not. Analysis prerequisite tests include normality tests for data distribution, homogeneity, and hypothesis tests.

4.1.3.1. Nomality Test

Normality test with SPSS version 26 for Windows. The normality test is performed to determine whether the data obtained are normally distributed or not. The sample is normally distributed if the significance value is > 0.05. The results of the normality test for student interest and learning outcomes can be seen in the Table 4.3.

Table 4.3. Normality Test of Student Learning Outcomes

Test of Normality			
Class	**Kolmogorov-Smirnov[a]**		
	Statistic	**Df**	**Sig.**
Pre_Control	.108	36	.200*
Pre_Experiment	.137	36	.086
Post_Control	.136	36	.091
Post_Experiment	.146	36	.051

Based on Table 4.3, the significance value from the Kolmogorov-Smirnov test for the pretest results in the control class is 0.200, while for the experimental class, it is 0.086. These values indicate that the pretest data for both the control and experimental classes are normally distributed. For the posttest, the significance value for the control class is 0.091, and for the experimental class, it is 0.051. This suggests that the posttest data in both classes are also normally distributed, as the significance values for both the pretest and posttest exceed the significance level of 0.05.

Table 4.4. Normality Test of Student Learning Activities

Tests of Normality			
	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig.
Activites_Control	.146	36	.051
Activities_Experiment	.133	36	.109
a. Lilliefors Significance Correction			

The significance value of the Kolmogorov-Smirnov test from the student activities results in the control class is 0.051 while the experiment class is 0.109 as shown in Table 4.4. The activities data in the experimental class and control class are normally distributed because the significance value of the pretest and posttest data is greater than the significance level value, which is 0.05.

4.1.3.2. Homogeneity Test

Homogeneity test with *SPSS version* 26 for Windows. The homogeneity test is performed to determine whether or not the data obtained can represent the entire existing population. The sample is considered homogeneous if the significance value is > 0.05. The results of the homogeneity test of student interest data and learning outcomes can be seen in the Table 4.5.

Table 4.5. Homogeneity Test of Students Learning Outcomes

Independent Samples Test			
		Levene's Test for Equality of Variances	
		F	Sig.
Pretest	Equal variances assumed	.057	.813
Posttest	Equal variances assumed	1.122	.293

Related to Table 4.5. above the significance value for the pretest results of both the experimental and control classes is 0.813, while the posttest results yield a significance value of 0.293. These values indicate that both the pretest and posttest results have significance values greater than or equal to the significance level. This implies that the two classes possess homogeneous abilities. The data collected during the pretest and posttest.

Table 4.6. Homogeneity Test of Students Learning Activities

Test of Homogeneity of Variances					
		Levene Statistic	df1	df2	Sig.
Student Activities	Based on Mean	2.260	1	70	.137
	Based on Median	1.590	1	70	.212
	Based on Median and with adjusted df	1.590	1	65.92	.212
	Based on trimmed mean	2.185	1	70	.144

The criteria for the homogeneity test in SPSS with the Levene test is that if Sig >0.05, then H_0 is accepted. Based on the results of the homogeneity test calculation in Table 4.6, there is a Significance value of 0.137. Therefore, H_0 is accepted. This shows that the students learning activities data of the control and experiment class have homogeneous variants.

4.1.3.3. Hypothesis Test

Independent Sample T-Test is one of the methods implemented in SPSS version 26 for Windows, used to conduct hypothesis testing. The testing criteria are as follows: if the significance value > 0.05, then H_0 is accepted and Ha is rejected. The result of hypothesis test of student learning outcome, we can see in Table 4.7 and student learning activities in Table 4.8.

Table 4.7. Hypothesis Test of Students Learning Outcomes

Students Outcomes	Class	Mean	St. Deviation	F	Sig.	Conclusion
Posttest	Control (Conventional)	74,61	6,109	1,122	0,000	Ha is accepted and Ho is rejected (The final abilities of the classes are significantly different)
	Experimental (PJBL)	83,83	5,299			

Table 4.7. shows that the posttest in experimental (using PjBL model learning) and control (using conventional learning) classes have a Sig. value is 0,000 < 0.05, then the null hypothesis (H_0) is rejected and the alternative hypothesis (Ha) is accepted. So by accepting the alternative hypothesis (Ha), it can be concluded that there is an effect.

Table 4.8. Hypothesis Test of Students Learning Activities

Students Activities	Class	Mean	St. Deviation	F	Sig.	Conclusion
Value	Control (Conventional)	65,33	10,206	2,260	0,000	Ha is accepted and Ho is rejected (The final abilities of the classes are significantly different)
	Experimental (PJBL)	77,00	8,042			

Related to the results of the Independet sample t-test of the experimental class students activities value and the control class in the Table 4.8, it can be seen that the value of Sig. value is 0.000 < 0.05. Therefore, it can be concluded that the H_0 is rejected and the H_a is accepted. This shows that the average activities score of students in the experimental class is significantly different from the control class after the observation in learning process. This demonstrates that the Project-Based Learning model has an effect on student learning activities.

4.1.3.4. N-gain

After carrying out the Independent sample t-test, the posttest learning results were then analyzed using N-gain. Based on the research results (see Appendix 16), in the control class that used conventional there were 2 student who obtained an N-gain of 0.7 with high criteria. There were 26 students who obtained 0.3≤N-gain ≥ 0.7 with medium criteria. There were 8 students who obtained N-gain<0.3 with low criteria. Meanwhile, in the experiment class using PjBL model there were 12 students who obtained N-gain >0.7 with high criteria. There were 24 students who obtained 0.3 ≤ N-gain ≥ 0.7 with medium criteria. The results of the N-gain calculation can be seen in Table 4.9.

Table 4.9. N-gain Scores of Control and Experiment Class

Score	Control	Percentage (%)	Experiment	Percentage (%)	Criteria
g > 0.7	2	5,55%	12	33,3%	High
0,3 ≤ g ≥ 0,7	26	72,2%	24	66,6%	Medium
g < 0.3	8	22,2%	0	0%	Low

Based on the difference in N-gain scores percentage in the control class that use conventional learning and the experiment class that used the PjBL model, it was known that the used of this PjBL model was quite effective in learning with the N-gain ratio of the class was higher than the class with conventional learning. It can be seen in Appendix 16.

4.2. Discussion

This research was conducted from 3 to 13 August 2024 at SMAN 1 Tanjungbalai. The researcher chose the school because it implemented an Kurikulum Merdeka in class X in accordance with the subject raised by the researcher. The purpose of this study was to find the effect of the Project Based Learning (PjBL) model on student learning outcomes and activities on the classification of living things subtopic for class X of SMAN 1 Tanjungbalai in the 2024/2025 academic year. This research is an experimental research, where in this study the researcher first gave different treatments to the research samples and then collected data.

Project-based Learning (PjBL) has several advantages, they are: motivating students by involving them in learning, helping students develop communication skills, and helping students learn to work together in group. Insectarium were made to make as a learning medium for observing insect body structure, understanding insect morphology, anatomy and systematics. The students can observe directly by using the media. According to Istiqomah (2014), the use of plant and animal specimens in biology learning helps increase students' interest in the existence of living things and increases cooperation between students during learning and increases learning completion. It also has disadvantages, that students can only see a limited number of specimens and it can lead to a decline in insect species if too many are used as insectarium material and become research materials.

This research has several advantages, especially in the context of applying the Project-Based Learning (PjBL) model on the living things classification subtopic. the use of an insectarium allows students to be directly involved in a contextual and authentic learning process. Students not only learn theoretically about the classification of living things, but also observe and group insects directly according to its structure of morphology. This increases deeper understanding of concepts because students are actively involved in the scientific investigation process. Through this project, students are also encouraged to think critically and solve problems, which are important skills in 21st century education. Apart from that, implementing PjBL with the insectarium project has

the potential to increase student learning activities significantly. Direct involvement in collecting data and conducting practical analysis makes students more motivated and active in learning. Students' high activity can be seen from their enthusiasm in exploring the surrounding environment to look for insect specimens and in discussing to determine classification categories. Thus, this research not only measures cognitive learning outcomes, but also assesses affective and psychomotor aspects, which provides a more holistic picture of the impact of project-based learning on students.

Even though the Project-Based Learning (PjBL) model has many advantages, there are several weaknesses that need to be considered in this research. One of them is the need for more time in making a project compared to conventional learning methods. Making insectarium project was required special equipment and environmental supports that enable students to collect and observe insects, which are not always easily available in all schools. Additionally, students with low levels of understanding or motivation may have difficulty completing projects independently, requiring extra guidance from the teacher. This can burden teachers in terms of class management and monitoring, especially if the number of students in the class is large.

Kurikulum Merdeka emphasizes student-centered learning with a focus on strengthening competence, developing 21st century skills (4C: critical thinking, creativity, collaboration, communication), and character building through the Pancasila Student profile (Kemendikbud, 2022). The Project-Based Learning (PjBL) and Problem-Based Learning (PBL) learning models have a strong connection to the curriculum because they both encourage contextual, active and exploratory learning. PjBL helps students learn through designing and completing real, relevant projects, while PBL trains students in solving authentic problems that require critical and creative thinking. These two models provide space for students to learn according to their interests and abilities, as well as develop collaboration and communication skills.

This research using the PjBL and conventional models has demonstrated efforts to compare the effectiveness of innovative methods on learning outcomes and student activities. This is an advantage because research is able to show the

weaknesses of conventional methods which tend to focus only on cognitive aspects and do not involve students in active learning. However, this research has shortcomings because it does not involve the Problem-Based Learning (PBL) model which should be more in line with the Kurikulum Merdeka. With PBL, learning can be more optimal in training critical thinking and problem solving skills, which are one of the main targets of the Kurikulum Merdeka. Apart from that, the combination of PjBL and PBL will be more effective in developing student characters, such as creativity, independence and collaboration.

The limitations of this research can be a recommendation for further research by comparing PjBL, PBL, and conventional methods to produce a more comprehensive picture of the effectiveness of the learning model. In addition, future research can assess broader indicators, such as developing the Pancasila Student profile through student creativity, collaboration and independence. Thus, focusing on student activities in solving problems through PBL and in designing projects through PjBL will make a real contribution to the development of education that is more innovative and relevant to the demands of Kurikulum Merdeka.

The implementation of PjBL is monitored through a syntax implementation observation sheet (see Appendix 10). The result shows that all PjBL syntax has been fulfilled. Students feel happy while carrying out project activities by seeing the differences in insect specimens in detail on the classification of living things subtopic, they are enthusiastic about discussing and working on projects therefore the class conditions look active during learning and group presentations. This is because students dominate more in learning activities. The teacher as a facilitator and students are active in learning by formulating problem topics, collecting data and analyzing data therefore a solution to the problem is obtained. The implementation of PjBL can make students play an active role in solving. The results of the syntax implementation observation of this research is 94% (very good), we can see in Appendix 15.

The data collected in this study were obtained by using learning outcome tests, namely pretest and posttest, as well as observations of student activities in

two classes, namely class X-6 (control) and X-4 (experimental) class. The details of the results of each variable are as follows:

4.2.1. Students Learning Outcomes

In the learning process, the test questions given are 30 multiple choice questions related to the topic that has been taught, namely the classification of living things. The results of the pretest and posttest for both classes which were tested for normality first using SPSS version 26 for Windows. This can be seen in the one-sample Kolmogorov Smirnov Test Table, which shows that the data is normally distributed. To test significant differences in student learning outcomes (posttest) in the experiment class that using the Project-Based Learning (PjBL) model and control class using conventional learning, the t-test was used, where the learning results obtained from the experiment class were compared with the learning results obtained from the control class. Based on the results of SPSS calculations, the sig value is obtained. (2-tailed) 0.000, and the significance level $\alpha = 0.05$, then $0.000 < 0.05$. Thus H_0 is rejected and H_1 is accepted, it can be concluded that there is an effect of the Project Based Learning model on student learning outcomes at SMAN 1 Tanjungbalai on Living Things Classification subtopic.

After the idependent sample t-test was carried out, the pretest and posttest scores of the control class and the experiment were also tested with the N-Gain test to measure the effectiveness of learning or intervention in improving student learning outcomes. Based on the results of the research, in the experiment class using a PjBL model with 36 students (see Appendix 16), there were 12 students who obtained N-gain >0.7 with high criteria and 24 students who obtained $0.3 \leq$ N-gain ≥ 0.7 with medium criteria. Meanwhile, in the control class that used conventional learning (see Appendix 17), we found 2 students who obtained an N-gain of 0.7 with high criteria, in medium criteria of $0.3 \leq$N-gain ≥ 0.7, 26 students were identified., and also 8 students who obtained N-gain<0.3 with low criteria. Based on this statement, it can be interpreted that the PjBL model was quite effective in learning process.

PjBL can motivate students to complete their tasks well and the importance of group work requires students to develop and practice

communication skills. No less important, if implemented well, it will provide students with learning and practice in project management, allocating time well, and using equipment to complete tasks efficiently. The implementation of PjBL has been shown to be able to improve learning outcomes in the cognitive domain. The advantage of PjBL is that it is able to involve students more in learning. With their involvement in learning, their understanding of the meaning of learning will increase (Jusita, 2019).

The Project-Based Learning model promotes a deeper understanding of concepts and improved learning outcomes compared to conventional learning methods. This approach utilizes contextual learning, allowing students to actively engage in formulating essential questions, designing project plans, making decisions, conducting research, presenting their findings, and creating the final project. Previous study stated that Project-Based Learning methods have been proven to have a different influence from conventional learning methods. The differences in learning outcomes that occur are the result of the control and treatment process in each class. The project based learning method can make learning outcomes better because there can be interactions from many directions in the student learning process in the classroom (Prabowo, 2015).

Biology learning is very appropriate if the class applies the project-based learning model in the learning process because this model has several advantages, including being able to increase student enthusiasm because students are always active, helping to create a conducive learning atmosphere because learning relies on real world problems and generating excitement in the teaching and learning process. This is because the learning process is dynamic and open from various directions. While direct learning model is dominated by the teacher as the information center (the teacher as the center). Furthermore, a learning orientation that only prioritizes products rather than processes results in students' limited ability to apply the concepts they learn in the real world. On the other hand, students just memorize concepts without understanding the meaning of the concepts being studied. This learning process causes students to only master the subject at the lowest cognitive level and is very dependent on the teacher's mastery of the learning subject (Jagantara, 2014).

4.2.2. Students Learning Activities

The results of observations of student learning activities were obtained during the learning activities using the Project Based Learning (PjBL) model which were measured using an observation assessment sheet instrument (See Appendix 11) for students by several assessment rubrics based on understanding of the purpose of observation and key elements of the learning process for student activities. Related to the results of observations, it is known that students' activities during biology learning on the living things classification subtopic using the Project Based Learning model by doing and seeing directly are more active. Students become active in exchanging ideas therefore new ideas emerge in the group and ask questions about the topic that is not yet understood. Initially, students were divided into small groups to discuss the classification of living things subtopic, each student in the group was given an LKPD (student work sheet) and students worked on the projects that had been prepared. It can be concluded that the results of observations of student activities in the learning process using the project based learning model obtained very high scores. This can be seen from the average percentage of the experiment class (see Table 4.2.) which is 77,00. This is in accordance with the student activity criteria, 61 – 80 = active. while in control class were lower with 65,33.

When carrying out the project assignment, students are given problems regarding the classification of several specimens of living things into the arthropod phylum. Students activities can be observed when they were guided to determine the topic of the problem, compile project completion steps, compile a project implementation schedule, and conduct direct observation activities. Furthermore, students observe the specimens of living things observed, seek information and discuss the results of observations to answer a number of questions given. After students have completed their observations and obtained the project results, students are directed to compile a project report and present the project results.

The use of project in learning activities is a form of effort to make students more able to explore all their abilities in learning activities. Through projects, students are expected to be more creative, identify problems, explore alternative

solutions to problems that occur, and be able to determine solutions to problems that occur through working on a project. The teacher is tasked with determining the time limit and limitations of making a project. The teacher continues to encourage student work, and after the project is completed, provides feedback in the form of exams and presentations by students regarding the making of the project. Based on several definitions that have been explained previously, it can be understood that what is meant by PjBL is a learning model that utilizes project media to activate student learning activities both physically and psychologically, both independently and in groups. The project media in question is expected to be able to stimulate students' thinking power in finding and solving problems that occur in learning (Kahar, 2022).

The results of this study are in line with the results of research conducted by Pasaribu and Simatupang (2020) which stated that the influence was caused by the learning model applied in the experiment class which required students to be able to choose, design and lead their own thoughts and work therefore students could apply their learning subjects.

In essence, project-based learning is a learning model that requires students to participate actively, both individually and in groups, because through group collaboration, students will be involved in the problem-solving investigation process (Na'imah, et al. 2015). This is shown when learning takes place, learning activities are dominated by students. Meanwhile, the teacher supervises the progress of the project and provides scaffolding for groups that need guidance. Assessment of the resulting product is carried out by the teacher when each group presents the results of their work. This aims to get students used to giving positive feedback to their friends' work. At the end of the meeting, there is a reflection carried out by students on the activities and results of the project carried out. Reflection at the end of learning is very important therefore students and teachers can find out how far the child's learning experience is and make improvements to learning in the future.

Students in a class have different characteristics, which can influence the acquisition of learning outcomes. Student learning outcomes can be influenced by several factors, including internal factors, external factors, or learning approach

factors. Internal factors can be physiological factors or the physical condition of students, which can affect the course of the learning process. Student intelligence factors, such as the high level of intelligence of a student, can make it easier to understand lessons and solve problems encountered in the learning process, thereby encouraging interest in learning. Another internal factor is student attitude, which can be influenced by student activeness and enthusiasm in participating in the learning process. External factors can originate from family or society, as these are the closest people to students. The level of attention and support provided by family members can positively influence students' motivation to engage in learning activities. Similarly, a supportive and positive community environment can also encourage students' learning efforts. While the learning approach factor can be influenced by the application of various learning strategies, methods, or techniques employed by educators to engage students and foster active learning (Farita, 2019).

