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PjBL Learning Training Based on Science Practicum Tools DNA and RNA Structures at the Attohiriyah Alfadiliyah Islamic Boarding School

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Abstract: The demands of globalization and the change of educational paradigms, bringing new policies in the field of education in Indonesia, namely the application of the curriculum MBKM (Merdeka Learning Kampus Merdeka), with the main characteristic is project-based learning that aims to develop soft skills and build the character of student profile Pancasila on pupils. In addition, today's science learning is still faced with challenges and problems, which are caused by the lack of participation of students in the learning process, lack of motivation and interest of students to learn science, inadequacy of learning materials with the needs and environment of students, inappropriate learning methods, as well as non-variative and innovative learning resources such as lack of use of tools. Then to solve this problem one of the ways you can do is by giving training to make science gear. So, the purpose of this activity is to train the teacher in making science gear, especially related to the use of ice cream sticks used as the basic material for building media structures of DNA and RNA. This dedication activity has been carried out locally, located in the Pondok Pesantren Attohiriyah Alfadiliyah Bodak, Central Lombok. The implementation of service activities has been carried out well, through three stages, namely, preparation, implementation, to evaluation and reporting. This dedication activity has been carried out locally, located in the Pondok Pesantren Attohiriyah Alfadiliyah Bodak, Central Lombok. The implementation of service activities has been carried out well, through three stages, namely, preparation, implementation, to evaluation and reporting. This dedication activity has been carried out locally, located in the Pondok Pesantren Attohiriyah Alfadiliyah Bodak, Central Lombok. The implementation of service activities has been carried out well, through three stages, namely, preparation, implementation, to evaluation and reporting.
Keywords: Science Learning, PjBL, Device, DNA, RNA

Introduction

In 2021 the Minister of Education and Culture Nadiem Makarim launched a new policy in the field of education in Indonesia, namely the MBKM (Merdeka Belajar Kampus Merdeka) curriculum. The main background of this policy is the demands of globalization and changes in the paradigm of education in Indonesia (Vhalery et al, 2022). Indonesia as a developing country has challenges in facing global competition in the era of globalization. Improving the quality of education in Indonesia is one of the crucial factors in facing global competition. For this reason, the Merdeka Curriculum policy is designed to produce graduates who have skills and competencies that are relevant to the demands of the global market.

Merdeka Belajar Kampus Merdeka consists of two concepts, namely "Free Learning" and "Independent Campus". Freedom of learning, namely freedom of thought and freedom of innovation (Ainia, 2020). While the independent

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campus is a continuation of the independent learning program for higher education. Transformation in the world of education through the independent learning policy is one of the steps taken to create superior human resources in Indonesia. In its implementation, one of the main characteristics of the Merdeka Curriculum is project-based learning which aims to develop soft skills and build the profile character of Pancasila students in students (Dewi, 2022).

Besides that, education in Indonesia is currently still facing various challenges. Based on the results of a survey issued by PISA (Program for International Student Assessment) in 2019, related to the secondary education system in the world in 2018, Indonesia is still in a low ranking, namely 74th out of 79 other countries (Kurniawati, 2022). Based on these data, it shows that Indonesia is below the minimum competence in education.

On the other hand, in science learning there are still some challenges and problems faced,such as the lack of student involvement in the learning process, the lack of motivation and interest of students in learning science, the mismatch of learning materials with the needs and environment of students,inappropriate learning methods, as well as learning resources that are not varied and innovative such as the lack of use of teaching aids.

In line with Prihatini (2017), stated that while being a teacher at a junior high school (SMP) in Jakarta for almost three decades, students considered that science subjects were one of the subjects they didn't like or were not interested in. Besides that, Setiyorini (2015) states that the main problem in the learning process is how the teacher can connect facts that have been seen and experienced by students in everyday life with science lessons, so as to make meaningful knowledge in the minds of students.

So far, students' understanding of science is only fixated on the description of the concepts in the book, without understanding what and how the meaning is contained in the concept (Setiyorini, 2015). The use of visual aids or media in learning Natural Sciences (IPA) has a significant role. Teaching aids or media act as a tool that can facilitate students' understanding of scientific concepts concretely and visually. Through the use of teaching aids or media, students can experience learning that is more interesting, interactive, and effective (Apriliyanti et al, 2015).

