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IMPLEMENTATION OF EXPERIMENTAL METHOD TO IMPROVE STUDENT LEARNING OUTCOMES IN GEOMETRIC OPTICS AT ESG ST. MADALENA DE CANOSSA DILI

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A R T I C L E I N F O

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A B S T R A C T

This study aims to determine whether the application of the experimental method can improve the learning outcomes of geometric optics at ESG St. Madalena de Canossa Academic Year 2022. The type of research is Classroom Treatment Research, and the research design used is a Single Classical Experimental Design. The treatment in this study includes planning, treatment, observation, evaluation, and reflection. The research subjects were 40 students in grade 1. The instruments were pre-test, post-test, and observation sheets. Based on the data analysis can be concluded that: the application of the experimental method improved the learning outcomes of students in geometric optics. This was proven by the results of student learning tests in the after-treatment activities. In the activities before the treatment with a completeness percentage of 65%, there was an increase with a completeness percentage of 90%.

INTRODUCTION

A school is a place or institution that organizes learning. Learning can be carried out by internal elements including educators, students, learning resources, the environment, learning, and their enter treatments.

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While external elements include things outside of learning that can affect a learning process. The learning process can run efficiently if there is intertreatment between the stimulus-respondent and the reciprocal factor relationship, in other words, the teacher must facilitate in developing and improving aspects of achieving student competence namely knowledge, skills, and attitudes, not just conveying subject matter but required according to with a learning system, (Zanti Ardi, 1997).

The learning system is a determining factor for achieving learning objectives that are applied in schools, namely input, process, output, and feedback. In this system, there is a process of intertreatment between students and educators and feedback between the two which includes an input (curriculum, teachers, teaching facilities, and infrastructure), processes (materials, methods, and media), output (students with certain competencies) and feedback, namely the information in question is related to what has been done, what the results are, and what must be done to improve it, (D. Ahdar, 2019).

The learning system in Timor-Leste is currently still running slowly when compared to other countries. Every year a lot of output is produced by both public and private schools in the hope that they can contribute both science and technology in building this country, but in reality, it is the opposite. This is because most students still have reasoning power or varied thinking, some are fast and some are slow and have clumsiness in the learning system itself, (Kahneman, n.d.). Therefore it is necessary to reform and overhaul the learning system in the classroom, namely learning methods, especially material related to experiments in the exact sciences, one of which is physics.

Physics subjects require teachers to be creative in determining various approaches, methods, and learning models so that students can be excited and motivated about the material itself so that the learning outcomes can be satisfying, (Tulandi, 2019). With a variety of methods, students will be invited to interact and discover something around them related to learning physics, students will gain new experiences that they will not simply forget. Students are allowed to conduct experiments, observe and discuss with other students following instructional objectives in learning physics. However, the reality on the ground is not all teachers can develop.

Based on the observations of researchers, most ESG teachers in Timor-Leste who teach physics, especially at the Catholic ESG Santa Madalena de Canossa Dili, still

use the old paradigm, namely the teacher as a learning center, the method used is still monotonous. This can affect students' interest and are not motivated to be creative, so it conflicts with the objectives of learning physics, namely for students to understand knowledge, concepts, and principles of physics, master knowledge, skills, and scientific attitudes, and their application both in everyday life and in science and technology. This can be proven through exam results, daily tests, and final trimestral exams that do not meet the minimum passing criteria or do not complete.

This student's incompleteness is supported and influenced by the habits of only prioritizing and prioritizing the principle of memorizing concepts and equations that exist in physics, but to be understood. In essence, students are required to be able to understand every concept and equation that exists in physics, especially its application, because a lot of physics material is considered abstract, for example, magnitude, force, waves, electricity, including geometric optics.

Geometric optics is the study of light which deals with the microscopic aspects of light, especially the incidents of visible light and the wavelengths around which they relate to the events of reflection and retreatment at the surface that separates the two media. Geometric optics is a part of physics that contains products, processes, and applications. In terms of its application, geometric optics can be applied to help the human eye as optical tools, for example, glasses for people with eye pain, microscopes which are usually used in laboratories, both manual and digital, telescopes or binoculars to observe celestial objects (Peatross & Michael, 2015).