CHAPTER V
CONCLUSION AND SUGGESTION

4.1. Conlusion

Related to the results and discussion of the research, the following conclusions are obtained:

1. We found an effect of Project-Based Learning (PjBL) model to students learning outcomes on an living things classification subtopic in class X at SMAN 1 Tanjungbalai 2024/2025 with significance value of 0,000< 0,05.
2. There is effect of Project-Based Learning (PjBL) model to students learning activities on an living things classification subtopic in class X at SMAN 1 Tanjungbalai 2024/2025 school year with significance value of 0,000<0,05.
3. Project-Based Learning (PjBL) Model increases students' learning outcomes in Biology class X at SMAN 1 Tanjungbalai 2024/2025 school year with N-gain score 0,66 (medium) .

4.2. Suggestion

In applying the PjBL model through making insectariums for living things classification subtopic in Biology, the author suggests the following:

1. The PjBL model through making insectarium preserves can be used as an alternative Biology learning model in improving learning outcomes and student activities.
2. Making insectarium can be used as an alternative learning medium for observing real living creatures.
3. Further research needs to be carried out with a longer duration and a different concept from the arthropod phylum, it can be applied to topic other than the living things classification.

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APPENDICES

Appendix 1. Observation Permit Letter

KEMENTERIAN PENDIDIKAN, KEBUDAYAAN,
RISET DAN TEKNOLOGI
UNIVERSITAS NEGERI MEDAN
FAKULTAS MATEMATIKA DAN ILMU PENGETAHUAN ALAM
Jl Willem Iskandar Psr V - Medan Estate. Kotak Pos No. 1589 Medan 20221
www.fmipa.unimed.ac.id

Nomor : 6060 /UN33.4.1/PG/2023 Medan, 21 September 2023
Lampiran : ---
Perihal : Izin Melaksanakan Observasi

Yth. Kepala SMA Negeri 1 Tanjung balai
di
Tempat

Dengan hormat, kami memohon bantuan Saudara agar dapat memberikan izin melaksanakan Observasi Penelitian di instansi yang Saudara pimpin kepada mahasiswa kami tersebut di bawah ini :

Nama : Nindya Zayani Ekaputri
NIM : 4201141010
Program Studi : S-1 Pendidikan Biologi Bilingual
Dosen Pembimbing : Khairiza Lubis, M.Sc., Ph.D

Perlu diketahui bahwa kegiatan observasi ini dilakukan untuk keperluan penyusunan proposal penelitian skripsi mahasiswa tersebut yang meliputi tentang :

1. Keadaan tempat observasi.
2. Sarana dan prasarana yang mendukung.
3. Melakukan wawancara di tempat observasi.

Demikian kami sampaikan, atas perhatian dan kerja sama yang baik diucapkan terima kasih.

a.n. Dekan,
Wakil Dekan Bidang Akademik

Dr. Jamalum Purba, M.Si
NIP. 19641207 199103 1 002

Appendix 2. Observation Statement Reply Letter from School

PEMERINTAH PROVINSI SUMATERA UTARA
DINAS PENDIDIKAN
CABANG DINAS PENDIDIKAN WILAYAH V
SMA NEGERI 1 TANJUNGBALAI
Jalan MT. Haryono No. 10 Kel. Karya Kec. Tanjungbalai Selatan Kode Pos : 21314
Email: sman1tanjungbalai1958@gmail.com, NSS : 301076401001, NPSN : 10212024
KOTA TANJUNGBALAI

SURAT KETERANGAN
Nomor : 09 /015 / SMAN.01 TB / 2024

Yang bertanda tangan di bawah ini Kepala SMA Negeri 1 Tanjungbalai Kelurahan Karya Kecamatan Tanjungbalai Selatan Kota Tanjungbalai Provinsi Sumatera Utara dengan ini menerangkan bahwa :

Nama	: NINDYA ZAYANI EKAPUTRI
NIM	: 4201141010
Program Studi	: S1 / Pendidikan Biologi Bilingual Universitas Negeri Medan

diberikan izin dan benar telah melakukan observasi penelitian untuk penyusunan skripsi di SMA Negeri 1 Tanjungbalai pada tanggal 30 September 2023 dengan Judul Skripsi : **"The Effect Of Project Based Learning Model With Insectarium On Students Learning Outcomes In Animal Classification Subtopic At SMA Negeri 1 Tanjungbalai"**

Demikian Surat Keterangan ini diperbuat dengan sebenarnya untuk dapat dipergunakan seperlunya.

Tanjungbalai, 08 Januari 2024
Kepala Sekolah,

DEDDI ANSHARI, S.Pd, M.Si
NIP.19730519 199903 1 004

Appendix 3. Interview Sheet

Interview Sheet

Questions	Answers
Kurikulum apa yang digunakan di sekolah ini, Bu?	Untuk kelas X diterapkan kurikulum merdeka, sementara kelas XI dan XII masih menggunakan kurikulum 2013.
Model pembelajaran apa yang sering diterapkan dalam pembelajaran biologi?	Model yang sering digunakan yaitu PjBL, tetapi penggunaannya masih sedikit belum diterapkan ke beberapa materi biologi.
Media pembelajaran apa yang sering ibu gunakan?	Sejauh ini kebanyakan menggunakan buku cetak dan *Powerpoint*, ada juga torso dalam pembelajaran sistem rangka kelas XI.
Apakah siswa sudah sangat aktif (berdisuksi, bereksperimen, memecahkan masalah) pada saat proses pembelajaran?	Sebagian aktif sebagian kurang, tergantung siswanya. Mungkin karena ada siswa yang sulit memahami materi dan memiliki rasa takut sehingga kurang aktif dalam proses pembelajaran.
Kemampuan (kognitif, afektif, psikomotorik) apakah yang masih perlu diperhatikan serta dikembangan pada siswa yang ibu ajarkan?	Semua ranah saya harap dapat ditingkatkan pada siswa, khususnya kognitif dan psikomotorik karena ini kurikulum merdeka yang lebih banyak membuat projek pembelajaran nantinya.
Apakah rata-rata hasil belajar siswa sudah mencapai KKM?	Sudah 60% mencapai KKM dan 40% belum mencapai KKM pada ulangan dan tugas harian.
Materi apa yang masih sulit untuk dipahami oleh siswa dan belum mencapai KKM?	Sejauh ini masih 2 materi yang dilewati mereka yaitu keanekaragaan hayati dan virus. Mungkin yang sulit itu pada materi Virus, karena mereka sulit membayangkan bagaimana bentuk dan struktur objek yang dibahas.
Bagaimana dengan materi keanekaragaman hayati, apa kesulitan yang dihadapi siswa khususnya dalam subtopik klasifikasi makhluk hidup?	Materi keanekaragaman hayati masih dianggap mudah dalam mempelajarinya tetapi untuk menentukan klasifikasi suatu makhluk hidup, beberapa siswa masih belum dapat membedakan hewan berdasarkan ciri-ciri khususnya.
Kendala apa yang seringkali ibu temukan pada saat proses belajar mengajar?	Menghadapi siswa yang kurang fokus dan kebanyakan bermain di kelas.

Appendix 4. Research Implementation Permit Letter

KEMENTERIAN PENDIDIKAN, KEBUDAYAAN,
RISET DAN TEKNOLOGI
UNIVERSITAS NEGERI MEDAN
FAKULTAS MATEMATIKA DAN ILMU PENGETAHUAN ALAM
Jl. Willem Iskandar Psr V - Medan Estate. Kotak Pos No. 1589 Medan 20221
www.fmipa.unimed.ac.id

Nomor : 4785 /UN33.4.1/PG/2024 Medan, 23 Juli 2024
Lampiran : 1 (satu) berkas Proposal Penelitian
Perihal : Izin Melaksanakan Penelitian

Yth. Kepala SMAN 1 Tanjungbalai
di
Tempat

Bersama ini kami mohon dengan hormat bantuan Saudara agar dapat memberikan izin melaksanakan Penelitian di instansi yang Saudara pimpin kepada mahasiswa kami tersebut di bawah ini :

Nama	: Nindya Zayani Ekaputri
NIM	: 4201141010
Program Studi	: S-1 Pendidikan Biologi Bilingual
Dosen Pembimbing	: Khairiza Lubis, M.Sc., Ph.D
Judul Penelitian	: The Effect of Project Based Learning Model on Students Learning Outcomes and Activities in Living Things Subtopic at SMAN 1 Tanjungbalai

Perlu diketahui bahwa kegiatan ini dilaksanakan untuk memperoleh data yang akan digunakan dalam penyusunan skripsi mahasiswa tersebut guna memenuhi salah satu syarat memperoleh gelar Sarjana Pendidikan (S.Pd) di FMIPA Unimed.

Demikian kami sampaikan, atas perhatian dan kerja sama yang baik diucapkan terima kasih.

an. Dekan,
Wakil Dekan Bidang Akademik

Dr. Jamalum Purba, M.Si
NIP. 19641207 199103 1 002

Appendix 5. Research Implementation Statement Reply Letter from School

PEMERINTAH PROVINSI SUMATERA UTARA
DINAS PENDIDIKAN
CABANG DINAS PENDIDIKAN WILAYAH V
SMA NEGERI 1 TANJUNGBALAI
Jalan. MT. Haryono No. 10 Kel. Karya Kec. Tanjungbalai Selatan Kode Pos : 21314
Email: sman1tanjungbalai1958@gmail.com, NSS : 301076401001, NPSN : 10212024
KOTA TANJUNGBALAI

SURAT KETERANGAN
Nomor : 09 /685/ SMAN.01 TB / 2024

Yang bertanda tangan di bawah ini Kepala SMA Negeri 1 Tanjungbalai Kelurahan Karya Kecamatan Tanjungbalai Selatan Kota Tanjungbalai Provinsi Sumatera Utara dengan ini menerangkan bahwa :

Nama	: NINDYA ZAYANI EKAPUTRI
NIM	: 4201141010
Program Studi	: S1 / Pendidikan Biologi Bilingual Universitas Negeri Medan

diberikan izin dan benar telah melakukan penelitian untuk penyusunan skripsi di SMA Negeri 1 Tanjungbalai pada tanggal 3 - 13 Agustus 2024 dengan Judul Skripsi : **"The Effect Of Project Based Learning Model On Students Learning Outcomes And Activities In Living Things Subtopic At SMAN 1 Tanjungbalai"**

Demikian Surat Keterangan ini diperbuat dengan sebenarnya untuk dapat dipergunakan seperlunya.

Tanjungbalai, 14 Agustus 2024

Kepala Sekolah,

DEDDI ANSHARI, S.Pd, M.Si
NIP.19730519 199903 1 004

Appendix 6. Flow of Learning Objectives

Alur Tujuan Pembelajaran	JP	Profil Pelajar Pancasila	Indikator Pencapaian
10.1. Menganalisis berbagai tingkat keanekaragaman makhluk hidup dan peranannya di lingkungan sekitar, beserta ancaman dan pelestariannya dalam bentuk tabel.	2 JP	Bernalar kritis	Menyajikan tabel tingkat keanekaragaman makhluk hidup dan peranannya di lingkungan sekitar, serta ancaman dan pelestariannya.
10.2. Melakukan penelitian observasi berbagai tingkat keanekaragaman makhluk hidup dan peranannya di lingkungan sekitar dengan membandingkan data keanekaragaman makhluk hidup dari berbagai wilayah di Indonesia dari sumber yang relevan.	4 JP	Mandiri dan bernalar kritis	Menyajikan data observasi pengamatan dan membandingkan dengan data keanekaragaman hayati dari berbagai wilayah di Indonesia.
10.3. Menganalisis data perbandingan hasil observasi berbagai tingkat keanekaragaman makhluk hidup (gen, jenis dan ekosistem) di lingkungan sekitar dalam bentuk laporan tertulis.	4 JP	Mandiri dan bernalar kritis	Menyajikan laporan tertulis hasil observasi tingkat keanekaragaman makhluk hidup di lingkungan sekitar.
10.4. Menyajikan usulan upaya pelestarian keanekaragaman makhluk hidup dalam berbagai bentuk media presentasi.	4 JP	Bernalar kritis dan kreatif	Menyajikan satu bentuk media presentasi yang mencantumkan 5 usulan upaya pelestarian keanekaragaman makhluk hidup.
10.5. Menganalisis karakteristik virus dan peranannya dalam fenomena-fenomena yang terjadi di lingkungan sekitar tempat tinggal dalam bentuk laporan	4 JP	Bernalar kritis	Menyajikan laporan tertulis minimal 5 karakteristik virus dan peranannya.

tertulis.			
10.6. Menyajikan data tentang ciri-ciri, cara replikasi, dan peranan virus dalam aspek kesehatan masyarakat dalam bentuk proyek sederhana/ simulasi visual.	4 JP	Bernalar kritis dan kreatif	Membuat satu proyek sederhana/ simulasi visual tentang ciri-ciri, cara replikasi dan peranan virus.
10.7. Mendiagnosis hasil kajian dari berbagai informasi media cetak/ online mengenai kerusakan lingkungan yang terjadi dan menyajikannya dalam bentuk presentasi.	4 JP	Bernalar kritis dan kreatif	Melakukan presentasi yang memuat minimal 5 hasil kajian tentang kerusakan lingkungan.
10.8. Melakukan penelitian percobaan polusi air atau udara untuk memprediksi daya tahan makhluk hidup terhadap kelangsungan hidupnya dan menyajikannya dalam bentuk laporan tertulis.	4 JP	Gotong royong dan bernalar kritis	Menyajikan data laporan penelitian sebuah percobaan polusi air atau udara.
10.9. Menganalisis data perubahan lingkungan dan dampaknya bagi kehidupan makhluk hidup serta menyajikannya dalam bentuk laporan tertulis.	2 JP	Bernalar kritis	Menyajikan laporan tertulis minimal 5 contoh perubahan lingkungan dan dampaknya bagi kehidupan makhluk hidup.
10.10. Memecahkan masalah lingkungan dengan membuat proyek sederhana dari bahan daur ulang limbah.	4 JP	Bernalar kritis dan kreatif	Membuat satu proyek sederhana dari bahan daur ulang limbah tentang masalah lingkungan.
10.11. Menganalisis data pengamatan tentang hubungan antara komponen biotik dan abiotik, peranannya dalam ekosistem, dan mengaitkannya dengan keseimbangan lingkungan yang disajikan dalam	2 JP	Bernalar kritis	Menyajikan laporan tertulis data pengamatan hubungan komponen biotik dan abiotik, peranannya, dan mengaitkannya dengan keseimbangan

bentuk laporan tertulis.			lingkungan.
10.12. Memprediksi ketidakseimbangan komponen ekosistem yang terjadi di alam dan upaya rehabilitasi yang dapat dilakukan agar keseimbangan alam tetap terjaga.	2 JP	Bernalar kritis	Menyajikan data prediksi ketidakseimbangan komponen ekosistem dan upaya rehabilitasi yang dapat dilakukan.
10.13. Menganalisis data tentang interaksi antar komponen ekosistem dan jaring-jaring makanan dalam bentuk proyek sederhana/ simulasi visual.	4 JP	Bernalar kritis, mandiri dan kreatif	Membuat satu proyek sederhana/ simulasi visual tentang interaksi antar komponen ekosistem dan satu jaring-jaring makanan.
10.14. Melakukan perencanaan dan penelitian observasi produk bioteknologi yang beredar di masyarakat berdasarkan prinsip dasar proses bioteknologi.	4 JP	Mandiri dan bernalar kritis	Melakukan rangkaian penelitian observasi 5 produk bioteknologi di lingkungan sekitar.
10.15. Menganalisis data hasil observasi produk bioteknologi yang dikomunikasikan dalam berbagai bentuk proyek sederhana.	2 JP	Bernalar kritis dan kreatif	Membuat satu proyek sederhana dari data hasil observasi produk bioteknologi.
10.16. Merencanakan percobaan penelitian produk bioteknologi dalam penerapan prinsip-prinsip bioteknologi konvensional.	2 JP	Bernalar kritis	Membuat satu rencana percobaan pembuatan produk bioteknologi.
10.17. Melakukan percobaan dalam penerapan prinsip-prinsip bioteknologi konvensional untuk menghasilkan produk bioteknologi.	4 JP	Bergotong-royong dan kreatif	Melakukan satu percobaan penelitian bioteknologi dengan menghasilkan suatu produk.
10.18. Mengevaluasi produk bioteknologi yang dihasilkan beserta prosedur yang dilaksanakan dalam bentuk presentasi.	4 JP	Bernalar kritis dan kreatif	Melakukan presentasi evaluasi produk bioteknologi beserta prosedur pelaksanaannya.

