

## **Project-Based Learning Governance on Natural Materials Improving the Creativity of Class VIII Students of SMP Negeri 1 Sigumpar**

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**Abstract:** This research is motivated by the low participation of students of SMP Negeri 1 Sigumpar in participating in scientific work competitions which are their own innovations. According to Bloom and Anderson's taxonomy, creative competence is very necessary for all students because by learning to make something from the materials around it, thinking construction is very important because children will be formed and more critical and innovative. Science, Technology, Engineering, and Mathematics (STEM)-based learning really needs to be empowered from an early age. This research was conducted at SMP N 1 Sigumpar with the aim of knowing whether the application of the project-based learning model in these subjects was effective. Nature can be a material for students' innovative work and improve student learning outcomes. This research method uses a quasi-experimental research design with a one group pretest – post-test design. Data collection methods used in this study was questionnaires, survey and observations in class VIII of 30 students. Data analysis was carried out descriptively and qualitatively. The results showed that project-based learning increased creativity and student learning outcomes. From the results of this study, the researchers found that project-based learning is very good to be applied in teaching students because based on students' experiences it increases the enthusiasm for learning.

**Keywords:** Project; Learning, STEM; Creative

**Abstrak:** Penelitian ini dilatarbelakangi oleh rendahnya partisipasi siswa SMP Negeri 1 Sigumpar dalam mengikuti lomba karya ilmiah yang merupakan inovasinya sendiri. Menurut taksonomi Bloom dan Anderson, kompetensi kreatif sangat perlu untuk semua siswa karena dengan belajar membuat sesuatu dari bahan-bahan yang ada di sekitarnya, konstruksi pemikiran anak akan terbentuk dan semakin kritis dan inovatif. Pembelajaran berbasis Science, Technology, Engineering, and Mathematics (STEM) sangat perlu diberdayakan sejak dini. Penelitian ini dilakukan di SMP N 1 Sigumpar dengan tujuan untuk mengetahui apakah penerapan model pembelajaran berbasis proyek pada mata pelajaran tersebut efektif. Alam dapat menjadi bahan karya inovatif siswa dan meningkatkan hasil belajar siswa. Metode penelitian ini menggunakan desain penelitian eksperimen semu dengan desain one group pretest – posttest design. Metode pengumpulan data yang digunakan dalam penelitian ini adalah angket, survey dan observasi di kelas VIII Sebanyak 30 siswa. Analisis data dilakukan secara deskriptif dan kualitatif. Hasil penelitian menunjukkan bahwa pembelajaran berbasis proyek meningkatkan kreativitas dan hasil belajar siswa. Dari hasil penelitian ini, peneliti menemukan bahwa metode pembelajaran project based learning ini sangat baik untuk diterapkan dalam mengajar siswa karena berdasarkan pengalaman siswa meningkatkan semangat belajar.

**Kata kunci:** Proyek; Pembelajaran, STEM; Kreatif

### **INTRODUCTION**

The scientific method will make a person think based on scientific evidence. In daily life, a student who already understands scientific concepts and procedures will be better able to solve the problems scientifically and responsibly. Teaching the scientific foundations is emphasized to students from school age, especially at the junior high school level. Understanding this scientific method can make students creative and innovative. A person learns much better through their active involvement in the learning process such as think about what is learned and then applying what has been learned in real situations (2013, Yulianti).

Nugraheni (2018) the reality in the field showed that the students not only have to understand the existing theory but how to be more creative to produce a product/work that can be used in helping the learning process and at the same time works that can be utilized by the community. In other words, students will be trained to be creative and critical from an early age. However, teachers still do not understand the meaning of creativity and how to improve it in the educational environment. One of the efforts to innovate teaching materials is to use learning models and media. One of the models that can be applied is the project-based learning model. Project-Based Learning (project-based learning) is a learning model that uses projects as the core of learning (Kemendikbud, 2014). Students explore, assess, interpret, synthesize and exchange information to produce various forms of activities.

In education it would be nice if students have knowledge, but in today's education, students are not only asked to know the food of something but students have been asked to be able to think critically as should the demands of today's education, therefore to help foster a mindset It would be better if an educator guides and directs students to be able to produce a work, create a product that can be used as the fruit of their critical thinking.

Abidin (2014: 167) states that the project-based learning model is a learning model that directly involves students in the learning process through research activities to work on and complete a particular learning project. Hosnan (2014: 321) defines the project-based learning model as a learning model that uses projects/activities as a means of learning to achieve competence in attitudes, knowledge, and skills as well as the construction of students' thinking that is orderly and does not jump to a conclusion. The emphasis of learning is focused on student activities to solve problems by applying scientific principles as a whole, analyzing problems, making designs, to present products or tools found based on real experiences carried out by themselves. After looking the definition above we know that project-based learning is one of effective design in teaching that can be used by the teacher as the way to improve the creativity of the students in order to achieve their higher order thinking skill and able to be person with a good attitude.

