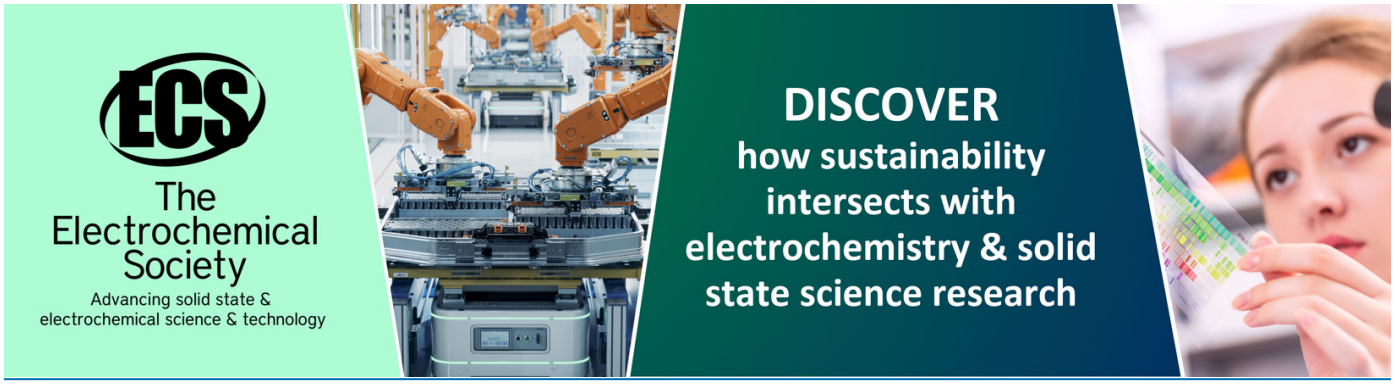
# Integrated STEM Project Based Learning Implementation to Improve Student Science Process Skills





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# Integrated STEM Project Based Learning Implementation to Improve Student Science Process Skills

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**Abstract**. This research aims to investigate the influence of project based learning (PjBL) learning that integrates with science, technology, engineering, and Mathematics (STEM) on optical concepts with improved student science process skills. The method of study used is a descriptive method. Data is obtained from a learning observation sheet to determine the skills of the science process developed by students and polls used to capture student responses to learning. The instrument in this study uses a science process skills test in the form of an observation sheet and a subjective test. The science process skills tests used in this study include asking questions, observing, hypothesized, planning experiments, interpretation, and communicating. The Data that has been obtained is then analyzed descriptively. The results of this study show that students have all indicators of the science process skills that belong to the good category (average rating 79.33). Students give a positive response to learning, because they feel more understanding, improving motivation and learning interests.

## 1. Introduction

Currently, 21st-century human resources must have life skills and career skills,critical and innovative learning skills and skills in technology, media, and information. Learning in the context of preparing for the 21st century refers to the concept of learning that provides experience to learners [1]. 21st-century learning emphasizes learning that teaches the 4C principles (communication, collaboration. critical thinking, and creativity) which use a student-centered learning approach [2]. Educational reformation has proceeded slowly despite the many calls to improve science and mathematics for our students.

Science learning includes not only concepts, principles, or theories, but there is also a science process taught through practicum, but this is rarely done by teachers for several reasons, such as there is no specific time to Practicum, inadequate tools and practical materials, and some do not master the Workways in the laboratory. Whereas practicum plays an important role in Science learning [3]. Low skills of the students ' science processes are a reason that underscore practical learning as low as well. Therefore, science learning is required that can cultivate the students ' science process skills.

Science process skills can be explained as skills belonging to students in the affective and psychomotor domains, where these skills are used to solve a problem in learning and also to practice thinking skills. The American Association for the Advancement of Science (AAAS) classified the

science process skills into fifteen [4]. These are: observing, measuring, classifying, communicating, predicting, inferring, using number, using space/ time relationship, questioning, controlling variables, hypothesizing, defining operationally, formulating models, designing experiment and interpreting data [5].

Optical learning is one of the physics material that requires practice in classroom learning, so that students better understand the material well. To better understand the skills of student science processes on optical material, students are trained to create optical props aimed at project assignments in classroom learning.

One of the learning innovations that teachers can use is the STEM integrated project based learning approach in learning to train the science process skills. Science, Technology, Engineering, and Mathematics (STEM) is an approach in the development of education, especially in the field of science. STEM Education is formed based on a combination of several disciplines into a whole new form of unified approach. The disciplines that become a component of the STEM approach are science, technology, engineering, and mathematics [6] [7]. Integrating some of these disciplines in one unit is expected to produce competent and qualified graduates not only in terms of concept mastery but also in applying them to life. STEM's approach is a mixture of science, technology, engineering, and mathematics into one curriculum as a whole.

The selection of learning models is handed over to teachers by adjusting to teaching material characteristics. Project-based learning is a student-centered model of learning and provides a meaningful learning experience for students. Student learning experiences as well as concept acquisition are constructed based on the products produced in the project-based learning process [8].

## 2. Method

The method of study used is a descriptive method. The research was conducted with The design of The Static Group Pretest-Posttest Design. Static Group In this study assumed classes that had equal ability and were taught by the same teacher. Treatment is done by providing Project Based Learning (PjBL) Integrated learning Science, Technology, Engineering, and Mathematics (STEM).