Appendix 7. Teaching Module

MODUL AJAR

BAB 1 : KEANEKARAGAMAN HAYATI
SUB BAB 1.2. : KLASIFIKASI MAKHLUK HIDUP

INFORMASI UMUM

I. IDENTITAS MODUL

Nama penyusun : Nindya Zayani Ekaputri
Sekolah : SMAN 1 Tanjungbalai
Kelas : X (Sepuluh)
Mata pelajaran : Biologi
Alokasi waktu : 3 JP (3 x 45 menit)
Jumlah Pertemuan: 2 Pertemuan (4 JP)
Tahun penyusunan: 2024

II. KOMPETENSI AWAL

Capaian Pembelajaran Biologi Fase E

Pada akhir fase E, peserta didik memiliki kemampuan untuk responsif terhadap isu-isu global dan berperan aktif dalam memberikan penyelesaian masalah. Kemampuan tersebut antara lain mengamati, mempertanyakan dan memprediksi, merencanakan dan melakukan penelitian, memproses dan menganalisis data dan informasi, mengevaluasi dan merefleksi, serta mengkomunikasikan dalam bentuk projek sederhana atau simulasi visual menggunakan aplikasi teknologi yang tersedia terkait dengan energi alternatif, pemanasan global, pencemaran lingkungan, nano teknologi, bioteknologi, kimia dalam kehidupan sehari-hari, pemanfaatan limbah dan bahan alam, pandemi akibat infeksi virus. Semua upaya tersebut diarahkan pada pencapaian tujuan pembangunan yang berkelanjutan (SDGs). Melalui keterampilan proses juga dibangun sikap ilmiah dan profil pelajar pancasila.

Elemen	Capaian Pembelajaran
Pemahaman Biologi	Pada akhir fase E, peserta didik memiliki kemampuan menciptakan solusi atas permasalahan-permasalahan berdasarkan isu lokal atau global dari pemahamannya tentang keanekaragaman makhluk hidup dan peranannya, virus dan peranannya, penerapan bioteknologi, komponen ekosistem dan interaksi antar komponen serta perubahan lingkungan.
Keterampilan proses	1. Mengamati Mampu memilih alat bantu yang tepat untuk melakukan

	pengukuran dan pengamatan. Memperhatikan detail yang relevan dari obyek yang diamati. 2. Mempertanyakan dan memprediksi Merumuskan pertanyaan ilmiah dan hipotesis yang dapat diselidiki secara ilmiah. 3. Merencanakan dan melakukan penyelidikan Peserta didik merencanakan dan memilih metode yang sesuai berdasarkan referensi untuk mengumpulkan data yang dapat dipercaya, mempertimbangkan resiko serta isu-isu etik dalam penggunaan metode tersebut. Peserta didik memilih dan menggunakan alat dan bahan, termasuk penggunaan teknologi digital yang sesuai untuk mengumpulkan serta mencatat data secara sistematis dan akurat. 4. Memproses, menganalisis data dan informasi Menafsirkan informasi yang didapatkan dengan jujur dan bertanggung jawab. Menggunakan berbagai metode untuk menganalisa pola dan kecenderungan pada data. Mendeskripsikan hubungan antar variabel serta mengidentifkasi inkonsistensi yang terjadi. Menggunakan pengetahuan ilmiah untuk menarik kesimpulan yang konsisten dengan hasil penyelidikan. 5. Mengevaluasi dan refleksi Mengevaluasi kesimpulan melalui perbandingan dengan teori yang ada. Menunjukkan kelebihan dan kekurangan proses penyelidikan dan efeknya pada data. Menunjukkan permasalahan pada metodologi dan mengusulkan saran perbaikan untuk proses penyelidikan selanjutnya. 6. Mengomunikasikan hasil Mengomunikasikan hasil penyelidikan secara utuh termasuk di dalamnya pertimbangan keamanan, lingkungan, dan etika yang ditunjang dengan argumen, bahasa serta konvensi sains yang sesuai konteks penyelidikan. Menunjukkan pola berpikir sistematis sesuai format yang ditentukan.

III. PROFIL PELAJAR PANCASILA

1) Beriman, bertakwa kepada Tuhan Yang Maha Esa, dan berakhlak mulia
2) Kreatif
3) Bergotong royong

IV. SARANA DAN PRASARANA

1. Gawai
2. Laptop
3. Akses internet
4. Buku teks
5. Papan tulis
6. Lembar kerja peserta didik

7. Infokus / proyektor
8. Lingkungan sekitar
9. Referensi lain yang mendukung

V. TARGET PESERTA DIDIK

Peserta didik kelas X-4 dan X-6 (Tipikal: Umum, tidak ada kesulitan dalam mencerna dan memahami materi ajar)

VI. MODEL PEMBELAJARAN

Model pembelajaran yang digunakan adalah *Project Based Learning (PjBL)*

KOMPONEN INTI

I. TUJUAN PEMBELAJARAN

Selama dan setelah mengikuti proses pembelajaran ini peserta didik diharapkan dapat :

1). Mengidentifikasi prinsip-prinsip dalam klasifikasi makhluk hidup

2). Menganalisis ciri-ciri umum dalam klasifikasi mahluk hidup dengan metode yang benar

3). Menciptakan projek awetan spesimen makhluk hidup

4). Mengevaluasi hasil materi berdasarkan projek dengan penuh tanggung jawab, jujur disiplin serta dapat berkolaborasi dan berkomunikasi dengan baik.

II. PEMAHAMAN BERMAKNA

Klasifikasi adalah cara pengelompokkan makhluk hidup berdasarkan persamaan ciri dan perbedaan yang dimilikinya menjadi tingkat tingkat hierarki. Cabang biologi yang khusus mempelajari tentang klasifikasi adalah taksonomi. Peserta didik mampu menerapkan materi klasifikasi atau pengelompokkan makhluk hidup untuk menyelesaikan permasalahan dalam kehidupan sehari-hari.

Ada beberapa alasan mengapa makhluk hidup harus diklasifikasikan, di antaranya: Menyederhanakan objek studi supaya mudah dipelajari; melabeli atau memberi nama makhluk tersebut; mengetahui hubungan kekerabatan makhluk tersebut; dan mengetahui tingka evolusi suatu makhluk hidup dengan dasar hubungan kekerabatan.

III. PERTANYAAN PEMANTIK

1. Apakah ciri-ciri tiap makhluk hidup sama?
2. Mengapa kita perlu mengenal dan mengklasifikasikan makhluk hidup?
3. Pernahkah kalian berfikir, bagaimana cara yang membandingkan perbedaan ciri-ciri mahluk hidup yang banyak jumlahnya?

IV. KEGIATAN PEMBELAJARAN

- Pertemuan ke-1

Kegiatan	Deskripsi Kegiatan	Alokasi waktu
Pendahuluan	**Orientasi** • Guru mengucapkan salam • Guru meminta salah satu peserta didik untuk memimpin doa	15 menit

	• Guru memeriksa/mempersiapkan siswa dan kelas untuk pembelajaran (termasuk mempersiapkan media pembelajaran yang akan digunakan) • Guru memeriksa presensi **Stimulasi** • Guru bertanya pada siswa "pernahkan kamu memperhatikan hewan di halaman atau lapangan sekitar rumahmu? Bagaimana hewan-hewan tersebut dikelompokkan? Dan mengapa dikelompokkan?" **Motivasi** • Guru memberikan gambaran manfaat mempelajari materi yang akan diajarkan • Guru memotivasi siswa untuk tercapainya kompetensi dan karakter yang sesuai dengan profil pelajar pancasila • Menyampaikan tujuan pembelajaran	
Inti	*Project Based Learning (PjBL)* **Menentukan pertanyaan dasar** • Guru menampilkan sebuah foto yang menunjukkan morfologi belalang dan jangkrik  • Guru bertanya "Apa perbedaan antara 2 hewan tersebut? Bagaimana ciri morfolgi dari masing-masing hewan tersebut?" • Guru mengajak siswa mengamati makhluk hidup dari kelompok invertebrata filum arthropoda kelas insekta • Guru meminta siswa untuk mengerjakan soal pretest **Membuat desain proyek** • Peserta didik menerima penjelasan guru bahwa pembelajaran kali ini akan di lakukan secara kelompok. • Peserta didik telah menerima LKPD dari guru, peserta didik membaca petunjuk pengerjaan LKPD, jika dirasa ada yang belum dipahami bisa ditanyakan kepada	105 menit

	guru. • Peserta didik mendapatkan pengarahan dari guru tentang kegiatan di LKPD. • Peserta didik berdiskusi menyusun rencana pembuatan proyek pemecahan masalah meliputi pembagian tugas, persiapan alat, bahan, media dan sumber yang dibutuhkan. • Peserta didik berdiskusi menyusun tahap penyelesaian proyek **Menyusun Jadwal** • Peserta didik dan guru membuat kesepakatan tentang jadwal pengumpulan proyek. • Peserta didik menyusun jadwal penyelesaian proyek dengan memperhatikan batas waktu yang telah ditentukan bersama. **Memonitor kemajuan proyek** • Guru memantau keaktifan peserta didik selama melaksanakan proyek, memantau realisasi perkembangan dan membimbing jika mengalami kesulitan. • Peserta didik melakukan pengerjaan proyek sesuai jadwal, mencatat setiap tahapan, mendiskusikan setiap masalah yang muncul selama penyelesaian proyek dengan guru.	
Penutup	• Peserta didik menyimpulkan pembelajaran • Peserta didik melakukan refleksi pembelajaran • Guru menginformasikan rencana kegiatan pembelajaran untuk pertemuan selanjutnya • Guru memotivasi peserta didik agar selalu belajar dan bekerja keras untuk cita-cita mereka • Guru meminta siswa memimpin doa • Guru mengucapkan salam	15 menit

- Pertemuan ke-2

Kegiatan	**Deskripsi Kegiatan**	**Alokasi waktu**
Pendahuluan	**Orientasi** • Guru mengucapkan salam • Guru meminta salah satu peserta didik untuk memimpin doa • Guru memeriksa/mempersiapkan siswa dan kelas untuk pembelajaran (termasuk mempersiapkan media pembelajaran yang akan digunakan) • Guru memeriksa presensi **Motivasi** • Guru memotivasi siswa dengan menyampaikan	15 menit

	pentingnya mempelajari keanekaragaman hayati • Guru menyampaikan tujuan pembelajaran	
Inti	*Project Based Learning (PjBL)* **Menilai Hasil Proyek** • Guru memantau hasil proyek yang telah dibuat, dan mengukur ketercapaian standar. • Peserta didik membahas kelayakan proyek yang telah dibuat. • Peserta didik memaparkan laporan karya yaitu menampilkan hasil insektarium tiap kelompok. • Guru memberi nilai proyek **Evaluasi pengalaman** • Setiap kelompok mempresentasikan hasil karyanya di depan kelas. • Peserta didik kelompok lain dan guru menanggapi hasil proyek.	105 menit
Penutup	• Guru meminta siswa mengambil kesimpulan dari aktivitas yang telah dilakukan • Guru memberikan masukan, kritik, dan saran kepada siswa • Guru meminta siswa memimpin doa • Guru mengucapkan salam	15 menit

V. ASESMEN / PENILAIAN

JENIS	BENTUK	TEKNIK
Pengetahuan	Tes Non tes	Pretest Aktivitas 2
Keterampilan	Non tes	Aktivitas 1
Sikap	Non tes	Observasi

Tabel rubrik penilaian kerja Proyek

No	Aspek	Keterangan	Skor
1	Perencanaan • Pemilihan lokasi pengambilan spesimen. • Pemilihan kelengkapan alat dan bahan. • Rancangan jadwal proses pelaksanaan Proyek. • Pemilihan spesimen yang baik.	4 poin terpenuhi	4
		3 poin terpenuhi	3
		2 poin terpenuhi	2
		1 poin terpenuhi	1
2	Proses pelaksanaan proyek • Persiapan perlengkapan pembuatan	4 poin terpenuhi	4
		3 poin terpenuhi	3

	insektarium. • Ketertiban mengerjakan proyek. • Kesesuaian prosedur pelaksanaan Proyek. • Kerjasama kelompok.	2 poin terpenuhi	2
		1 poin terpenuhi	1
3	Hasil Produk Kampanye • Media yang digunakan menarik. • Menampilkan media sesuai sistem klasifikasi. • Kebenaran isi media kampanye. • Kemudahan dalam memahami media kampanye.	4 poin terpenuhi	4
		3 poin terpenuhi	3
		2 poin terpenuhi	2
		1 poin terpenuhi	1
4	Presentasi • Penggunaan bahasa yang baik dan benar. • Penyampaiannya mudah dipahami. • Penggunaan media yang menarik. • Kekompakan tim.	4 poin terpenuhi	4
		3 poin terpenuhi	3
		2 poin terpenuhi	2
		1 poin terpenuhi	1

VI. PENGAYAAN DAN REMEDIAL

- Ajaklah peserta didik di dalam kelompok kecil untuk merancang sebuah Proyek untuk mengidentifikasi keanekaragaman hayati yang ada di lingkungan sekitarnya dengan membuat daftar nama spesies serangga yang hidup di lingkungan sekitarnya sesuai dengan intruksi
- Perhatikan bagaimana proses peserta didik merancang kegiatan sehingga dimensi kreatif, mandiri, bergotong royong dan berpikir kritis dapat terbentuk
- Tekankan bahwa Proyek yang dilakukan dilaksanakan berkelanjutan sepanjang proses pembelajaran dan di akhir bab akan dipamerkan hasil proyeknya.

VII. REFLEKSI

- Ajaklah peserta didik untuk berdiskusi hal-hal apa yang telah dipelajari, hal-hal apa yang masih belum dipahami tentang subbab keanekaragaman hayati.
- Mintalah peserta didik menyampaikan pembelajaran apa yang mereka peroleh pada subbab ini.
- Tekankan pada peserta didik manfaat belajar pada subbab ini.

Appendix 8. Student Worksheet

Tujuan Pembelajaran

1). Mengidentifikasi prinsip-prinsip dalam klasifikasi makhluk hidup
2). Menganalisis ciri-ciri umum dalam klasifikasi mahluk hidup dengan metode yang benar
3). Menciptakan projek awetan spesimen makhluk hidup
4). Mengevaluasi hasil materi berdasarkan projek

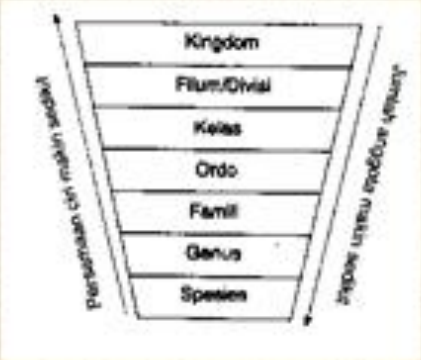
Dasar Teori

Ada beberapa alasan mengapa makhluk hidup harus diklasifikasikan, di antaranya: Menyederhanakan objek studi supaya mudah dipelajari; melabeli atau memberi nama makhluk tersebut; mengetahui hubungan kekerabatan makhluk tersebut; dan mengetahui tingka evolusi suatu makhluk hidup dengan dasar hubungan kekerabatan.

Dalam sistem klasifikasi, pengelompokan dilakukan berdasarkan persamaan dan perbedaan ciri-ciri setiap makhluk hidup. Makhluk hidup yang mempunyai sifat serupa digabungkan menjadi satu kelompok, dan makhluk hidup yang mempunyai sifat berbeda membentuk kelompok lain. Apabila masih terdapat perbedaan, maka dikelompokkan kembali menjadi kelompok-kelompok yang lebih kecil sehingga membentuk suatu struktur kelompok yang disebut takson.

Dasar Teori

Sistem klasifikasi diperkenalkan oleh Carolus Linnaeus pada abad ke-18. Ia mengelompokkan makhluk hidup berdasarkan kesamaan ciri dan menamainya dengan sistem tata nama binomial. Carolus Linnaeus menciptakan 7 kategori pengelompokan makhluk hidup, yaitu kingdom, filum, kelas, ordo (bangsa), famili (suku), genus, dan spesies (jenis).



Gambar 1.1. Tingkatan kategori pengelompokkan makhluk hidup
Sumber: bit.ly/Klasifikasi_Makhluk

Aktivitas 1

AYO LAKUKAN

Membuat Proyek Insektarium

A. Alat dan Bahan

Alat

No.	Alat	Jumlah
1.	Styrofoam	1 buah
2.	Karton	1 buah
3.	Jarum anti karat	Secukupnya
4.	Pinset	1 buah
5.	Botol spray	1 buah
6.	Gunting	1 buah
7.	Suntikan	1 buah
8.	Sarung tangan	1 pasang

Bahan

No.	Bahan	Jumlah
1.	Spesimen belalang	1 ekor
2.	Spesimen jangkrik	1 ekor
3.	Spesiemn Capung	1 ekor
4.	Alkohol 70 %	1 botol
	Kertas HVS	Secukupnya

B. Langkah Prosedur

1) Buatlah kelompok belajar yang terdiri atas 5 orang
2) Lakukanlah observasi di lingkungan tempat tinggal dan sekolah Kalian secara berkelompok

Aktivitas 1

AYO LAKUKAN

Membuat Proyek Insektarium

3) Tangkaplah masing-masing 1 ekor belalang capung, dan jangkrik menggunakan tangan/jaring, usahakan agar bagian-bagian tubuh serangga tidak rusak atau terlepas
4) Matikan serangga dengan cara dibius.
5) Letakkan spesimen di atas styrofoam menggunakan jarum

6) Awetkan serangga menggunakan alkohol 70% disemprotkan ke serangga dan diamkan selama 12 – 24 jam
7) Setelah kering, lakukan penataan letak awetan serangga, lalu diberi label nama menggunakan kertas seperti gambar 1.2. dan 1.3.'

Gambar 1.2. dan 1.3. contoh insektarium dan tata penataan label nama

Aktivitas 2

EVALUASI

Mengklasifikasikan Makhluk Hidup

Setelah melakukan Aktivitas 1, amati dan catat hewan serangga pada insectarium yang kalian buat Setelah mengamati, jawablah pertanyaan berikut

1. Ada berapa jenis serangga yang kalian temukan? Serangga apa sajakah itu? Sebutkan ordo serangga tersebut!

Jawab: ....

2. Bagaimana ciri-ciri morfologi dari serangga tersebut?

Jawab: ...