The project-based learning model is chosen in science learning because students are trained to design projects and make their products according to student's creativity, then explain the results of the products that have been made in front of their friends, so that learning becomes more meaningful and interesting. This is in accordance with the focus of the project-based learning model (MPBP) which is on the main concepts and principles of a discipline, involving students in problem-solving activities and other meaningful tasks, providing opportunities for students to work autonomously in constructing their learning. themselves, and culminating in producing student work products.

Currently, learning needs to keep up with the times in the era of globalization by integrating Science, Technology, Engineering, and Mathematics (STEM). The linkages between science and technology or other sciences cannot be separated in science learning. STEM is a discipline that is closely related to one another. Science requires mathematics as a tool in processing the data obtained, while technology and engineering are applications of science in the form of design. The STEM approach to learning is expected to produce meaningful learning for students through the systematic integration of knowledge, concepts, and skills. Some of the benefits of the STEM approach make students better problem solving, innovators, inventors, independent, logical thinkers, and technological literacy. Interesting and motivating learning; can help understand teaching materials, and form creative attitudes, and students are increasingly aware of the importance of protecting the environment. Students feel happy to work in groups so they want PjBL STEM learning to be re-applied to other materials (Afriana, 2016).

Entering the era of the industrial revolution 4.0, education specifically in science learning has the responsibility to create intelligent, responsible, and adaptive humans to the times (Arnyana, 2018). Mastery of the basics of science and mathematics is also believed to be owned by every individual living in the 21st century. Mastery of the basics of science and mathematics can be obtained through STEM education (Science, Technology, Engineering, and Mathematics).

Science and mathematics are considered appropriate to be vehicles for carrying STEM education, because these two subjects are the main subjects in primary and secondary education, and become the basis for students to enter careers in STEM disciplines that are seen as fundamental to technological innovation and economic productivity. (Word, 2015, p.6)

Kennedy and Odell (in Kelley, 2016) show that high-quality STEM education must include several concepts in it, namely: (a) integration between technology and engineering into science and mathematics in it; (b) promoting scientific inquiry and clear engineering design, including coherent mathematics and science instruction; (c) a collaborative approach to learning, connecting students with educators through STEM; (d) Provide free global and multi-perspective perspectives; (e) Combining learning with strategies such as project-based learning, providing formal and informal learning experiences; (f) Incorporating technology that is in accordance with students' abilities to improve learning.

Toba Regency is rich in natural wealth and has the potential to be used as STEM learning materials in learning. Connecting to STEM-based learning with local wisdom will provide many benefits for students from various aspects. Local wisdom is a culture or activity in an area and trusted by the community until it is carried out for generations (Alviah, 2015). Cultural wealth that has not studied scientifically can be a source of inspiration for students to create a project that will be implemented in learning.

Natural Sciences (IPA) is a subject that looks for the relationship between nature and mathematical concepts, technological designs that can be proven true so that science is an invention of concepts or facts that exist in nature. The results of a preliminary study on STEM-based science learning integrated with project-based learning have not been widely carried out at the junior high school level. The study time available at the school was deemed insufficient for students to complete the project because other learning materials had to be delivered.

## METHODS

This research was conducted at SMP Negeri 1 Sigumpar from January 2020-March 2020. The sample of this research was class 8A consists of 30 students of SMP Negeri 1 Sigumpar class VIII. This research was conducted using the Quasi Experiment method, whereby the research design used a one-group pretest-posttest design by Cresswell, (2008) This research was previously carried out using the same method by (Randika. A, et.al: 2020) with the title "*PENGARUH MODEL PEMBELAJARAN PROJECT BASED LEARNING (PjBL) TERINTEGRASI STEM TERHADAP KEMAMPUAN BERPIKIR KREATIF SISWA KELAS 5 DI SDN SUMBERPINANG 02 JEMBER*" in In this study, the researchers used a quasi-experimental design method using 2 classes kelas 5A 20 students and 5B students with the aim of knowing whether or not there was an effect or impact of a certain treatment on changes in certain conditions or circumstances by conducting a pre-test or post-test.

Project planning was prepared with students by discussing the potential that exists in the surrounding environment. Projects were done in groups and students are free to be creative according to the material being studied. During project work, students are free to consult with the teacher. The project results are presented to be assessed and the best will be entered into a research competition. Assessment includes creativity, usefulness, and teamwork. At the end of the learning, students were tested cognitively with written questions. To find out about student learning activities, attitude observations were carried out. In short, the research design is:



**Figure 1.** Research Design Flow

## RESULT AND DISCUSSION

Learning was carried out in 3 meetings according to the lesson plan. Students were divided into 5 project groups. Project planning was carried out in group discussions and is guided by the teacher. The project process from the beginning is made in the form of a Time Line. After the project is completed, then a project assessment is carried out.

The first meeting went well by carrying out a pretest which will be used as a reference to determine the level of students' initial concept knowledge about Natural Materials. The meeting was held online during the COVID-19 pandemic. The pretest questions used were 10 questions that were valid and reliable. The pre-test was carried out using google form questions combined with google meet.