In line with this, the PjBL (Project-based Learning) learning model is one of the suggested learning models to be used in the independent curriculum in order to strengthen the profile of Pancasila students. Project-Based Learning (PjBL) is a learning model that focuses on real projects or assignments. In this method, students are involved in projects that demand problem solving, collaboration, and application of knowledge in a practical context (Dianawati, 2022). PjBL encourages students to develop critical skills, creativity, communication, and problem solving (Fitriyah & Ramadani, 2021).

In line with Zubaidah (2018) states that Project-based learning is an ideal learning model for achieving 21st century educational goals, because it involves the principles of critical thinking, communication, collaboration, and creativity. And Almulla (2020) states that PjBL is an effective way to develop skills needed in the 21st century, by emphasizing critical thinking processes as well as problem solving, interpersonal communication, information and media literacy, collaboration, leadership and working in teams, innovation, and creativity.

PjBL encourages a paradigm shift from teacher-centered learning to student-centered learning. Students become active in defining projects, identifying problems, and developing solutions. They have more control over their own learning process. PjBL prepares students to face the demands of an ever-evolving world by developing 21st century skills. Through projects, students learn to think critically, communicate effectively, collaborate in teams, manage time, and develop creativity and personal initiative (Dianawati, 2022).

PjBL enables students to learn through hands-on experience and the application of knowledge in real contexts. Students engage in projects that relate to their daily lives, enabling them to see the connections between what they learn in school and the real world. Through PjBL, students are more motivated because they see the purpose and relevance of what they are learning. They feel involved in the project and have a sense of ownership of the results of their work. This increases student satisfaction and motivation to continue learning.

The use of visual aids or media in learning Natural Sciences (IPA) has a significant importance. Teaching aids or media act as a tool that can facilitate students' understanding of scientific concepts concretely and visually. Through the use of teaching aids or media, students can experience learning that is more interesting, interactive, and effective. Thus, the use of teaching aids or media in science learning has an important role in increasing student understanding, enriching learning experiences, developing critical thinking skills, and

increasing student participation and interest. Therefore, teachers need to utilize teaching aids or media in an effective and creative manner in the learning process to achieve optimal learning objectives in science learning.

Method

Responding to problems and challenges in science learning, which are caused bylack of student involvement in the learning process, lack of student motivation and interest in science learning, mismatch of learning materials with student needs and environment, inappropriate learning methods, as well as learning resources that are not varied and innovative such as the lack of use of teaching aids. So, to solve this problem the method that can be used is to provide training in making science teaching aids, especially in the use of used ice cream sticks as the basic material for making DNA and RNA structure media. This training is intended for Mr/Mrs Teachers at Pondok Pesantren Attohiriyah Alfadiliyah Bodak Central Lombok. There are three stages to go through in solving this problem, namely the preparation stage, the implementation stage, and the evaluation and reporting stage, which can be seen in detail in the flowchart of community service activities in Figure 1.