3. Bagaimana perbedaan yang ditunjukkan oleh serangga yang Kalian dapat? Simpulkan ke dalam tabel berikut

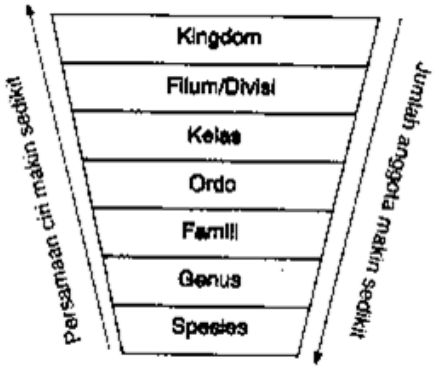
No.	Pembeda	Ciri-ciri			Kesimpulan
		Spesies 1	Spesies 2	Dst..	
1.					
2.					

Jawab: ...

4. Buatlah sebuah Kesimpulan!

Jawab: ...

Appendix 9. Cognitive Domain Test Instrument

Indikator	Tingkat Kognitif	No soal	Uraian Soal	Kunci
Analisis prinsip-prinsip sistem klasifikasi makhluk hidup	C5	2	Perhatikan gambar berikut!  Sistem klasifikasi makhluk hidup akan menempatkan suatu individu ke dalam tingkatan takson tertentu seperti pada gambar. Pernyataan berikut ini yang *tidak* benar mengenai tingkatan takson makhluk hidup adalah... A. tingkatan takson yang rendah memiliki jumlah makhluk hidup yang lebih banyak B. jenis makhluk hidup pada tingkatan takson yang tinggi jumlahnya lebih banyak C. makhluk hidup dengan persamaan ciri yang sedikit dimasukkan ke dalam takson yang lebih tinggi D. makhluk hidup dengan persamaan ciri yang banyak dimasukkan ke dalam takson yang lebih rendah	A
	C4	5	Analisis morfologi menjadi faktor penting dalam proses klasifikasi makhluk hidup, karena…. A. memudahkan identifikasi spesies B. menunjukkan hubungan evolusi antar kelompok C. berfokus pada struktur internal organisme D. tidak memberikan informasi yang relevan	A
	C4	12	Pembuatan sistem klasifikasi biologis dianggap sebagai komponen kunci dalam ilmu biologi karena... A. untuk memperluas ilmu ilmuwan biologi B. mempermudah pengenalan makhluk hidup C. menyederhanakan pemahaman	C

			keanekaragaman hayati D. tidak berperan dalam penelitian biologi	
	C4	28	Mengapa pemahaman dasar tentang sistem klasifikasi biologis dianggap penting bagi ilmuwan dan peneliti dalam bidang biologi? A. memungkinkan ilmuwan untuk mengidentifikasi hubungan evolusioner antar spesies dan merencanakan penelitian yang lebih terfokus B. tidak memberikan dampak signifikan pada penelitian biologi C. klasifikasi biologis hanya berlaku untuk organisme kompleks D. relevan untuk ilmuwan biologi tingkat lanjut	A
Menentukan habitat dan cara hidup makhluk hidup	C4	8	Di sebuah perkebunan apel, keberlangsungan hidup populasi lebah sangat berperan dalam penyerbukan bunga apel. Namun, populasi lebah di area tersebut mengalami penurunan drastis karena siklus hidup lebah dan waktu berbunga tanaman apel tidak sinkron. Faktor yang mempengaruhi keberlangsungan hidup populasi serangga pada kasus di atas adalah.. A. kepadatan populasi manusia B. penggunaan pestisida C. perubahan iklim D. parasit atau penyakit	D
	C4	16	Bagaimana metamorfosis serangga berkontribusi pada keberlanjutan populasinya? A. menyesuaikan diri dengan perubahan lingkungan B. mengurangi tingkat reproduksi C. meningkatkan kerentanan terhadap penyakit D. menurunkan tingkat keberlangsungan hidup	A
	C4	23	Pengelompokkan insekta yang mengalami metamorfosis sempurna adalah... A. lalat, kupu-kupu, dan nyamuk B. jangkrik, kecoa, dan capung C. kupu-kupu, kumbang, dan belalang D. nyamuk, ngengat, dan belalang	A
	C4	24	Hubungan penggunaan pestisida berlebihan terhadap keberlanjutan ekosistem serangga dapat memberi dampak, yaitu... A. meningkatkan keanekaragaman hayati B. membuat serangga lebih resisten terhadap	D

<table>
<tr><td></td><td></td><td></td><td>penyakit
C. memperkuat populasi serangga
D. merusak populasi serangga</td><td></td></tr>
<tr><td rowspan="5">Mengidentifikasi ciri-ciri organisme berdasarkan kelompok klasifikasinya</td><td>C1</td><td>3</td><td>Ordo yang termasuk dalam kelas insekta adalah...
a. Araneae
b. Coleoptera
c. Diplopoda
d. Gastropoda</td><td>B</td></tr>
<tr><td>C2</td><td>15</td><td>Penggolongan belalang ke dalam kelas dan ordo yang sesuai adalah...
A. kelas Insecta, ordo hemiptera
B. kelas Arachnida, ordo orthoptera
C. kelas Insecta, ordo orthoptera
D. kelas Arachnida, ordo hemiptera</td><td>C</td></tr>
<tr><td>C2</td><td>1</td><td>Organisme yang tubuhnya terbagi atas segmen-segmen, eksoskeleton, dan alat pernapasan dengan permukaan tubuh, insang, dan trakea adalah...
a. Annelida
b. Arthropoda
c. Mollusca
d. Platyhelmintes</td><td>B</td></tr>
<tr><td>C2</td><td>6</td><td>Sebuah organisme memiliki sel eukariotik, autotrof, dan berklorofil. Organisme ini termasuk dalam...
a. Kingdom Animalia
b. Kingdom Plantae
c. Kingdom Protista
d. Kingdom Fungi</td><td>B</td></tr>
<tr><td>C5</td><td>7</td><td>Perhatikan ciri-ciri Arthropoda pada tabel di bawah ini:
<table>
<tr><th>No.</th><th>Tubuh</th><th>Kaki</th><th>Kepala</th><th>Dada</th><th>Sayap</th></tr>
<tr><td>1.</td><td>Terbagi banyak ruas yang sama</td><td>Setiap ruas ada 1 pasang</td><td>Jelas terlihat</td><td>Tidak ada</td><td>Tidak ada</td></tr>
<tr><td>2.</td><td>Terbagi menjadi dua bagian</td><td>4 pasang</td><td>Menjadi satu dengan dada</td><td>Menjadi satu dengan kepala</td><td>Tidak ada</td></tr>
<tr><td>3.</td><td>Terbagi menjadi tiga bagian</td><td>4 pasang</td><td>Jelas terlihat</td><td>Ada tiga ruas</td><td>Ada</td></tr>
<tr><td>4.</td><td>Terbagi menjadi dua bagian</td><td>Terdapat pada setiap ruas</td><td>Menjadi satu dengan dada</td><td>Menjadi satu dengan kepala</td><td>Tidak ada</td></tr>
</table></td><td>D</td></tr>
</table>

			Klasifikasi ciri-ciri Arachnida dan Insecta secara berurutan ditunjukkan oleh nomor… A. 1 dan 2 B. 1 dan 3 C. 2 dan 3 D. 2 dan 4	
	C2	30	Berikut ini yang *bukan* merupakan ciri-ciri invertebrata adalah.. A. alat pernafasan melalui kulit B. tidak memiliki tulang belakang C. mayoritas berukuran kecil D. mempunyai tulang endoskeleton	D
Menjelaskan struktur dan fungsi tubuh makhluk hidup	C1	10	Organ yang menjadi alat pernapasan Insekta adalah... A. paru-paru B. insang C. trakea D. kulit	C
	C5	4	Berikut ini merupakan ciri-ciri arthropoda (1) kepala dan dadanya bersatu, perut terpisah (2) tubuhnya ditutupi oleh kerangka luar (3) kaki hanya pada segmen dada saja, berjumlah 4 pasang (4) sayap ditemukan berpasangan pada ruas dada (5) matanya merupakan mata facet. Klasifikasi ciri-ciri yang dimiliki **insecta** adalah… a. (1), (2), dan (4) b. (2), (3), dan (4) c. (2), (3), dan (5) d. (2), (4), dan (5)	B
	C2	9	Contoh spesies serangga yang dapat diterapkan sebagai pengendalian ham1a pertanian adalah.. A. kumbang tanduk panjang B. belalang C. lebah D. kecoa	C
	C4	11	Bagaimana perbedaan struktur tubuh antara serangga dan arachnida mencerminkan gaya hidup mereka? A. Arachnida memiliki sayap, serangga tidak B. Arachnida memiliki empat pasang kaki, serangga tiga pasang kaki C. serangga memiliki dua bagian tubuh, arachnida tiga bagian	B

<table>
<tr><td></td><td></td><td></td><td>D. Arachnida memiliki antena, serangga tidak</td><td></td></tr>
<tr><td></td><td>C3</td><td>19</td><td>Zat racun yang akan dikeluarkan oleh kalajengking dihasilkan oleh...
A. kaki rahang yang berbentuk gunting pada bagian kepala
B. kelenjar pada segmen pertama badan belakang
C. semua ujung-ujung kaki
D. kelenjar dari dalam mulutnya</td><td>B</td></tr>
<tr><td></td><td>C5</td><td>20</td><td><table><tr><th>Hewan</th><th>Alat pernapasam</th></tr><tr><td>1. Kalajengking</td><td>1. Trakea</td></tr><tr><td>2. Kutu</td><td>2. Paru-paru</td></tr><tr><td>3. Udang</td><td>3. Insang</td></tr></table>Hewan yang sesuai dengan alat pernapasannya adalah...
A. 1-3
B. 1-1
C. 2-3
D. 3-1</td><td>D</td></tr>
<tr><td></td><td>C2</td><td>21</td><td>Cara serangga bereproduksi pada umumnya adalah..
A. melalui telur
B. melalui embrio
C. melalui vivipar
D. melalui spora</td><td>A</td></tr>
<tr><td></td><td>C3</td><td>27</td><td>Peranan eksoskeleton sangat penting bagi serangga dikarenakan...
A. melindungi diri dari predator
B. memungkinkan terbang
C. menyimpan air
D. memberikan dukungan struktural</td><td>D</td></tr>
<tr><td>Evaluasi cara memberi nama ilmiah pada makhluk hidup</td><td>C5</td><td>14</td><td>Berikut penamaan ilmiah yang benar untuk belalang kayu adalah...
a. Valanga nigricornis
b. Valanga Nigricornis
c. Valanga nigricornis
d. Valanga Nigricornis</td><td>A</td></tr>
<tr><td></td><td>C3</td><td>17</td><td>Bahasa Latin sering digunakan dalam pemberian nama ilmiah pada organisme memiliki nilai penting karena...
A. agar terdengar lebih formal
B. sebagai tradisi tanpa alasan khusus
C. agar nama-nama ilmiah lebih mudah diucapkan</td><td>D</td></tr>
</table>

			D. memastikan konsistensi dan universal dalam komunikasi ilmiah	
	C5	29	Tujuan utama pemberian nama ilmiah pada organisme dalam konteks klasifikasi biologis adalah... A. untuk memberikan identitas unik pada organisme tersebut B. merupakan tradisi dalam dunia ilmu pengetahuan alam C. memfasilitasi komunikasi internasional dan presisi dalam identifikasi organisme D. nama ilmiah digunakan sebagai formalitas dalam penelitian biologi	C
Identifikasi kunci determinasi sederhana	C3	13	Perbedaan tiap ordo serangga dapat diidentifikasi dengan cara... A. menghitung jumlah kaki B. menggunakan ciri morfologis dan deskripsi kunci determinasi C. menilai perilaku makan D. memeriksa warna tubuh	B
	C3	25	Perhatikan kelompok organisme berikut ini!  Organisme-organisme di atas tergolong dalam filum yang sama berdasarkan persamaan ciri yang dimilikinya, yaitu… A. tubuh tidak beruas-ruas, eksoskeleton, dan tubuh ditutupi oleh kitin B. tubuh beruas-ruas, tubuh terdiri atas caput, toraks dan abdomen C. diploblastik, tubuh lunak, dan endoskeleton D. triploblastik, bersayap, dan memiliki antenna	B
	C3	26	Penggunaan penerapan teknologi DNA dalam kunci determinasi dianggap sebagai langkah inovatif dalam bidang taksonomi... A. teknologi DNA hanya berguna untuk organisme kompleks B. kunci determinasi tradisional sudah cukup akurat tanpa melibatkan teknologi DNA C. teknologi DNA memungkinkan identifikasi spesies berdasarkan informasi genetik yang	C

			lebih akurat D. kunci determinasi seharusnya hanya mempertimbangkan karakteristik morfologi	
Menerapkan aspek filogenetik dalam klasifikasi kehidupan	C6	18	Dalam proyek pembuatan insektarium, Anda diminta untuk menyusun ide desain yang paling inovatif agar insektarium dapat menampilkan klasifikasi serangga dengan jelas dan menarik. Dari pilihan berikut, manakah rancangan yang paling tepat? A. Menata serangga berdasarkan warna tubuh dan ukuran secara acak agar terlihat estetik. B. Menyusun serangga berdasarkan habitat hidupnya (air, darat, udara) disertai label klasifikasi yang jelas. C. Mengelompokkan serangga berdasarkan tanggal pengumpulan dengan keterangan penangkapnya. D. Memajang serangga secara berderet mengikuti alfabet nama ilmiahnya agar terlihat sistematis	B
	C6	22	Dalam proyek pembuatan insektarium, Anda ingin membuat tampilan label klasifikasi serangga yang kreatif agar mudah dipahami oleh pengunjung pameran. Ide manakah yang paling inovatif dan komunikatif? A. Menuliskan nama ilmiah serangga dengan huruf kecil tanpa tambahan informasi. B. Menggunakan kartu label berwarna dengan informasi nama ilmiah, ordo, dan ciri khusus serangga. C. Membuat satu papan informasi umum tentang serangga tanpa keterangan detail per spesimen. D. Menempelkan gambar serangga pada label tanpa mencantumkan nama ilmiahnya.	B

Appendix 10. Syntax Implementation Observation Sheet

Keterangan:
Nilai 4= Sangat baik/ sangat sesuai
Nilai 3= Baik/sesuai
Nilai 2= Kurang baik/ kurang sesuai
Nilai 1= Tidak baik/ tidak sesuai

Tahap Pembelajaran	Sintaks Model Pembelajaran PjBL	Deskripsi Kegiatan	Skor			
			1	2	3	4
Pendahuluan		1. Guru mengucapkan salam dan memeriksa presensi				
		2. Guru memeriksa/mempersiapkan siswa dan kelas untuk pembelajaran (termasuk mempersiapkan media pembelajaran yang akan digunakan)				
		3. Guru mengajukan pertanyaan tentang materi yang sudah dipelajari dan terkait dengan materi yang akan dipelajari				
		4. Guru memberikan gambaran manfaat mempelajari materi yang akan diajarkan				
Inti	Menentukan pertanyaan dasar	1. Guru bertanya “Apa perbedaan antara jangkrik dan belalang? Bagaimana ciri morfolgi dari masing-masing hewan tersebut?”				

Tahap Pembelajaran	Sintaks Model Pembelajaran PjBL	Deskripsi Kegiatan	Skor			
			1	2	3	4
		2. Guru meminta siswa untuk mengerjakan soal pretest				
	Membuat desain projek	1. Guru menjelaskan kepada peserta didik bahwa pembelajaran akan dilakukan secara kelompok. 2. Guru memberikan LKPD dan mengarahkan peserta didik tentang kegiatan di LKPD.				
	Menyusun jadwal	1. Peserta didik dan guru membuat kesepakatan tentang jadwal pengumpulan proyek.				
	Memonitor kemajuan projek	1. Guru memantau keaktifan peserta didik selama melaksanakan proyek, memantau realisasi perkembangan dan membimbing jika mengalami kesulitan.				
		2. Guru membantu diskusi setiap masalah yang muncul selama penyelesaian proyek dengan peserta didik.				