Data is obtained from a learning observation sheet to determine the skills of the science process developed by students and polls used to capture student responses to learning. The instrument in this study uses a science process skills test in the form of an observation sheet and a subjective test. The science process skills tests used in this study include asking questions, observing, hypothesized, planning experiments, interpretation, and communicating. The Data that has been obtained is then analyzed descriptively.

## 3. Result and Discussion

The research procedure are the planning stage, implementation stage and final stage. The planning phase is the creation of a learning implementation plan and student Worksheets PjBL STEM, process science skills sheet, and evaluation (postest) in science learning. Implementation stage by providing PjBL STEM learning treatment. While the final stage by conducting data analysis, discussion and draw the research conclusions.

Results of students' science process skills after implementation integrating STEM project based learning is seen in table 1.

Table 1. The value of student science process skills

| No | Indicator | Value |
|---|---|---|
| 1 | Prediction | 80 |
| 2 | Observation | 79 |
| 3 | Hyphoteses | 78 |
| 4 | Experiment | 82 |
| 5 | Interpretation | 78 |
| 6 | Communication | 79 |

| No | Indicator | Value |
|---|---|---|
| | Average | 79,33 |

Detailed indicators of students ' science process skills are interpreted in Figure 1 below

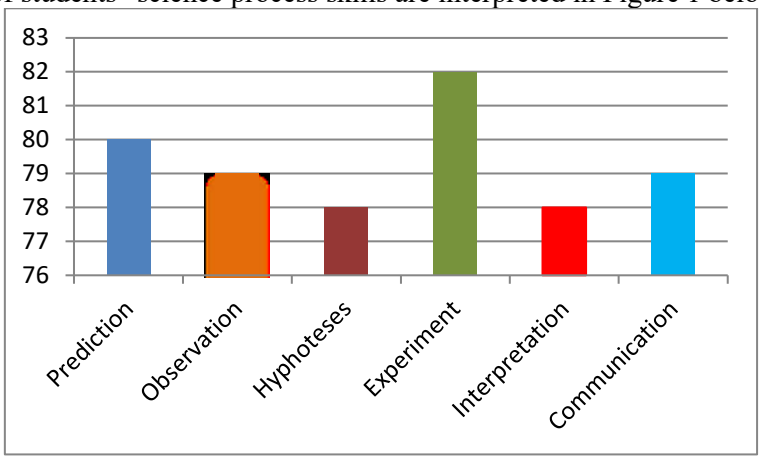


Figure 1. Graph of Science Process Skills

Figure 1 shows the highest indicator of science process skills is experimentation. It proves that students ' science process skills greatly affect the learning activities in the classroom in the practice of physics. At first the skill Student Science process is in the category of "Low". This is due to students who are still not accustomed to Eliciting many ideas for various questions and unfamiliar to perform the steps detailed.

After using the learning of project based learning with STEM Integerasi, the students ' science process skills are in the "high" category. Through the learning of project based learning, STEM integerated developed, students are taught to to search for data through activities and troubleshooting steps in a detailed and systematic so that students can answer various questions vary,so that all skill indicators the scientific process of predicting indicators, the indicator of formulating hypotheses, variable identification indicators, data interpretation, and an indicator of formulating problems experienced.

Students have also been able to create physics products that relate to the optical material well. The results of the student products that them self are light microscope, digital microscope, binoculars earth, pantul binoculars, and a simple camera. By creating your own physics product, you can develop your students ' interests and learning creativity. Understanding of the students ' optical material is also well developed. Project Based learning learning integrated with STEM students can learn in four aspects namely science, technology, engineering and mathematics from the products they have made. The science concepts they get from the optical material. Technology concept They can apply optical products in accordance with the development of technology today is digital microscope. Engineering concepts that students acquire, students are able to create their own tools. The mathematical concept they learned is that students are able to calculate the optical formula and can be applied in daily life [9].

The implementation of engineering aspects in the STEM-based worksheets in the form of a project to make simple tools provided to students. The project of creating a simple tool in STEM-based worksheet aims to help the students to understand the concept of science applied in the tool and to involve the students to actively build the learning experience [10] [11]. In line with the principle of constructivism learning theory that centralizes the learning process experienced directly to form the concept of learning and understanding [12].

The efficacy of the increasing skills of the science process is the increasing understanding of students in the learning process [5]. Science process skills oriented high order thinking skills can increase independence and problem solving skills [4] [13].

Similar result show the effects of the scientific process skills training on the students' scientific creativity, achievement and attitude were investigated [14]. This result shows that giving scientific process skills training increased the academic achievements of the students. Science, technology, engineering, and mathematics (STEM) education starts with a refresher type course in mathematics. Next, modelling or simulation activities are based on known rules that must be formulated in mathematical expressions. Equally, physics concepts or laws can be expressed as compact notes using mathematical formulations [10] [15] [16].

## 4. Conclusion

The results of this study show that students have all indicators of the science process skills that belong to the good category (average rating 79.33). Students give a positive response to learning, because they feel more understanding, improving motivation and learning interests.

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