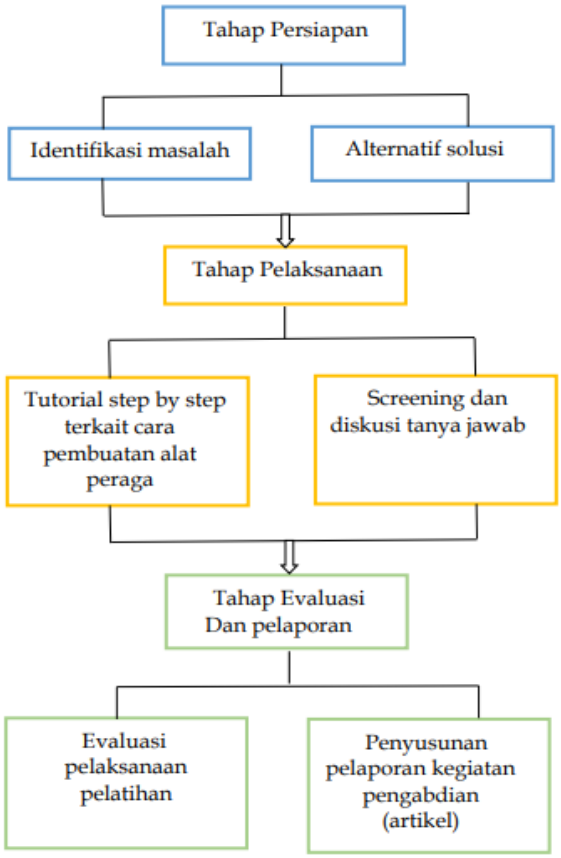

Figure 1. Service Activity Flowchart

Preparatory Stages

In the preparatory stage, observations were made of science learning, in order to identify the problems encountered in learning science. With the results of observations it was found that in learning science, which was caused bylack of student involvement in the learning process, lack of student motivation and interest in science learning, mismatch of learning materials with student needs and environment,learning methods that are not suitable, as well as learning resources that are not varied and innovative, especially such as the lack of use of visual aids in learning.So in response to this, one of the efforts that can be done is to conduct training on making science teaching aids for Mr/Mrs Teachers at Pondok Pesantren Attohiriyah Alfadiliyah Bodak Central Lombok.

Implementation Stages

At the implementation stage this is a follow-up to solving problems in science learning for Mr/Mrs Teachers at Pondok Pesantren Attohiriyah Alfadiliyah Bodak Central Lombok regarding making science teaching aids, namely by conducting direct training to Mr/Mrs Teachers regarding how to make science teaching aids so they are able to make their own science teaching aids and it is hoped that they can be implemented in science learning at the Attohiriyah Alfadiliyah Islamic Boarding School. In this activity, Mr/Mrs Teachers will be treated to step by step in the form of tutorials and explanations on how to make science teaching aids through PPT and videos on making props that have previously been prepared, and of course by showing props that have been made before as an example. After that, it was followed by screening and question and answer.

Stages of Evaluation and Reporting

Evaluation of the results of the training was carried out directly by assessing the understanding of the teacher regarding the process of making science teaching aids through discussion sessions. Reporting on service activities is carried out by compiling training reports in the form of service articles

Result and Discussion

The results of the community service activities that have been carried out at the Attohiriyah Alfadiliyah Bodak Islamic Boarding School in Central Lombok, and in accordance with the above activity methods are discussed in three ways according to the stages of community service,

namely preparation, implementation, and evaluation. Description of the results of the activities referred to as follows.

Preparation Stage (Making Media/Props)

1. Make DNA nitrogenous base pairs

Nitrogen base pairs in DNA consist of four types of bases, namely adenine (A), thymine (T), guanine (G), and cytosine (C). These nitrogenous base pairs are formed through hydrogen bonds between the paired bases. Adenine always pairs with thymine (AT), and guanine always pairs with cytosine (GC).In the first stage, students were asked to make nitrogen base pairs, with different colored ice cream sticks, the green color represented cytosine (C), the purple color represented Guanine (G), the orange color represented thymine (T), and the red color represented adenine (A). After that, according to the pair, ice cream sticks/nitrogen bases were attached by gluing them using glue. In this case the student indicators can understand the concept of nitrogen bases, seen based on the accuracy in making nitrogen base pairs, as shown in Figure 2.

Figure 2.DNA Nitrogen Base Pairs

2. Make Pentose Sugar Clusters

The pentose sugar group in DNA is called deoxyribose. Deoxyribose is a type of sugar with five carbon atoms. The deoxyribose groups are connected to each other to form the DNA framework. Each deoxyribose molecule relates to a phosphate group and a nitrogenous base. The phosphate group serves as the "ladder" side of the DNA and forms the bond between the two sugar groups. The nitrogenous base is attached to the 1st carbon of deoxyribose and forms a base pair with the nitrogenous base on another DNA molecule.

In the second stage, students were asked to make sugar clusters in the form of a pentagon using Styrofoam, with a size of 3x3 cm. In this case the student indicator can understand the concept of sugar clusters, seen based on the accuracy in making the shape of sugar clusters (five-sided/carbon 5), as shown in Figure 3.