Tahap Pembelajaran	Sintaks Model Pembelajaran PjBL	Deskripsi Kegiatan	Skor			
			1	2	3	4
	Menilai hasil	1. Guru memantau hasil proyek yang telah dibuat, dan mengukur ketercapaian standar.				
	Evaluasi pengalaman	1. Guru memberikan penilaian hasil proyek. 2. Guru dan eserta didik kelompok lain menanggapi hasil proyek. 3. Guru memberikan *Posttest*				
Penutup	Pengambilan keputusan, analisis dan evaluasi proses pemecahan masalah	1. Guru memotivasi peserta didik agar selalu belajar dan bekerja keras untuk cita-cita mereka 2. Guru bersama-sama dengan siswa membuat rangkuman/simpulan pelajaran				

Tanjungbalai, Agustus 2024

Pengamat

(_____)

Appendix 11. Student Activities Observation Sheet

Hari/ Tanggal :
Nama Siswa :
Sekolah :
Kelas :
Materi Pokok :

No.	Aspek	Indikator	Skor			
			4	3	2	1
1.	**Kesiapan siswa untuk menerima materi pelajaran**	Masuk kelas tepat waktu				
		Menyiapkan perlengkapan belajar				
		Tidak melakukan pekerjaan lain yang akan mengganggu proses belajar				
2.	**Antusiasme siswa dalam mengikuti kegiatan diskusi kelompok**	Menyimak seluruh informasi yang disampaikan oleh guru				
		Tidak mengobrol dengan teman kecuali membahas bahan pelajaran				
		Memberiksan tanggapan terhadap apa yang disampaikan oleh guru				
3.	**Aktivitas siswa dalam kegiatan diskusi kelompok**	Mengajukan pendapat pada saat diskusi kelompok				
		Melaksanakan diskusi kelompok sampai batas waktu yang ditentukan				
		Memperlihatkan hasil diskusi kelompok pada guru				
4.	**Aktivitas siswa dalam memecahkan masalah**	Mengerjakan LKPD yang diberikan secara diskusi				
		Memastikan semua anggota kelompok menguasai LKPD				

		Menanyakan hal-hal yang belum dipahami pada LKPD				
5	**Aktivitas siswa dalam mengerjakan soal latihan**	Mengerjakan soal latihan yang diberikan				
		Mengacungkan tangan untuk menjawab soal latihan				
		Memberi tanggapan atas jawaban soal latihan yang telah dikerjakan temannya				
6	**Partisipasi siswa dalam menutup kegiatan pembelajaran**	Membuat kesimpulan materi yang telah diberikan				
		Memperbaiki jawaban teman jika kesimpulan masih belum lengkap				
		Mencatat rangkuman materi yang diberikan				

Keterangan:
Nilai 4= Sangat baik/ sangat sesuai
Nilai 3= Baik/sesuai
Nilai 2= Kurang baik/ kurang sesuai
Nilai 1= Tidak baik/ tidak sesuai

Tanjungbalai, Agustus 2024

Pengamat

_____

(Nindya Zayani Ekaputri)

Appendix 12. Validation Instrument Sheet of Teaching Module

IDENTITAS

Nama Validator : Halim Simatupang, S.Pd., M.Pd.
NIP : 198104232008121002
Instansi : Universitas Negeri Medan

PETUNJUK PENGISIAN INSTRUMEN

Sebelum mengisi angket penelitian, dimohon Bapak/Ibu terlebih dahulu membaca modul yang akan digunakan.
Mohon Bapak/Ibu memberikan penilaian lembar validasi modul ajar yang telah peneliti susun. Bapak/Ibu memberikan tanda checklist (√) pada kolom penilaian yang sudah disediakan dalam lembar validasi modul ajar. Adapun keterangan lebih lanjut mengenai kriteria penilaiannya, sebagai berikut:
TS= tidak ada/tidak sesuai
KS= ada, kurang lengkap/kurang sesuai
S= ada, lengkap dan sesuai

Setelah mengisi kolom penilaian, mohon Bapak/Ibu memberikan tanda checklist (√) pada bagian kesimpulan terhadap lembar validasi modul ajar.
Apabila ada suatu hal yang perlu direvisi, mohon ditulis pada bagian komentar dan saran.

No.	Rincian Kegiatan	Penilaian		
		S	KS	TS
1.	Informasi Umum			
A	Identitas Modul			
	Terdapat nama sekolah, nama guru, modul, fase, materi pokok, alokasi waktu,kelas, semester, tahun pelajaran, dan peminatan/program	√		
B	Kompetensi Awal			
	Gambaran kompetensi awal yang mendasari materi untuk mencapai tujuan pembelajaranpada ranahpengetahuan dan keterampilan pada materi yang merujuk pada CP mata pelajaran.	√		
C	Profil Belajar Pancasila			
	Gambaran sikap perilaku profil pelajar pancasila yang diharapkan peserta didik: Beriman, bertakwa kepada Tuhan Yang Maha Esa, dan berakhlak mulia, mandiri, bernalar kritis, kreatif, dam bergotong royong yang tercermin pada: materi/isi pelajaran, pendagogi, dan/atau kegiatan proyek atau asesmen/penilaian.		√	

D	Sarana dan Prasarana			
	Memuat sarana/bahan/alat yang digunakan seperti: materi (modul), L.KPD dan sebagainya.	✓		
	Memuat prasarana atau fasilitas yang digunakan seperti: ruang kelas dan jaringan internet atau fasilitas lainnya.	✓		
E	Target Peserta Didik			
	Peserta diidk regular/tipikal: umum, tidak ada kesulitan dalam mencerna dan memahami materi ajar	✓		
F	Model Pembelajaran			
	Gambaran model pembelajaran yang diterapkan berupa model pembelajaran berbasis projek (PjBL)	✓		
2.	Komponen Inti			
	Adanya gambaran kompetensi kemampuan peserta didik memahami konsep materi, menerapkan dan menggunakan materi pada bidang keilmuan yang dipelajarinya. Misal: 1) mengidentifikasikan; 2) mendefinisikan; 3) menjelaskan; 4) menerapkan.	✓		
A	Tujuan Capaian Pembelajaran			
	Gambaran tujuan akhir fase berupa kemampuan peserta didik yang dapat diuraikan secara berjenjang, dari pemahaman yang rendah, meningkat sampai pada penerapan, missal memahami atau mengidentifikasi, menjelaskan materi, menerapkan dan menggunakan materi pada bidang keilmuan yang dipelajarinya	✓		
B	Pemahaman Bermakna			
	Adanya gambaran umum kontribusi mata pelajaran dalam memebentuk peserta didik memiliki pemahaman, pengetahuan dan keterampilan, dalam cara berpikir yang memungkinkan untuk menguraikan suatu masalah menjadi beberapa bagian yang lebuh kecil dan sederhana, menemukan pola maslah, serta menyusun langkah-langkah solusi mengatasi masalah melalui berbagai aktivitas proses saintifik dan membekali peserta didik dengan seperangkat pengetahuan dan keterampilan, dan sikap agar memiliki dasar yang kuat dalam mempelajari mata pelajaran-mata pelajaran selanjutnya.	✓		
C	Pertanyaan Pemantik			

	Pertanyaan pemantik untuk menumbuhkan rasa ingin tahu dan kemampuan berpikir kritis dalam diri peserta didik.	✓		
D	Kegiatan Pembelajaran			
	Penugasan terbimbing terkait dengan materi (dengan lembar kerja peserta didik).	✓		
	Eksplorasi pemahaman materi melalui sumber belajar secara berkelompok.	✓		
	Penyususan laporan hasil diskusi kelompok.	✓		
	Presentasi hasil diskusi kelompok.	✓		
E	Asesmen			
	Asesmen digunakan untuk mengukur capaian pembelajaran di akhir kegiatan. Kriteria pembelajaran harus ditentukan dengan jelas sesuai dengan tujuan pembelajaran yang ditetapkan.	✓		
	Tes tertulis (tes objektif, pilihan ganda, atau essay)			
F	Pengayaan dan Remedial			
	Pengayaan diberikan ada peserta didik dengan capaian tinggi.	✓		
	Remedial diberikan kepada peserta didik dengan capaian rendah.	✓		
G	Refleksi			
	Peserta didik diminta untuk melakkan refleksi terhadap kegiatan yang sudah dilaksanakan selama proses pembelajaran berlangsung sebagai bentuk evaluasi proses kegiatan pembelajaran dalam bentuk tes lisan dan tertulis.	✓		

KESIMPULAN

Berdasarkan penilaian atau validasi Bapak/Ibu di atas, maka berilah tanda cek pada pilihan di bawah ini yang menunjukkan penilaian secara umum dari aspek kelayakan dan validasi instrumen Modul Ajar.

( ) Layak digunakan tanpa revisi

( ) Layak digunakan, namun dengan revisi

( ) Tidak layak digunakan

SARAN DAN KOMENTAR

Instrumen layak dipergunakan
Saran diberikan kepada peserta didik

Medan, 17 Juli 2024

Validator

Halim Simatupang, S.Pd., M.Pd.

Nip. 198104232008121002

Appendix 13. Validation Instrument Sheet of Cognitive Domain Test

IDENTITAS

Nama Validator :
NIP :
Jurusan :
Keahlian :
Instansi :

PETUNJUK PENGISIAN INSTRUMEN

Berdasarkan pendapat Bapak/Ibu berilah penilaian: V-Valid, CV-Cukup Valid. KV-Kurang Valid, TV-Tidak Valid. Pada kolom Validitas dengan memberi centang (√)

Berdasarkan pendapat Bapak/Ibu berilah penilaian: SDP-Sangat Dapat Dipahami, KDP-Kurang Dapat Dipahami, TDP-Tidak Dapat Dipahami. Pada kolom Bahasa dan Penulisan dengan memberi ceklis (√)

Sebagai petunjuk untuk mengisi tabel perhatikan hal berikut:

a. Validitas isi

1) Apakah soal sudah sesuai dengan indikator pembelajaran yang ingin dicapai

2) Apakah soal dirumuskan secara singkat dan jelas

3) Apakah petunjuk pengerjaan soal dituliskan secara jelas

b. Bahasa dan penulisan

1) Apakah soal menggunakan bahasa Indonesia yang baku sesuai kaidah.

2) Apakah soal menggunakan bahasa yang komunikatif, mudah dipahami dan tidak menimbulkan penafsiran ganda.

Isilah kolom berikut ini:

Butir Soal	Validitas Isi				Bahasa dan Punulisan			Kesimpulan			
	V	CV	KV	TV	SDP	KDP	TDP	Tanpa revisi	Revisi kecil	Revisi besar	Soal tidak dapat digunakan
1	✓				✓			✓			
2	✓				✓			✓			
3	✓				✓			✓			
4	✓				✓			✓			
5	✓				✓			✓			
6	✓				✓			✓			
7	✓				✓				✓		
8	✓				✓			✓			
9	✓				✓				✓		
10	✓				✓			✓			
11	✓				✓			✓			
12	✓				✓				✓		
13	✓				✓			✓			
14	✓				✓			✓			
15	✓				✓			✓			
16	✓				✓			✓			
17	✓				✓			✓			
18	✓				✓			✓			
19	✓				✓			✓			
20	✓				✓				✓		
21	✓				✓			✓			
22	✓				✓			✓			
23	✓				✓				✓		
24	✓				✓			✓			
25	✓				✓			✓			
26	✓				✓			✓			
27	✓				✓			✓			
28	✓				✓				✓		
29	✓				✓				✓		
30	✓				✓			✓			

Medan, 18 Juli 2024

Validator

Dr. Hasruddin, M.Pd.

Nip. 196404241989031027

Appendix 14. Validation Instrument Sheet of Student Activities Observation

IDENTITAS

Nama Validator: Rizal Mukra, M.Pd.

NIP : 199310162023211015

Instansi : Pendidikan Biologi

PETUNJUK PENGISIAN INSTRUMEN

Sebelum mengisi angket penelitian, dimohon Bapak/Ibu terlebih dahulu membaca lembar observasi aktivitas belajar siswa yang akan digunakan.

Mohon Bapak/Ibu memberikan penilaian lembar validasi observasi aktivitas belajar siswa yang telah peneliti susun.

Bapak/Ibu memberikan tanda checklist (√) pada kolom penilaian yang sudah disediakan dalam lembar validasi observasi aktivitas belajar siswa. Adapun keterangan lebih lanjut mengenai kriteria penilaiannya, sebagai berikut:

Kurang, Cukup, atau Baik.

Setelah mengisi kolom penilaian, mohon Bapak/Ibu memberikan tanda checklist (√) pada bagian kesimpulan terhadap lembar validasi observasi aktivitas belajar siswa.

Apabila ada suatu hal yang perlu direvisi, mohon ditulis pada bagian komentar dan saran.

No.	Aspek yang dinilai	Penilaian		
		Kurang	Cukup	Baik
Format lembar observasi aktivitas belajar siswa				
1.	Petunjuk dinyatakan dengan jelas			✓
2.	Kejelasan sistem penomoran			✓
Format Isi				
3.	Pernyataan dirumuskan dengan singkat dan jelas			✓
4.	Indikator yang diamati sudah mencakup semua aspek yang mendukung keterlaksanaan modul			✓
5.	Isi sesuai dengan sintaks model pembelajaran berbasis Projek (PjBL)			✓
Bahasa dan tulisan				
6.	Kesesuaian bahasa dengan kaidah bahasa Indonesia			✓
7.	Bahasa yang digunakan komunikatif		✓	

KESIMPULAN

Berdasarkan penilaian atau validasi Bapak/Ibu di atas, maka berilah tanda cek pada pilihan di bawah ini yang menunjukkan penilaian secara umum dari aspek kelayakan dan validasi instrumen lembar observasi aktivitas siswa.

( ) Layak digunakan tanpa revisi
(✓) Layak digunakan, namun dengan revisi
( ) Tidak layak digunakan

SARAN DAN KOMENTAR

Instrumen sudah dinyatakan dan layak digunakan untuk penelitian

Medan, 22 Juli 2024

Validator

Rizal Mukra, M.Pd.

Nip. 199310162023211015

Appendix 15. Results of the Syntax Implementation Observation Sheet Assessment

Kelas Eksperimen (PJBL)							
Indikator	**Deskripsi**	**Pertemuan 1**	**PKS**	**Kriteria**	**Pertemuan 2**	**PKS**	**Kriteria**
Pendahuluan	1	4	100%	Sangat Baik	4	100%	Sangat Baik
	2	4	100%	Sangat Baik	4	100%	Sangat Baik
	3	4	100%	Sangat Baik	4	100%	Sangat Baik
	4	4	100%	Sangat Baik	3	75%	Baik
Pertanyaan Mendasar	1	4	100%	Sangat Baik	4	100%	Sangat Baik
	2	4	100%	Sangat Baik	2	50%	Kurang Baik
Membuat Desain Projek	1	4	100%	Sangat Baik	4	100%	Sangat Baik
	2	4	100%	Sangat Baik	4	100%	Sangat Baik
Menentukan jadwal	1	4	100%	Sangat Baik	3	75%	Baik
Memonitor kemajuan projek	1	4	100%	Sangat Baik	4	100%	Sangat Baik
	2	4	100%	Sangat Baik	4	80%	Sangat Baik
Menilai Hasil	1	3	75%	Baik	3	75%	Baik
Evaluasi Pengalaman	1	4	100%	Sangat Baik	4	100%	Sangat Baik
	2	4	100%	Sangat Baik	4	100%	Sangat Baik
	3	2	50%	Kurang Baik	4	100%	Sangat Baik
Penutup	1	4	100%	Sangat Baik	4	100%	Sangat Baik
	2	4	100%	Sangat Baik	4	100%	Sangat Baik
	3	4	100%	Sangat Baik	4	100%	Sangat Baik
Rata-rata	**3,8**		**96%**		**3,7**	**92%**	
Rata-rata 2 pertemuan	**94% (Sangat Baik)**						

Appendix 16. N-gain Scores of Control Class (X-6)

Nama	Pretest	Postest	Post-Pre	Skor ideal (100)-pre	N-gain score	N-gain (%)	Criteria
Afirah	60	67	7	40	0,18	**17,50**	low
Aina	57	70	13	43	0,30	30,23	medium
Aira	60	73	13	40	0,33	32,50	medium
Al giffari	50	67	17	50	0,34	34,00	medium
Alqy	47	77	30	53	0,57	56,60	medium
Amisha	60	77	17	40	0,43	42,50	medium
Anggita	57	80	23	43	0,53	53,49	medium
Asila	50	73	23	50	0,46	46,00	medium
Ayu	50	83	33	50	0,66	66,00	medium
Cheysa	70	67	-3	30	-0,10	-10,00	low
Danil	63	83	20	37	0,54	54,05	medium
Dinda	50	73	23	50	0,46	46,00	medium
Fitra	57	73	16	43	0,37	37,21	medium
Hafiz	43	83	40	57	0,70	70,18	medium
Jihan	40	67	27	60	0,45	45,00	medium
Kirana	60	67	7	40	0,18	17,50	low
Klaudia	53	83	30	47	0,64	63,83	medium
M.hady	43	80	37	57	0,65	64,91	medium
M.alif	53	77	24	47	0,51	51,06	medium
M.rafa	60	67	7	40	0,18	17,50	medium
Maya	53	87	34	47	0,72	72,34	high
M.farhan	57	70	13	43	0,30	30,23	medium
M.haziq	63	77	14	37	0,38	37,84	medium
M.rizky	57	70	13	43	0,30	30,23	medium
Nhada	50	77	27	50	0,54	54,00	medium
Nur wafiq	53	77	24	47	0,51	51,06	medium
Putri C	53	73	20	47	0,43	42,55	medium
Putri S	57	67	10	43	0,23	23,26	low
Revando	53	77	24	47	0,51	51,06	medium
Salwa	43	87	44	57	0,77	77,19	high
Saskia	43	80	37	57	0,65	64,91	medium
Syarifa	77	70	-7	23	-0,30	-30,43	low
Taniya	67	77	10	33	0,30	30,30	medium
Yahya	67	70	3	33	0,09	9,09	low
Yasri	63	73	10	37	0,27	27,03	low
Zsaqila	50	67	17	50	0,34	34,00	low
				Avarage Score	0,40	40,02	
				Category	Medium	Less effective	

Appendix 17. N-gain Scores of Experiment Class (X-4)