The second meeting was held face-to-face limited after dividing the student work groups. The second meeting was held by six sessions of discussion to plan the stages of the project and STEM for each group. At this second meeting, students used various literacy sources obtained from research journals accessed via the internet. The concept of natural materials was very interesting to be associated with problems that often occur in the daily environment. Each group plans their project with structured stages to be done together with simple tools and materials. Research or projects carried out by students include aspects of science, technology, engineering, and mathematics. The selection of students' STEM projects refers to the application of scientifically studied local wisdom. Based on the initial group division, students can create 6 different projects according to the theme of Natural Materials.



*Figure 2. The second group was creating the project and finding some literacy*

The third meeting was a project assessment carried out with the presentation of project results by students. The implementation of the presentation of the results of this STEM-based project includes reference literacy, design drawings, experimental results in the form of tools or goods, and mathematical calculations in a graph or table. Presentations could be done live or make videos that are uploaded to You tube.



**Figure 3.** One of the Student's project using a simple method and tools to make Tuba Saba mosquito repellent lotion.

The project work process was carried out with a limited tools and materials. Students are required to be able to take advantage of existing tools and design replacement tools with designs that still work. As in the picture above, students use a used hose instead of a condenser and connect it to water in the distillation process. To find out the students' initial abilities on the subject of Natural Materials, a pretest was carried out using questions that had been tested for validity and reliability.

#### N-GAIN

*Table 1. Recapitulation of students' concept understanding scores*

Test	Score ideal	Score Max	Score Min	( G )	Criteria
Pre-test	100	54	32	0,67	Moderate
Post-test	100	88	46		

With a Gain value of 0.67 in the moderate category, Based on this value, it can be seen an increase in students' conceptual understanding after STEM learning. The increasing in students' understanding of concepts is caused by students directly working on something that is real around them. In this line with research conducted by (Randika. A, et.al: 2020), if we apply PjBL in learning, through this method we can improve student's achievement, critical thinking skills through problem solving in learning, which has been described using Science, Technology, Engineering, Mathematics (STEM) approach.

From the results of this STEM-based learning, there are 5 types of products produced by students and discuss local wisdom. The five student project products are: (1). Tuba Saba anti-mosquito DHF lotion, (2). Selay Sansit, (3). Borax indicator from Rondang flower,(4). Tourism Solu from Used Bottles,(5). Ihan Batak is not cooked. These five projects were studied scientifically by students in groups using various literature sources. Generally, project-based learning includes three stages, namely project planning, project implementation, and project evaluation. This is in line with research conducted by Robinson (2013). The results of his research indicate that project-based learning can improve student learning outcomes in audio media development courses. Through this research, students also appear to be more active in learning, more motivated to learn and have higher collaboration among students. Through this research, researchers get an idea that good learning media is needed in improving the quality of learning.

## STUDENT LEARNING ACTIVITIES

The summary of observational data to determine student activities during STEM integrated PjBL learning is presented in Table 2:

*Table 2. Recapitulation of student learning activities*

Component	Indicator	Student Activities	
		Mean	Criteria
<i>Oral activity</i>	Delivering opinion on the discussion	85,0	Very Active
	Give questions related to the subject	85,5	Very active
<i>Mental activity</i>	Able to deliver of opinion	87,5	Very active
<i>Writing activity</i>	Take notes on subject matter based on the project made	85,0	Very active
<i>Visual activity</i>	Students observe various components of the ecosystem in the miniature ecosystem project they made	88,5	Very active
The Average of the score activities		86,2	Very active

With an average student activity of 86.2 which is categorized as very active, the learning process is very active and trains students to be brave. After looking the table above we know that by applying project based learning the student become very active in their orally activity, mental activity, writing activity, and also visual activity. In other words after doing observations during the project, students were very active and felt interested in making something with their own thoughts. Working in groups gives students the opportunity to more freely discuss with their peers.

With STEM learning, students' literary abilities increase and the teacher also teaches students with scientific thinking constructions from an early age. During project implementation, students and their teamwork together and discuss to solve the problems they face. Learning the scientific stages and working in groups will support the readiness of students to face their future and based on the student learning motivation questionnaire obtained.

## CONCLUSION AND SUGGESTIONS

Based on research data and analysis, it can be concluded that the application of STEM-based learning by using projects in science learning can increase students' mastery of concepts in Natural Materials material in SMP class VIII with a medium category. The STEM learning model increases student learning activities in the very active category. For all teachers, we can apply Project Based Learning (PjBL) in teaching as our way to improve our students abilities especially in critical thinking skills as an important skill that must be have by the students facing challenges in the 21st century. By using this method indirectly we are also familiarizing students to overcome their own problems which in this case they are dealing with is a problem in learning science as one of the subjects taught in school. My suggestion for this school is to keep using this method as one of the steps and ways to help students improve their critical thinking skills as well as train students in solving problems that they may encounter.

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