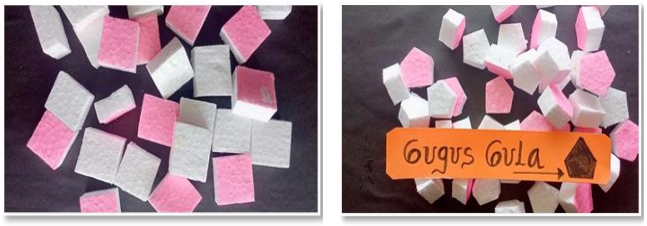

Figure 3. Sugar Group (Deoxyribose)

3. Make Phosphate Groups

The phosphate group of one pentose sugar molecule is linked to the next pentose sugar group via a phosphodiester bond. A phosphodiester bond is formed between the phosphate group and the hydroxyl group on the 3rd carbon of the next pentose sugar. This binding process forms a stable and continuous polymeric framework, which is called the DNA side ladder. In the third stage, students were asked to make spherical phosphate groups using Styrofoam, with a size of 1.5 x 1.5 cm. In this case the indicator students can understand the concept of phosphate groups, seen based on the accuracy of making the shape of phosphate groups (round), as shown in Figure 4.

Figure 4. Phosphate group

4. Make a series of Nucleotides

In the fourth stage, students were asked to make a nucleotide sequence consisting of a sugar group, a phosphate group, and one of the four nitrogenous bases of DNA. In this case the student indicator can understand the concept of nucleotides, seen based on the accuracy in making a nucleotide sequence consisting of three constituent components, as shown in Figure 5.

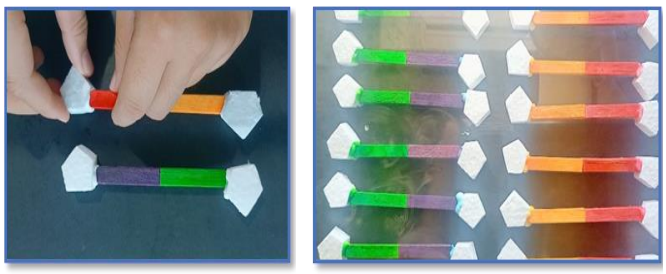

Figure 5. Nucleotide sequence

5. Make a DNA Chain (Double helix)

In the fifth stage, students are asked to make a DNA sequence from a collection of nucleotides. In this case the student indicator can understand the concept of a DNA chain (double helix), seen based on the accuracy in making a DNA sequence consisting of a collection of several nucleotides, as shown in Figure 6.

Figure 6. DNA chain sequence

6. Make an RNA Chain (Single helix)

In the sixth stage, students were asked to make an RNA sequence consisting of one sugar group, one phosphate group, and one of the four RNA nitrogenous bases (Uracil, Adenine, Guanine, Cytosine). In this case, student indicators can understand the concept of an RNA chain (single helix), seen from the accuracy in making RNA sequences according to codon pairs as shown in Figure 7.

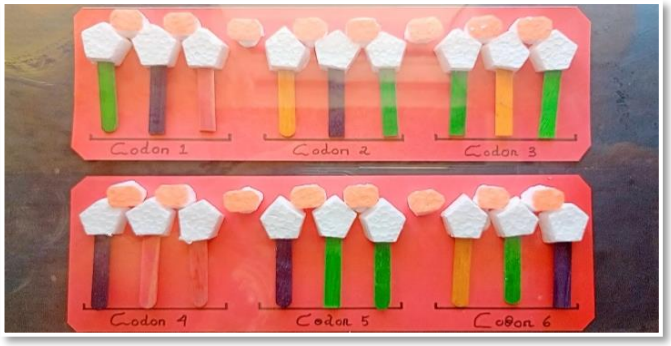

Figure 7.RNA chain sequence

7. Results

In the last stage, to assess students' understanding of the concept of DNA and RNA structure as a whole, it can be seen from the final results of the media that have been made, as well as the suitability of the manufacturing stages with the concept of DNA and RNA structure, starting from the suitability of nitrogen base pairs, sugar groups, phosphate groups, nucleotides, to the arrangement of DNA and RNA chains, as shown in Figure 8.

Figure 8. Structure Learning Media DNA and RNA

8. Simulation of a monohybrid cross

Leftover ice cream sticks in the manufacture of nitrogenous bases, can then be used as a simulation medium for crossing, in this case done by providing a simulation example on monohybrid crosses. In the process of use, popsicle sticks are written using a marker to represent the Genotype (AA, aa).