Nama	Pretest	Postest	Post-Pre	skor ideal (100)-pre	N-gain score	N-gain (%)	Criteria
Ade	53	77	24	47	0,51	51,06	Medium
Alifia	40	80	40	60	0,67	66,67	Medium
Amel	53	83	30	47	0,64	63,83	Medium
Bambang	57	77	20	43	0,47	46,51	Medium
Charisa	53	87	34	47	0,72	72,34	High
Cindy	57	87	30	43	0,70	69,77	Medium
Debora	50	90	40	50	0,80	80,00	High
Dini	53	83	30	47	0,64	63,83	Medium
Esra	53	93	40	47	0,85	85,11	High
Fitra	57	77	20	43	0,47	46,51	Medium
Fitra	53	93	40	47	0,85	85,11	High
Gio	43	83	40	57	0,70	70,18	Medium
Gusti	43	83	40	57	0,70	70,18	Medium
Halima	67	93	26	33	0,79	78,79	High
Karina	67	77	10	33	0,30	30,30	Medium
Kayla	67	77	10	33	0,30	30,30	Medium
Keren	53	93	40	47	0,85	85,11	High
M.Ridho	50	90	40	50	0,80	80,00	High
M.Ali	60	87	27	40	0,68	67,50	Medium
M.Khairul	57	77	20	43	0,47	46,51	Medium
M Afdal	60	83	23	40	0,58	57,50	Medium
M Habib	40	80	40	60	0,67	66,67	Medium
Nindya	47	87	40	53	0,75	75,47	High
Nurfaidza	40	80	40	60	0,67	66,67	Medium
Putri	57	87	30	43	0,70	69,77	Medium
Quila	50	87	37	50	0,74	74,00	High
Raditya	40	83	43	60	0,72	71,67	High
Ramadani	40	77	37	60	0,62	61,67	Medium
Rayhan	63	87	24	37	0,65	64,86	Medium
Rja	50	83	33	50	0,66	66,00	Medium
Runa aprila	37	90	53	63	0,84	84,13	High
Said	43	80	37	57	0,65	64,91	Medium
Savira	40	87	47	60	0,78	78,33	High
Stive	50	80	30	50	0,60	60,00	Medium
Suci	53	83	30	47	0,64	63,83	Medium
Wahyu	43	77	34	57	0,60	59,65	Medium
				Avarage Score	0,66	65,96	
				Category	Medium	Quite effective	

Appendix 18. Validation Test of Learning Outcomes Instrument

No.	Name	Butir Soal																																		jumlah
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	
1	Audia	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	31
2	Aulia	0	0	0	1	0	0	0	0	0	0	1	1	0	1	0	0	1	1	0	0	1	1	0	0	1	0	0	1	0	1	0	1	0	1	0	13
3	Bagas	1	1	0	1	1	1	1	1	0	1	0	1	1	0	0	0	1	0	1	1	0	1	0	0	0	1	1	1	1	0	1	0	1	0	1	21
4	Baginda	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	33
5	Bambang	0	0	1	1	0	1	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	1	0	1	1	0	0	0	0	1	0	1	0	0	0	11
6	Bayu	0	1	1	0	1	0	0	0	1	0	0	0	0	1	1	0	0	1	0	0	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	20
7	Cantika	0	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	0	0	0	26
8	Christian	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	0	0	1	1	1	1	1	1	0	1	0	28
9	Cintya	0	0	1	1	0	1	0	0	1	0	0	0	1	0	1	0	0	1	0	0	0	1	1	1	1	0	1	1	0	1	1	0	0	1	0	16
10	Dilyan	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	0	1	1	1	0	1	1	1	1	1	1	0	1	0	28
11	Dita	0	0	1	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	1	1	1	0	1	1	0	1	1	1	0	1	0	14
12	Eko	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	30
13	Halim	1	1	1	1	0	1	1	1	0	0	1	1	0	1	0	0	0	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	26
14	Hanifah	0	0	1	1	0	1	1	0	1	1	0	1	1	1	1	1	1	1	1	0	0	1	1	1	1	0	1	0	1	1	0	1	0	0	0	22
15	Jesika	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	0	28
16	Keke	1	0	1	1	1	0	0	0	0	1	0	1	1	0	1	0	0	1	0	0	0	1	0	1	1	0	1	1	1	1	1	1	0	1	0	19
17	Keysa	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	0	1	0	0	1	1	0	1	1	1	1	1	1	1	1	0	1	28
18	Lilis	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	1	0	0	1	0	1	1	0	0	1	1	0	0	0	11
19	Lutfia	1	0	0	1	0	0	0	1	0	0	1	0	0	0	1	0	1	1	0	1	0	1	0	1	1	0	0	0	1	0	0	0	1	1	1	15
20	M.Fajar	1	0	0	0	0	1	0	1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	1	0	1	1	1	1	1	0	0	0	0	13
21	M.Ridho	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	31
22	M.Ridho T	1	0	1	0	0	0	0	1	0	1	0	1	1	0	0	0	0	1	0	1	1	1	0	1	1	0	1	1	1	0	1	1	0	0	0	17
23	Melisa	1	0	1	0	1	1	0	1	0	1	1	0	0	1	1	0	1	1	0	1	1	0	1	1	1	0	1	1	0	1	1	1	0	1	0	22
24	Nabila	1	1	0	0	1	0	0	0	0	1	1	0	0	1	0	0	0	1	0	0	0	0	1	0	1	1	1	1	1	0	1	0	0	0	0	14
25	Naila	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	6
26	Raissya	1	0	0	1	0	0	0	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	1	1	0	0	0	10
27	Rani	1	0	1	1	1	1	0	1	0	0	1	1	1	0	0	0	1	1	0	1	1	0	0	1	1	0	0	1	1	0	1	1	0	0	0	19
28	Teruna	0	0	1	1	1	0	0	1	0	1	1	1	1	0	1	0	0	1	0	1	0	1	1	1	0	0	0	1	1	0	1	1	0	1	0	19
29	Tina	1	0	1	0	1	0	0	1	0	1	1	0	0	1	1	0	1	1	0	1	1	0	0	1	1	0	1	0	1	1	0	1	0	0	0	18
30	Vinsent	1	0	1	1	1	1	0	0	1	1	1	0	0	1	1	0	1	1	0	0	1	0	1	1	1	0	1	1	0	1	1	1	0	1	0	22
31	Vivi	1	0	1	1	1	1	0	0	1	1	1	1	0	0	1	0	0	0	0	0	0	1	0	1	1	0	1	1	1	1	1	1	0	1	1	21
32	Wilda	1	0	1	1	1	0	0	1	1	0	1	1	1	0	1	0	0	0	0	1	0	0	1	1	1	0	1	0	0	1	0	1	0	1	0	18
33	Wirda	0	0	0	1	1	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	1	1	0	0	0	0	0	10
34	Yudi	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	1	0	0	1	0	0	0	0	7
35	Yulia	0	0	1	1	1	1	0	0	1	1	0	0	0	0	1	0	1	0	0	0	0	0	1	1	0	0	1	1	1	1	1	1	0	0	0	15
36	Zahra	1	0	1	1	1	1	0	1	1	1	0	1	1	1	1	0	0	1	0	1	0	1	1	1	0	0	1	1	1	1	1	1	0	0	0	23
	t tabel	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,334	0,33	0,334	0,334	
	t hitung	0,45	0,57	0,66	0,31	0,43	0,44	0,6	0,55	0,42	0,41	0,42	0,63	0,49	0,57	0,44	0,58	0,43	0,16	0,6	0,55	0,27	-0,19	0,65	0,43	-0,19	0,57	0,57	0,44	0,48	0,49	0,41	0,441	0,45	0,482	0,393	
	Keterangan	V	V	V	TV	V	V	V	V	V	V	V	V	V	V	V	V	V	TV	V	V	TV	TV	V	V	TV	V	V	V	V	V	V	V	V	V	V	

Appendix 19. Reliability Test of Learning Outcomes Instrument

Uji Reliabilitas																																	
k	35																																
k-1	34																																
b^2 (Var Item)	0,24	0,21	0,21	0,18	0,22	0,24	0,19	0,25	0,25	0,22	0,25	0,25	0,25	0,26	0,25	0,16	0,25	0,24	0,19	0,25	0,26	0,26	0,25	0,18	0,19	0,21	0,21	0,18	0,21	0,21	0,18	0,21	0,22	0,26	0,22
$\sum b^2$	7,78																																
t^2	52,54																																
r11	0,877																																

Reliability Statistics

Cronbach's Alpha	N of Items
.877	35

Appendix 20. Difficulty Index of Learning Outcomes Instrument

Indek kesukaran																																		
	Butir Soal																																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
B	22	10	26	28	25	22	9	21	20	25	21	21	21	18	21	7	15	22	9	21	17	17	21	28	27	10	26	28	26	26	28	26	11	19	11
JS	36																																		
P	0,61	0,28	0,72	0,78	0,69	0,61	0,25	0,58	0,56	0,69	0,58	0,58	0,58	0,50	0,58	0,19	0,42	0,61	0,25	0,58	0,47	0,47	0,58	0,78	0,75	0,28	0,72	0,78	0,72	0,72	0,78	0,72	0,31	0,53	0,31
hasil	S	SK	M	M	M	S	SK	S	S	S	S	S	S	S	S	SK	S	M	SK	S	S	S	S	M	M	SK	M	M	M	M	M	M	SK	S	SK
Ket	Sedang	Sukar	Mudah	Mudah	Mudah	Sedang	Sukar	Sedang	Sedang	Sedang	Sedang	Sedang	Sedang	Sedang	Sedang	Sukar	Sedang	Mudah	Sukar	Sedang	Sedang	Sedang	Sedang	Mudah	Mudah	Sukar	Mudah	Mudah	Mudah	Mudah	Mudah	Mudah	Sukar	Sedang	Sukar

Appendix 21. Discrimination Index of Learning Outcomes Instrument

No.	Name	Butir Soal																																	jumlah	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35		
4	Baginda	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	33	KELOMPOK ATAS
1	Audia	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	31	
21	M.Ridho	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	31	
12	Eko	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	30	
8	Christian	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	0	0	1	1	1	1	1	1	0	1	0	28	
10	Dilyan	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	0	1	1	1	0	1	1	1	1	1	1	0	1	0	28	
15	Jesika	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	0	28	
17	Keysa	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	0	1	0	0	1	1	0	1	1	1	1	1	1	1	1	0	1	28	
7	Cantika	0	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	0	0	0	26	
13	Halim	1	1	1	1	0	1	1	1	0	0	1	1	0	1	0	0	0	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	26	
36	Zahra	1	0	1	1	1	1	0	1	1	1	0	1	1	1	1	0	0	1	0	1	0	1	1	1	0	0	1	1	1	1	1	1	0	0	0	23	
14	Hanifah	0	0	1	1	0	1	1	0	1	1	0	1	1	1	1	1	1	1	1	0	0	1	1	1	1	0	1	0	1	1	0	1	0	0	0	22	
23	Melisa	1	0	1	0	1	1	0	1	0	1	1	0	0	1	1	0	1	1	0	1	1	0	1	1	1	0	1	1	0	1	1	1	0	1	0	22	
30	Vinsent	1	0	1	1	1	1	0	0	1	1	1	0	0	1	1	0	1	1	0	0	1	0	1	1	1	0	1	1	0	1	1	1	0	1	0	22	
3	Bagas	1	1	0	1	1	1	1	1	0	1	0	1	1	0	0	0	1	0	1	1	0	1	0	0	0	1	1	1	1	0	1	0	1	0	1	21	
31	Vivi	1	0	1	1	1	1	0	0	1	1	1	1	0	0	1	0	0	0	0	0	0	1	0	1	1	0	1	1	1	1	1	1	0	1	1	21	
6	Bayu	0	1	1	0	1	0	0	0	1	0	0	0	0	1	1	0	0	1	0	0	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	20	
16	Keke	1	0	1	1	1	0	0	0	0	1	0	1	1	0	1	0	0	1	0	0	0	1	0	1	1	0	1	1	1	1	1	1	0	1	0	19	
27	Rani	1	0	1	1	1	1	0	1	0	0	1	1	1	0	0	0	1	1	0	1	1	0	0	1	1	0	0	1	1	0	1	1	0	0	0	19	KELOMPOK BAWAH
28	Teruna	0	0	1	1	1	0	0	1	0	1	1	1	1	0	1	0	0	1	0	1	0	1	1	1	0	0	0	1	1	0	1	1	0	1	0	19	
29	Tina	1	0	1	0	1	0	0	1	0	1	1	0	0	1	1	0	1	1	0	1	1	0	0	1	1	0	1	0	1	1	0	1	0	0	0	18	
32	Wilda	1	0	1	1	1	0	0	1	1	0	1	1	1	0	1	0	0	0	0	1	0	1	1	1	0	1	0	0	1	0	1	0	1	0	0	18	
22	M.Ridho	1	0	1	0	0	0	0	1	0	1	0	1	1	0	0	0	0	1	0	1	1	1	0	1	1	0	1	1	1	0	1	1	0	0	0	17	
9	Cintya	0	0	1	1	0	1	0	0	1	0	0	0	1	0	1	0	0	1	0	0	0	1	1	1	1	0	1	1	0	1	1	0	0	1	0	16	
19	Lutfia	1	0	0	1	0	0	0	1	0	0	1	0	0	0	1	0	1	1	0	1	0	1	0	1	1	0	0	0	1	0	0	0	1	1	1	15	
35	Yulia	0	0	1	1	1	1	0	0	1	1	0	0	0	0	1	0	1	0	0	0	0	0	1	1	0	0	1	1	1	1	1	0	0	0	0	15	
11	Dita	0	0	1	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	1	1	1	0	1	1	0	1	1	1	0	1	0	14	
24	Nabila	1	1	0	0	1	0	0	0	0	1	1	0	0	1	0	0	0	1	0	0	0	0	1	0	1	1	1	1	1	0	1	0	0	0	0	14	
2	Aulia	0	0	0	1	0	0	0	0	0	0	1	1	0	1	0	0	1	1	0	0	1	1	0	0	1	0	0	1	0	1	0	1	0	1	0	13	
20	M.Fajar	1	0	0	0	0	1	0	1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	1	0	1	1	1	1	1	0	0	0	0	13	
5	Bamban	0	0	1	1	0	1	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	1	1	0	1	0	0	0	0	1	0	1	0	0	0	11	
18	Lilis	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	1	0	0	1	0	1	1	0	0	1	1	0	0	0	11	
26	Raissya	1	0	0	1	0	0	0	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	1	1	0	0	0	10	
33	Wirda	0	0	0	1	1	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	1	1	0	0	0	0	0	10	
34	Yudi	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	1	0	0	0	1	0	0	0	0	7	
25	Naila	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	6	
Uji Daya Pembeda																																				
P(A)		0,78	0,50	0,94	0,89	0,89	0,83	0,50	0,72	0,78	0,89	0,67	0,83	0,72	0,78	0,78	0,39	0,56	0,67	0,50	0,72	0,56	0,44	0,83	0,89	0,67	0,50	0,94	0,94	0,89	0,94	0,94	0,89	0,50	0,72	0,50		
P(B)		0,44	0,06	0,50	0,67	0,50	0,39	0,00	0,44	0,33	0,50	0,50	0,33	0,44	0,22	0,39	0,00	0,28	0,56	0,00	0,44	0,39	0,50	0,33	0,67	0,83	0,06	0,50	0,61	0,56	0,50	0,61	0,56	0,11	0,33	0,11		
P		0,33	0,44	0,44	0,22	0,39	0,44	0,50	0,28	0,44	0,39	0,17	0,50	0,28	0,56	0,39	0,39	0,28	0,11	0,50	0,28	0,17	-0,06	0,50	0,22	-0,17	0,44	0,44	0,33	0,33	0,44	0,33	0,33	0,39	0,39	0,39		
Ket		good	medium	good	medium	medium	good	good	good	good	medium	bad	good	medium	good	medium	medium	medium	bad	good	medium	medium	bad	good	medium	bad	good	good	medium	medium	good	medium	medium	medium	medium	medium		

Appendix 22. Learning Activities Result in Experimental Class (X-4)

Name	Result	Category
Ade Shafa Riskya Tambunan	63,8	Active
Alifia Annisa	84,7	Very active
Amel Saskia Mesi Br.Simarmata	86,1	Very active
Bambang Rizki	72,2	Active
Charisa Shilvia Sirait	77,7	Active
Cindy Yunita Manurung	86,1	Very active
Debora Cristiyani Simanjuntak	81,9	Very active
Dini Artika	75	Active
Esra Sandria Sidabutar	59,7	Quite active
Fitra Azikri	47,2	Quite active
Fitra Hadika Pratama	70,8	Active
Gio Dicaprio	72,2	Active
Gusti Mahendra	75	Active
Halimatussakdiyah	80,5	Active
Karina Azmi Arifin	84,7	Very active
Kayla Mutiara Putri Sirait	81,9	Very active
Keren Hapukh Silitonga	88,8	Very active
M.Ridho Wiyadi	79,1	Active
M.Ali Akbar Sibuea	63,8	Active
M.Khairul Fazri	79,1	Active
Muhammad Afdal Ridho Mirza	83,3	Very active
Muhammad Habib Riziq Rambe	77,7	Active
Nindya Ardisa	87,5	Very active
Nurfaidza Maulidza	75	Active
Putri Anatasya Br.Simatupang	75	Active
Quila Maria Tambunan	86,1	Very active
Raditya Prayuga	73,6	Active
Ramadani	80,5	Active
Rayhan Januar Risky	45,8	Quite active
Rja Ridwan Napitupulu	79,1	Active
Runaaprila	51,3	Quite active
Said Franzi Rahman	85,7	Very active
Savira Maharani Putri Sinambela	66,6	Active
Stive One Simus Surbakti	73,6	Active
Suci Maulida Nasution	80,5	Active
Wahyu Ramadhan Siagian	80,5	Active
Avarage	**75,33**	**Active**

Appendix 23. Learning Activities Result in Experimental Class (X-6)

Name	Result	Category
Afirah khairunnisa	69,4	active
Aina sofiani nasution	56,9	quite active
Aira wahdini	52,7	quite active
Al giffari santoso	47,2	quite active
Alqy rizqil akbar	66,6	active
Amisha sakilla	47,2	quite active
Anggita dewi siregar	59,7	quite active
Asila tabani balqis	88,8	very active
Ayu lestari	59,7	quite active
Cheysa aryadinata	79,1	active
Danil ibrahim harahap	56,9	quite active
Dinda	54,1	quite active
Fitra hidayat	47,2	quite active
Hafiz alfaruq	55,5	quite active
Jihan berliani	72,2	active
Kirana thalita	48,6	quite active
Klaudia eliyanti marpaung	69,4	quite active
M.hady al ikhsan mangunsong	51,3	quite active
M.alif pratama	48,6	quite active
M.rafa alfarisyi	43	quite active
Maya anggelasari	62,5	active
M.farhan hasibuan	47,2	quite active
M.haziq gunawan	48,6	quite active
M.rizky syahputra	47,2	quite active
Nhada anggriani	59,7	quite active
Nur wafiq azizah siagian	76,3	active
Putri cahaya	59,7	quite active
Putri syafira	56,9	quite active
Revando dwi pramana nasution	47,2	quite active
Salwa azani	59,7	quite active
Saskia nabila sirait	50	quite active
Syarifa nur'aini	73,6	active
Taniya diza putri panjaitan	51,3	quite active
Yahya aulia akbar	41,6	quite active
Yasri yuanditra	41,6	quite active
Zsaqila queen azzahra	70,8	active
Avarage	**57,44**	**quite active**

Appendix 24. Avarage Value Per Indicators of Students Activities

No	Nama siswa	Aktivitas Kelas Kontrol (Konvensional)																		Jlh	Nilai
		Kesiapan Siswa			Antusiasme Siswa			Diskusi Kelompok			Memecahkan Masalah			Mengerjakan Latihan			Menutup Kegiatan				
		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3		
1	AFIRAH	4	4	3	4	3	1	2	4	1	4	3	2	4	3	2	3	1	2	50	69
2	AINA	4	2	3	2	1	1	2	2	1	4	3	2	4	2	2	3	1	2	41	57
3	AIRA	4	2	1	2	1	1	2	4	3	3	3	1	3	2	1	3	1	1	38	53
4	AL GIFFARI	4	2	3	4	2	1	2	4	1	3	2	1	3	2	1	3	1	1	40	56
5	ALQY	4	4	3	4	2	1	2	4	1	3	3	2	4	2	3	3	1	2	48	67
6	AMISHA	4	2	3	3	1	1	2	2	1	4	3	2	4	2	1	3	1	2	41	57
7	ANGGITA	4	4	2	4	3	1	2	4	1	4	3	2	4	3	2	3	2	2	50	69
8	ASILA	4	4	4	4	3	3	2	4	4	4	4	4	4	2	3	4	3	4	64	89
9	AYU	4	2	3	2	1	1	2	2	1	4	3	2	4	2	2	3	3	2	43	60
10	CHEYSA	4	4	3	4	3	1	2	4	4	4	3	4	4	3	3	3	2	2	57	79
11	DANIL	4	2	3	2	1	1	2	2	1	4	3	2	4	2	2	3	1	2	41	57
12	DINDA	4	2	1	2	1	1	2	4	3	3	3	2	3	2	1	3	1	1	39	54
13	FITRA	4	4	3	4	3	4	2	4	4	4	4	4	4	2	3	4	3	4	64	89
14	HAFIZ	4	2	3	4	2	1	2	4	1	3	2	1	3	2	1	3	1	1	40	56
15	JIHAN	4	4	3	4	3	1	2	4	1	4	3	2	4	3	3	3	2	2	52	72
16	KIRANA	4	4	3	4	3	1	2	4	1	4	3	2	4	3	2	3	1	2	50	69
17	KLAUDIA	4	4	3	4	3	4	2	4	1	4	2	2	4	1	2	3	1	2	50	69
18	M.HADY	4	4	3	2	3	1	2	4	1	4	3	2	3	2	1	3	1	1	44	61
19	M.ALIF	4	2	3	2	1	1	2	2	1	4	2	2	4	2	3	4	1	2	42	58
20	M.RAFA	4	4	2	4	3	1	2	4	1	4	3	2	3	1	1	3	1	2	45	63
21	MAYA	4	4	3	4	1	1	2	4	1	4	2	2	4	1	2	3	2	1	45	63
22	M.FARHAN	4	4	3	4	3	1	2	4	1	4	4	2	4	3	4	3	2	4	56	78
23	M.HAZIQ	4	2	3	3	1	1	2	2	1	4	3	2	4	3	1	3	2	2	43	60
24	M.RIZKY	4	2	3	3	1	1	2	2	1	4	3	2	4	2	1	3	1	2	41	57
25	NHADA	4	4	4	4	3	3	2	4	4	4	4	4	4	2	3	4	3	4	64	89
26	NUR WAFIQ	4	4	3	4	3	1	2	4	1	4	3	2	3	3	2	3	1	1	48	67
27	PUTRI C	4	2	3	3	1	1	2	2	1	4	3	4	3	2	1	3	2	2	43	60
28	PUTRI S	4	4	3	4	3	1	2	4	1	4	3	2	4	3	3	2	2	4	53	74
29	REVANDO	4	4	2	4	3	1	2	4	1	4	3	2	4	3	2	3	2	2	50	69
30	SALWA	4	4	3	4	1	1	2	4	1	4	2	2	4	1	1	3	1	1	43	60
31	SASKIA	4	2	1	4	3	1	2	4	1	3	2	1	2	1	1	2	1	1	36	50
32	SYARIFA	4	4	3	4	3	1	2	4	1	4	3	2	4	3	3	2	2	4	53	74
33	TANIYA	4	4	3	2	3	1	2	4	1	4	3	2	3	2	1	3	1	1	44	61
34	YAHYA	4	2	1	4	3	1	2	4	1	3	2	1	3	2	1	3	1	1	39	54
35	YASRI	4	4	3	2	3	1	2	4	1	4	4	2	3	2	1	3	1	1	45	63
36	ZSAQILA	4	4	3	4	3	1	2	4	1	4	3	2	4	1	1	3	3	4	51	71
Total		144	116	99	122	81	46	72	128	52	138	105	77	131	77	67	109	56	74	1693	9406
Jlh Benar		359			249			252			320			275			239			x̄ (rata-rata)	
x̄ (rata-rata)		3,32			2,31			2,33			2,96			2,55			2,21			2,61	
		83%			58%			58%			74%			64%			55%			65%	

No	Nama siswa	Aktivitas Kelas Eksperimen (PjBL)																		Jlh	Nilai
		Kesiapan Siswa			Antusiasme Siswa			Diskusi Kelompok			Memecahkan Masalah			Mengerjakan Latihan			Menutup Kegiatan				
		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3		
1	Ade	4	4	3	4	3	4	2	4	1	4	3	4	4	3	2	4	2	2	57	79
2	Alifia	4	4	3	4	3	1	2	4	1	4	3	2	4	2	1	3	1	2	48	67
3	Amel	4	4	3	4	3	1	3	4	3	4	3	4	4	4	2	4	4	4	62	86
4	Bambang	4	4	3	4	3	1	2	4	2	4	3	4	4	2	2	3	2	2	53	74
5	Charisa	4	4	2	4	3	1	2	4	1	4	3	2	4	2	1	3	1	3	48	67
6	Cindy	4	4	4	4	4	1	4	4	3	4	3	2	4	4	3	3	4	4	63	88
7	Debora	4	4	2	4	3	1	2	4	4	4	3	4	4	3	2	4	4	2	58	81
8	Dini	4	4	2	4	3	1	2	3	4	4	3	4	4	2	4	3	4	2	57	79
9	Esra	4	4	3	4	3	1	2	4	1	4	2	2	4	2	2	2	2	2	48	67
10	Fitra A	4	4	3	4	3	1	4	4	1	4	4	2	4	4	1	4	1	4	56	78
11	Fitra H	4	4	3	4	3	1	2	4	2	4	3	4	4	4	4	3	3	3	59	82
12	Gio	4	4	2	4	2	3	4	4	4	4	4	4	4	4	1	4	3	2	61	85
13	Gusti	4	4	4	4	3	4	3	4	1	4	3	2	3	2	1	4	1	2	53	74
14	Halima	4	4	2	4	3	1	2	4	3	4	3	2	4	2	1	3	1	3	50	69
15	Karina	4	4	4	4	4	3	2	4	1	4	4	4	3	3	4	2	3	4	61	85
16	Kayla	4	4	3	4	3	1	2	4	1	4	3	2	2	3	3	1	2	2	48	67
17	Keren	4	4	3	4	3	1	4	4	4	4	4	4	4	4	4	4	2	3	64	89
18	M.Ridho	2	4	3	4	3	4	4	4	1	4	3	2	4	3	2	3	4	2	56	78
19	M.Ali	4	4	3	4	3	1	2	4	1	4	3	4	3	3	3	4	4	4	58	81
20	M.Khairul	4	4	3	4	3	1	2	4	1	4	3	2	4	4	4	3	4	3	57	79
21	M Afdal	4	4	3	4	3	1	2	4	4	4	4	4	4	4	2	3	1	4	59	82
22	M Habib	4	4	3	4	3	1	2	4	4	4	4	2	4	4	2	3	2	2	56	78
23	Nindya	4	4	3	4	3	2	2	4	4	4	4	4	4	2	4	4	4	4	64	89
24	Nurfaidza	4	4	3	4	3	3	2	4	1	4	2	2	4	2	1	2	1	2	48	67
25	Putri	4	4	3	4	3	1	2	4	1	4	3	2	4	3	4	3	3	3	55	76
26	Quila	4	4	3	4	3	1	2	4	1	4	3	2	4	3	4	2	4	1	53	74
27	Raditya	4	4	3	4	3	1	2	4	2	4	3	4	4	4	4	3	3	3	59	82
28	Ramadani	4	4	3	4	3	1	2	4	2	4	3	4	4	3	4	3	3	3	58	81
29	Rayhan	4	4	2	4	3	1	2	4	1	4	3	2	4	2	2	3	2	1	48	67
30	Rja	4	2	1	2	1	2	1	4	3	2	3	2	3	2	1	2	1	1	37	51
31	Runa aprila	4	4	3	4	3	1	2	4	2	4	3	4	4	3	4	3	3	3	58	81
32	Said	4	4	4	4	4	3	2	4	2	4	3	4	4	3	4	3	3	3	62	86
33	Savira	4	4	3	4	3	1	2	4	1	4	3	2	4	1	2	2	2	2	48	67
34	Stive	4	4	3	4	3	1	2	4	1	4	3	2	4	3	2	4	3	2	53	74
35	Suci	4	4	3	4	3	1	2	4	1	4	3	4	4	4	2	4	4	3	58	81
36	Wahyu	4	4	3	4	3	1	2	4	1	4	4	4	4	4	2	3	1	1	53	74
Total		142	142	104	142	108	55	83	143	71	143	114	108	138	107	91	111	92	93	1986	###
Jlh Benar		388			305			297			365			336			296			x̄ (rata-rata)	
x̄ (rata-rata)		3,59			2,82			2,75			3,38			3,11			2,74			3,07	
		90%			71%			69%			84%			78%			69%			77%	

Appendix 25. Students Learning Outcome Indicators Achievement of Control Class

No	Nama siswa	Pretest Kelas Kontrol (Konvensional)																														Jlh	Nilai
		engetahuan (C		Pemahaman (C2)						Penerapan (C3)						Analisis (C4)								Sintesis (C5)						:valuasi C6			
		3	10	1	6	9	15	21	30	13	17	19	25	26	27	5	8	11	12	16	23	24	28	2	4	7	14	20	29	18	22		
1	AFIRAH	1	0	1	0	0	1	1	0	0	1	0	1	1	1	1	0	0	1	0	1	1	1	1	0	1	0	1	1	1	0	18	60
2	AINA	1	1	1	0	0	1	1	1	1	0	1	1	0	0	0	1	0	1	0	0	1	1	0	1	0	1	1	0	1	0	17	57
3	AIRA	0	1	1	0	0	1	0	1	0	1	1	0	1	0	1	1	1	1	1	0	1	1	1	1	1	0	1	0	0	0	18	60
4	AL GIFFARI	1	1	0	1	1	0	1	0	1	1	0	1	0	1	0	1	0	0	1	0	1	0	1	0	0	0	0	1	0	1	15	50
5	ALQY	1	1	1	0	1	0	0	1	0	1	1	0	1	1	0	1	0	1	0	0	1	1	0	0	0	0	0	1	0	0	14	47
6	AMISHA	0	1	1	1	1	0	1	0	1	1	0	1	0	1	1	0	1	1	1	1	0	0	0	1	1	0	0	0	1	1	18	60
7	ANGGITA	1	1	1	1	1	1	1	1	1	1	0	1	1	0	0	1	0	0	0	0	1	0	0	0	0	1	0	1	1	0	17	57
8	ASILA	1	1	0	0	1	0	0	1	0	0	0	1	0	0	0	1	1	1	0	1	0	0	1	1	0	1	1	1	1	0	15	50
9	AYU	1	1	1	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	15	50
10	CHEYSA	1	1	1	1	0	1	1	0	0	1	1	1	1	1	1	1	0	1	1	0	1	0	1	0	1	0	0	1	1	1	21	70
11	DANIL	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	0	1	0	0	0	1	0	1	0	1	0	0	1	0	1	19	63
12	DINDA	0	1	0	1	0	1	1	0	1	1	0	1	0	0	0	0	1	0	0	1	0	1	0	0	1	1	1	0	1	1	15	50
13	FITRA	1	0	0	1	0	0	0	1	0	0	1	0	1	0	1	0	0	1	1	1	1	1	0	1	1	0	1	1	1	1	17	57
14	HAFIZ	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	15	50
15	JIHAN	1	0	0	1	1	1	0	1	1	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	12	40
16	KIRANA	0	1	0	1	0	1	1	0	1	1	1	1	0	1	1	1	0	0	1	0	0	1	1	1	0	0	1	1	1	0	18	60
17	KLAUDIA	1	1	1	1	1	1	1	0	1	1	1	1	1	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	1	16	53
18	M.HADY	0	0	1	0	0	0	0	1	1	1	1	0	0	1	0	1	1	0	0	1	1	1	0	1	0	0	1	0	0	0	13	43
19	M.ALIF	1	0	1	1	1	1	1	1	0	1	1	1	0	0	1	0	1	0	0	1	0	0	0	0	1	1	1	0	0	0	16	53
20	M.RAFA	1	1	0	0	1	1	1	0	0	0	1	0	1	1	0	0	1	1	1	0	1	1	1	1	0	1	0	1	0	1	18	60
21	MAYA	1	0	0	0	1	0	0	1	1	0	0	1	1	0	0	1	1	1	0	0	1	1	0	0	1	0	1	1	1	1	16	53
22	M.FARHAN	0	1	1	1	1	1	1	1	0	0	1	1	0	1	1	1	0	0	0	1	1	1	0	1	0	1	0	0	0	0	17	57
23	M.HAZIQ	1	1	1	1	0	1	1	1	1	1	0	0	1	0	0	0	1	1	1	0	0	0	1	1	1	1	0	0	1	1	19	63
24	M.RIZKY	1	1	1	0	0	1	1	0	1	0	1	0	0	1	1	0	0	0	1	1	1	1	0	0	1	0	1	1	0	1	17	57
25	NHADA	1	1	0	0	1	1	0	1	0	1	0	1	1	0	1	1	0	1	0	0	1	1	0	1	0	1	0	0	0	0	15	50
26	NUR WAFIQ	1	0	0	0	1	0	1	1	1	0	1	0	0	1	1	0	0	0	0	1	1	1	0	1	0	1	1	1	1	0	16	53
27	PUTRI C	1	0	1	1	1	1	1	1	1	0	1	0	1	0	0	0	0	1	1	0	1	0	1	0	1	0	0	0	0	1	16	53
28	PUTRI S	0	1	1	0	0	1	0	0	1	1	0	0	0	1	1	1	0	0	0	1	1	1	1	1	0	1	1	0	1	1	17	57
29	REVANDO	0	1	0	1	1	1	0	0	0	0	1	0	0	1	1	0	0	0	1	1	0	1	0	0	1	1	1	1	1	1	16	53
30	SALWA	0	1	1	0	1	0	0	0	1	1	0	1	1	0	0	1	1	0	0	0	1	0	1	1	0	0	0	0	1	0	13	43
31	SASKIA	1	0	0	1	1	0	0	0	1	0	0	1	1	0	0	0	1	1	0	0	1	0	1	0	0	0	1	1	1	0	13	43
32	SYARIFA	0	0	0	1	0	1	1	1	1	1	1	1	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	23	77
33	TANIYA	0	1	1	1	1	0	0	0	0	0	0	1	1	1	1	0	0	1	1	1	1	1	1	1	0	1	1	1	1	1	20	67
34	YAHYA	1	1	1	1	1	1	0	1	0	1	0	1	1	1	0	1	0	1	1	1	1	0	1	1	0	1	0	1	0	0	20	67
35	YASRI	1	1	0	1	1	1	1	1	1	1	1	0	1	0	0	0	0	1	0	1	1	1	1	0	1	0	1	0	1	0	19	63
36	ZSAQILA	0	0	1	1	1	0	0	1	1	0	0	1	1	0	0	1	1	1	0	1	1	1	1	1	0	0	0	0	0	0	15	50
Total		24	24	22	23	24	24	21	22	23	22	20	23	23	17	15	17	14	19	13	17	26	20	19	19	16	19	18	19	19	17	599	1997
Jlh Benar		48		136						128						141								110						36		x̄ (rata-rata)	
x̄ (rata-rata)		0,67		0,63						0,59						0,49								0,51						0,50		0,56	
		67%		63%						59%						49%								51%						50%		56%	