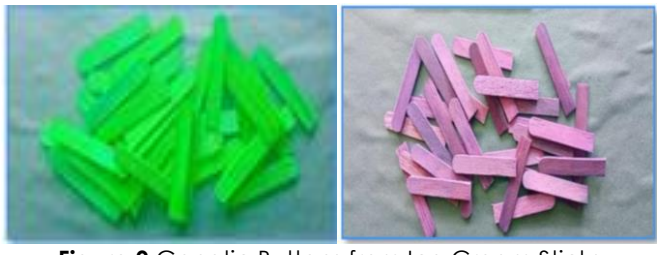

Figure 9. Genetic Buttons from Ice Cream Sticks

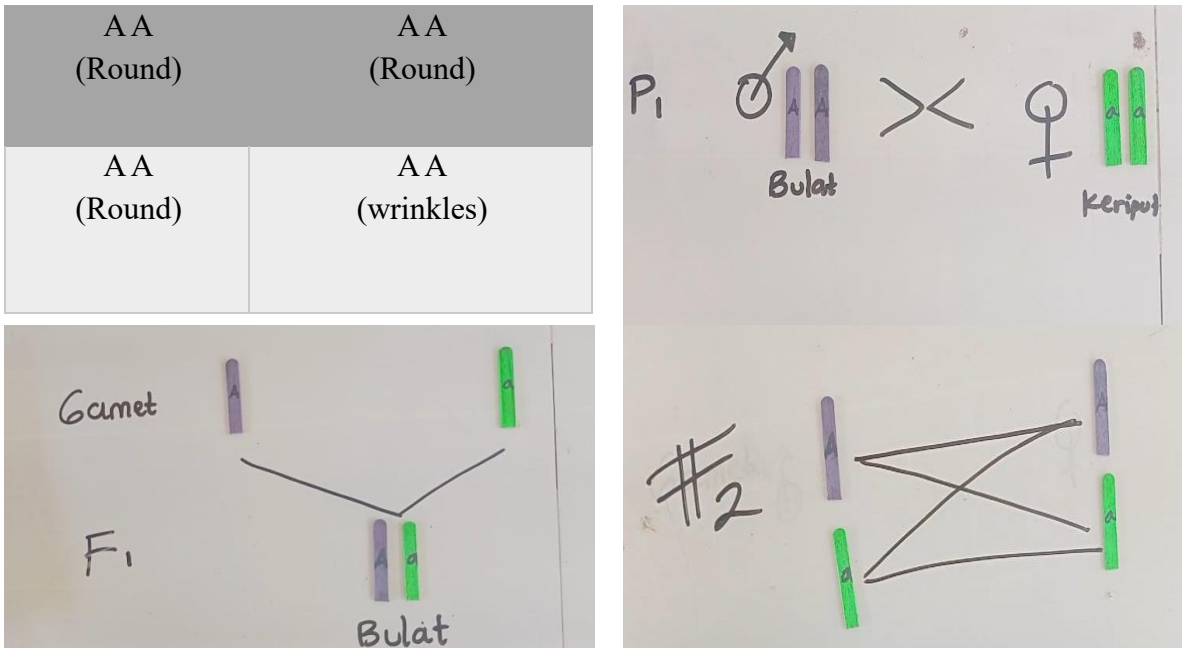

Figure 10. Cross Simulation

Implementation Stage

At the implementation stage the activity is carried out by explaining step by step from each step of making DNA and RNA structure media using PPT delivery media, then proceed with showing a video related to how to make media, which aims to clarify the concepts previously explained. The implementation activities can be seen in Figure 11.

Gambar 11. Photos of Training Activities

Evaluation and Reporting Stage

In the last stage of the activity, the evaluation was only limited to seeing the understanding of the teacher regarding the concept of making DNA and RNA structure media with the basic ingredients of ice cream sticks. Then the activity of reporting the results of the activity is carried out by compiling a service article.

Conclusion

In accordance with the objectives formulated in this service activity, in general, this training activity has gone well through three stages, namely the preparation, implementation and evaluation stages. It is hoped that through this activity in the future Mr/Mrs Teachers will be able to implement the use of visual aids in supporting science learning.

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