No	Nama siswa	Posttest Kelas Kontrol (Konvensional)																														Jlh	Nilai
		engetahuan (C		Pemahaman (C2)						Penerapan (C3)						Analisis (C4)								Sintesis (C5)						:valuasi C6			
		3	10	1	6	9	15	21	30	13	17	19	25	26	27	5	8	11	12	16	23	24	28	2	4	7	14	20	29	18	22		
1	AFIRAH	1	0	1	1	0	1	1	0	0	1	1	1	1	1	0	1	0	1	0	1	1	1	1	0	1	0	1	1	1	0	20	67
2	AINA	1	1	1	0	1	0	0	1	1	1	1	1	0	0	0	1	1	1	1	0	1	1	0	1	1	1	1	1	1	0	21	70
3	AIRA	0	1	1	1	0	1	0	1	0	1	1	0	1	0	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	22	73
4	AL GIFFARI	1	1	1	1	1	0	1	1	1	1	1	0	0	1	1	1	0	1	1	1	0	1	1	0	0	0	0	1	0	1	20	67
5	ALQY	1	1	1	1	1	1	0	1	0	1	1	1	1	1	0	1	0	1	1	0	1	1	0	1	1	1	0	1	1	1	23	77
6	AMISHA	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	0	1	1	1	1	0	1	0	1	1	0	1	0	1	1	23	77
7	ANGGITA	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	0	0	1	1	1	0	1	0	1	1	1	1	1	24	80
8	ASILA	1	1	0	1	1	1	0	1	0	1	1	1	0	0	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	0	22	73
9	AYU	1	1	1	1	1	0	1	1	1	1	1	0	1	1	0	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	25	83
10	CHEYSA	1	1	1	1	0	1	1	0	0	1	1	1	1	1	1	1	0	1	1	0	0	0	1	0	1	0	0	1	1	1	20	67
11	DANIL	1	1	1	1	1	0	1	1	1	0	1	1	1	1	0	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	25	83
12	DINDA	0	1	0	1	0	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	0	1	0	1	1	1	1	0	1	1	22	73
13	FITRA	1	0	1	1	1	1	0	1	1	1	1	0	1	0	1	0	0	1	1	1	1	1	0	1	1	0	1	1	1	1	22	73
14	HAFIZ	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	0	0	1	1	1	1	1	1	1	1	25	83
15	JIHAN	1	0	0	1	1	1	0	1	1	1	0	1	1	0	0	1	1	0	1	1	0	1	1	1	1	1	1	1	0	0	20	67
16	KIRANA	0	1	0	1	0	1	1	0	1	1	1	1	0	1	1	1	0	1	1	0	1	1	1	1	0	0	1	1	1	0	20	67
17	KLAUDIA	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	0	1	1	1	1	1	0	0	1	25	83
18	M.HADY	1	1	1	0	1	0	0	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	24	80
19	M.ALIF	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	1	1	1	1	0	1	0	1	1	1	1	0	1	0	23	77
20	M.RAFA	1	1	0	0	1	1	1	1	0	1	1	0	1	0	1	1	1	0	1	0	1	1	1	1	0	1	0	1	0	1	20	67
21	MAYA	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	26	87
22	M.FARHAN	0	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	0	1	0	1	1	0	1	1	0	1	1	1	0	0	21	70
23	M.HAZIQ	1	1	1	1	0	1	1	1	1	1	1	0	1	0	0	1	1	1	1	0	0	1	1	1	1	1	1	0	1	1	23	77
24	M.RIZKY	1	1	1	0	1	1	1	0	1	1	1	0	0	1	1	0	0	0	1	1	1	1	1	0	1	1	1	1	0	1	21	70
25	NHADA	1	1	0	0	1	1	0	1	0	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	0	1	1	1	1	1	23	77
26	NUR WAFIQ	1	0	1	1	1	0	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	0	1	0	1	1	1	1	0	23	77
27	PUTRI C	1	1	1	1	1	1	1	0	1	0	1	1	1	0	0	1	1	1	1	0	1	0	1	0	1	1	0	1	1	1	22	73
28	PUTRI S	0	1	1	0	0	1	0	0	1	1	0	0	1	1	1	1	1	0	0	1	1	1	1	1	0	1	1	1	1	1	20	67
29	REVANDO	1	1	0	1	1	1	1	1	0	1	1	1	0	1	1	0	1	1	1	1	0	1	0	0	1	1	1	1	1	1	23	77
30	SALWA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	1	0	26	87
31	SASKIA	1	0	0	1	1	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	24	80
32	SYARIFA	0	0	0	1	0	1	1	1	1	1	1	1	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0	0	21	70
33	TANIYA	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	23	77
34	YAHYA	1	1	1	1	1	1	0	1	0	1	1	1	1	1	0	1	0	1	1	1	1	0	1	1	0	1	0	1	0	0	21	70
35	YASRI	0	1	0	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	0	1	1	1	1	1	1	0	1	0	1	0	22	73
36	ZSAQILA	0	0	1	1	1	0	0	1	1	0	0	1	1	0	0	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	20	67
Total		28	28	26	30	28	27	23	26	25	30	31	26	27	24	21	28	25	28	26	27	27	29	26	29	24	27	30	28	28	23	805	2683
Jlh Benar		56		160						163						211								164						51		x̄ (rata-rata)	
x̄ (rata-rata)		0,78		0,74						0,75						0,73								0,76						0,71		0,75	
		78%		74%						75%						73%								76%						71%		75%	

Appendix 26. Students Learning Outcome Indicators Achievement of Experimental Class

No	Nama siswa	Pretest Kelas Eksperimen (PjBL)																																Jlh	Nilai
		engetahuan (C1		Pemahaman (C2)					Penerapan (C3)					Analisis (C4)								Sintesis (C5)					Evaluasi C6								
		3	10	1	6	9	15	21	30	13	17	19	25	26	27	5	8	11	12	16	23	24	28	2	4	7	14	20	29	18	22		
1	Ade	1	1	1	0	1	1	1	0	0	1	0	1	0	1	1	0	1	1	0	1	0	0	1	0	1	0	1	0	0	0	16	53
2	Alifia	1	0	1	0	0	0	1	0	0	0	1	1	0	1	0	0	1	1	0	1	1	0	0	0	0	0	0	1	1	0	12	40
3	Amel	0	1	1	1	0	1	1	0	1	1	0	0	1	1	1	1	1	0	1	1	0	1	0	0	0	0	0	1	0	0	16	53
4	Bambang	1	0	0	1	1	0	1	1	0	1	0	1	0	0	0	1	1	0	1	1	1	0	1	1	1	0	0	0	1	1	17	57
5	Charisa	1	1	1	0	1	0	1	0	1	1	1	0	1	0	1	1	0	0	0	1	1	0	1	0	0	1	0	0	0	1	16	53
6	Cindy	0	0	1	1	1	1	1	0	0	0	1	1	0	0	1	0	0	1	0	1	0	1	1	1	1	0	1	0	1	1	17	57
7	Debora	1	0	1	1	0	1	0	1	1	1	1	0	1	0	1	1	0	1	0	0	1	0	1	0	0	0	0	1	0	0	15	50
8	Dini	0	1	1	1	0	0	0	0	0	1	0	1	1	0	0	1	1	0	1	0	0	1	1	0	1	1	1	0	1	1	16	53
9	Esra	0	0	1	0	0	0	1	0	1	0	0	1	1	1	1	1	0	1	0	1	1	0	1	1	0	1	0	1	1	0	16	53
10	Fitra A	1	1	1	1	0	1	1	1	1	1	0	1	1	0	1	1	0	0	0	0	1	0	0	1	0	1	0	1	0	0	17	57
11	Fitra H	1	0	1	1	1	1	0	1	1	0	1	1	0	0	1	0	1	0	1	0	1	1	0	1	0	1	0	0	1	0	16	53
12	Gio	0	1	0	0	0	0	0	0	1	0	0	0	1	0	1	0	1	0	0	1	1	1	1	0	0	1	1	0	1	1	13	43
13	Gusti	1	0	0	1	0	0	1	0	1	0	0	0	1	0	0	1	0	1	0	0	1	0	1	0	1	0	1	0	1	1	13	43
14	Halima	1	0	1	0	1	0	1	0	1	1	0	0	1	1	1	1	1	1	0	0	1	0	1	1	0	1	1	1	1	1	20	67
15	Karina	1	1	0	1	1	1	0	0	1	1	0	1	1	0	1	1	0	0	1	1	1	1	1	0	1	1	0	0	1	1	20	67
16	Kayla	0	0	1	0	0	1	0	1	1	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0	1	8	27
17	Keren	1	1	1	1	1	0	1	0	1	0	1	0	1	0	1	0	1	1	1	0	0	1	0	0	1	0	0	0	0	1	16	53
18	M.Ridho	0	1	0	0	1	0	0	1	1	1	0	0	0	1	1	0	1	0	1	0	1	1	1	1	0	0	0	0	1	1	15	50
19	M.Ali	1	0	1	1	1	1	0	1	1	0	1	0	0	0	0	1	0	1	0	1	0	1	0	1	1	1	1	0	1	1	18	60
20	M.Khairul	1	1	0	0	1	1	1	0	1	1	1	1	0	0	1	0	0	1	0	1	0	1	0	1	1	1	0	1	1	0	17	57
21	M Afdal	1	1	1	0	0	0	1	1	0	1	1	1	1	0	0	1	1	1	1	0	0	0	1	0	1	0	1	1	1	0	18	60
22	M Habib	0	0	1	0	0	1	0	1	1	0	0	0	0	0	0	0	1	0	0	1	1	0	1	1	0	1	0	1	0	1	12	40
23	Nindya	0	1	0	0	0	1	1	1	1	0	1	1	1	1	0	0	1	1	0	0	1	0	1	0	0	0	0	0	0	1	14	47
24	Nurfaidza	1	0	1	0	0	0	1	0	1	0	0	0	1	0	1	1	0	1	0	0	0	1	0	1	1	1	1	0	0	1	14	47
25	Putri	1	0	0	1	0	1	1	0	0	0	1	0	1	0	1	1	0	0	0	0	1	0	0	1	0	1	0	1	0	0	12	40
26	Quila	1	1	1	0	1	0	1	1	0	0	1	1	0	1	1	1	0	1	0	1	1	0	0	0	0	0	0	0	1	0	15	50
27	Raditya	1	0	1	0	1	1	1	1	0	0	1	0	0	1	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	12	40
28	Ramadani	1	1	1	0	0	0	1	0	1	1	0	1	0	0	1	0	0	0	0	1	1	0	1	0	0	0	0	0	0	1	12	40
29	Rayhan	0	1	1	1	1	1	0	0	1	0	0	1	1	0	0	1	0	1	1	0	1	1	1	1	1	1	1	0	1	1	19	63
30	Rja	1	1	1	1	0	1	0	1	1	0	0	1	1	0	0	0	1	1	0	0	0	1	0	1	0	0	0	0	1	0	15	50
31	Runa aprila	1	1	0	0	1	1	1	0	0	0	0	0	0	1	0	1	1	0	0	0	1	1	0	0	0	0	0	0	1	0	11	37
32	Said	0	0	1	1	0	0	1	1	1	1	1	0	0	1	0	1	0	0	0	1	1	0	0	0	0	0	0	1	0	0	13	43
33	Savira	0	1	1	0	0	0	1	0	0	1	0	1	1	1	0	0	1	0	0	1	1	0	1	0	0	0	0	1	0	0	12	40
34	Stive	1	0	1	0	0	1	0	0	0	0	0	1	0	0	1	1	1	1	0	1	1	0	1	0	0	1	0	1	0	1	15	50
35	Suci	1	1	0	0	1	0	0	1	0	1	0	1	0	1	0	1	0	1	0	1	1	1	0	0	1	1	1	0	0	1	16	53
36	Wahyu	0	1	1	1	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	1	0	1	1	1	1	1	0	1	13	43
	Total	23	20	26	16	16	18	22	15	22	16	14	19	17	14	19	20	20	19	11	18	27	14	22	14	14	16	12	17	17	19	537	1790
	Jlh Benar	43		113					102					148								95					36						x̄ (rata-rata)	
	x̄ (rata-rata)	0,60		0,52					0,47					0,51								0,44					0,50						0,51	
		60%		52%					47%					51%								44%					50%						51%	

No	Nama siswa	Pretest Kelas Eksperimen (PjBL)																																Jlh	Nilai
		engetahuan (C1		Pemahaman (C2)					Penerapan (C3)						Analisis (C4)							Sintesis (C5)						Evaluasi C6								
		3	10	1	6	9	15	21	30	13	17	19	25	26	27	5	8	11	12	16	23	24	28	2	4	7	14	20	29	18	22		
1	Ade	1	1	1	0	1	1	1	1	0	1	0	1	1	1	1	1	1	1	0	1	0	1	1	0	1	1	1	1	0	1	23	77
2	Alifia	1	1	1	0	0	1	1	1	1	0	1	1	1	1	0	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	24	80
3	Amel	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	0	25	83
4	Bambang	1	0	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	0	1	1	1	1	0	0	1	1	23	77
5	Charisa	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	26	87
6	Cindy	0	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	26	87
7	Debora	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	27	90
8	Dini	1	1	1	0	1	1	0	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	25	83
9	Esra	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	28	93
10	Fitra A	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	0	1	0	0	1	1	1	23	77
11	Fitra H	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	28	93
12	Gio	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	0	1	1	25	83
13	Gusti	1	1	1	1	1	0	1	1	1	1	1	1	1	0	0	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	25	83
14	Halima	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	28	93
15	Karina	1	1	0	1	1	1	0	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	0	0	1	1	23	77
16	Kayla	0	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	1	0	0	1	1	0	1	23	77
17	Keren	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	28	93
18	M.Ridho	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	27	90
19	M.Ali	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	1	0	1	0	1	1	1	1	1	0	1	24	80
20	M.Khairul	1	1	0	0	1	1	1	0	1	1	1	1	1	1	0	0	1	1	1	0	1	1	1	1	1	0	1	1	1	1	23	77
21	M Afdal	1	1	1	1	1	0	0	1	0	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	25	83
22	M Habib	0	1	1	1	1	1	1	1	1	1	0	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	24	80
23	Nindya	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	0	1	1	26	87
24	Nurfaidza	1	1	1	0	0	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	24	80
25	Putri	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	0	1	1	1	26	87
26	Quila	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	26	87
27	Raditya	1	0	1	1	1	1	1	1	1	0	1	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	25	83
28	Ramadani	1	1	1	0	0	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	23	77
29	Rayhan	0	1	0	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	26	87
30	Rja	1	1	1	1	1	0	1	1	1	1	0	1	1	0	1	1	0	1	0	1	0	1	1	1	1	1	1	1	1	1	25	83
31	Runa aprila	1	1	0	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	27	90
32	Said	0	0	1	1	0	1	1	1	1	1	1	1	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	24	80
33	Savira	0	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	26	87
34	Stive	1	1	1	1	1	1	1	1	0	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	0	24	80
35	Suci	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	0	1	1	1	1	0	1	1	1	1	1	1	25	83
36	Wahyu	0	0	1	1	1	1	1	0	1	1	0	0	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1	23	77
	Total	26	31	29	30	27	30	31	28	31	29	27	33	30	31	31	32	31	31	28	32	34	32	32	28	30	32	28	30	30	29	903	3010
	Jlh Benar	57		175					181					251								180					59						x̄ (rata-rata)	
	x̄ (rata-rata)	0,79		0,81					0,84					0,87								0,83					0,82						0,83	
		79%		81%					84%					87%								83%					82%						83%	

Appendix 27. Insectarium Project Work Assessment Rubric Table

Nama :

Kelompok :

Kelas :

No.	Aspek	Indikator	Keterangan (✓)	Skor
1.	**Perencanaan**	Pemilihan lokasi pengambilan spesimen.		
		Pemilihan kelengkapan alat dan bahan.		
		Rancangan jadwal proses pelaksanaan Proyek.		
		Pemilihan spesimen yang baik.		
2.	**Proses Pelaksanaan Proyek**	Persiapan perlengkapan pembuatan insektarium.		
		Ketertiban mengerjakan proyek.		
		Kesesuaian prosedur pelaksanaan Proyek.		
		Kerjasama kelompok.		
3.	**Hasil Produk Kampanye**	Media yang digunakan menarik.		
		Menampilkan media sesuai sistem klasifikasi.		
		Kebenaran isi media kampanye.		
		Kemudahan dalam memahami media kampanye.		
4.	**Presentase**	Penggunaan bahasa yang baik dan benar.		
		Penyampaiannya mudah dipahami.		
		Penggunaan media yang menarik.		
		Kekompakan tim.		

Keterangan:

Nilai 4= 4 poin terpenuhi

Nilai 3= 3 poin terpenuhi

Nilai 2= 2 poin terpenuhi

Nilai 1= 1 poin terpenuhi

Appendix 28. T Test Pretest Values for Control and Experimental Classes

T-Test

Group Statistics

	kelas	N	Mean	Std. Deviation	Std. Error Mean
pretest	eksperimen	36	51.0833	8.42573	1.40429
	kontrol	36	55.2500	8.23711	1.37285

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
pretest	Equal variances assumed	.057	.813	-2.122	70	.037	-4.16667	1.96386	-8.08346	-.24987
	Equal variances not assumed			-2.122	69.964	.037	-4.16667	1.96386	-8.08350	-.24984

Appendix 29. Documentation of Research

<table>
<tr>
<td> 
Interview with the biology teacher SMAN 1 Tanjungbalai</td>
<td> 
Trial test of the question instrument in Clas XI-4</td>
</tr>
<tr>
<td> 
Pretest and posttest in Experimental Class (X-4)</td>
<td> 
Pretest and posttest in Control Class (X-6)</td>
</tr>
<tr>
<td> 
Students work on insectarium projects according to the LKPD</td>
<td> 
The product of insectarium</td>
</tr>
<tr>
<td> 
Students are doing presentation of the LKPD questions in front of class</td>
<td> 
Students study with Powerpoint media</td>
</tr>
</table>