The concepts/principles of geometric optics are widely applied in optical technology to change mindsets and improve the welfare of human life. To maximize and improve learning outcomes that satisfy the learning process of geometric optics in class 11o Ano CT at ESG St. Madalena de Canossa Dili is efficient and effective, one of which can be developed through experimental methods. With the hope that experimental learning methods can invite students to acquire new knowledge to develop scientific process skills that support the science process. This is supported by (Fowles & Lynch, 1968) that the experimental method is a learning process carried out in the laboratory that is used to display the experimental or practicum process to make physics material more real and not abstract.

The application of the experimental method to the concept of geometric optics is expected to increase students' understanding of the concepts/principles of geometric optics being taught. Students who have high learning outcomes indicate

that they have a high level of mastery of the subjects programmed, similarly, this can be determined through intellectual quality, emotional quality, and spiritual quality (IQ, EQ, SQ), (D. Ahdar, 2019).

Thus the purpose of developing the experimental method can answer the findings put forward by other studies that there are many obstacles faced by students during exams, students will find it difficult to complete exam questions given by the teacher because students are not used to solving sample questions related to the material taught affects student learning outcomes, so that there are students who score below the KKM score (Minimum Completeness Criteria 70), (Wulan, E. Ratna, 2014).

METHOD

This research is Classroom Treatment Research (CAR). The purpose of Classroom Treatment Research (CAR) is none other than to improve the teaching and learning process of students in certain classes. Thus classroom treatment research is an examination of learning activities in the form of a treatment, which is deliberately raised and occurs in class together. Each treatment includes planning, treatment, observation, evaluation, and reflection, (Brien, 2001). The designs that will be carried out in this study are as follows:

Classical experimental design R	R O X O O O
Pre-experimental designs	
a. One-shot case study	X O
a. One-group pretest-posttest	O X O
c. Static group comparison	X O O

Table 1 Classical Experimental Design

R: random assignments

X: Treatment

O: Measurements

This research was conducted in November 2022 with the subjects in the study being students of class 11o CT-A trimester ESG Canossa Manleuana Dili Academic Year 2022 with a total of 40 students, consisting of 12 boys and 28 girls. The selection

of grade 11 students is because grade 11 is a stage in the development of increasingly broad thinking, children have a high interest in learning and this requires a tool that can further increase their high interest in learning so that learning achievement increases. Another reason for choosing class 11-A is because class 11-A students are still passive in the learning process. It is hoped that with the experimental learning method students can be more active in the teaching and learning process.

The data collected in this study were in the form of student test results, and the results of student work in solving the questions given by the researcher. The test was given at the start before the treatment and the test after the research treatment. To ensure and strengthen test data both pre-test and post-test can be supported by the results of interviews, observations both before and after the treatment, and field notes containing the implementation of student activities in learning during the research. To calculate test results, both pre-test and post-test in the learning process using the experimental method, the percentages correction formula is used as follows.

$$\boldsymbol{S = \frac{R}{N} x 100}$$

Data analysis of learning outcomes is carried out descriptively and presented in percentages. Indicators of success of student learning outcomes are said to increase if classical learning mastery is achieved, namely ≥ 75% and students obtain individual completeness scores ≥ 75. Student learning outcomes are said to increase if there is an increase and change in score on treatment, (Huda, 2014).

RESULT AND DISCUSSIONS

Result before treatment (Pre-Test)

Based on the learning outcomes before treatment, namely by applying conventional methods, namely lecture and demonstration methods, it shows that there is no student interest in geometric and confusing optical material so students are less active and do not show any changes in behavior when participating in learning activities. This is shown through less active treatments both in personal and group work and students are less daring to express opinions in the use of conventional or classical learning methods.

The learning outcomes in the case before treatment showed that the highest score achieved by students was 90 and the lowest score was 30 with a class average

of 65%. Judging from the learning completeness, 40 students participated in the activities before the treatment. Of the total students, 26 students had succeeded in achieving the minimum completeness criteria (65%), and students who had not completed as many as 14 students (35%).

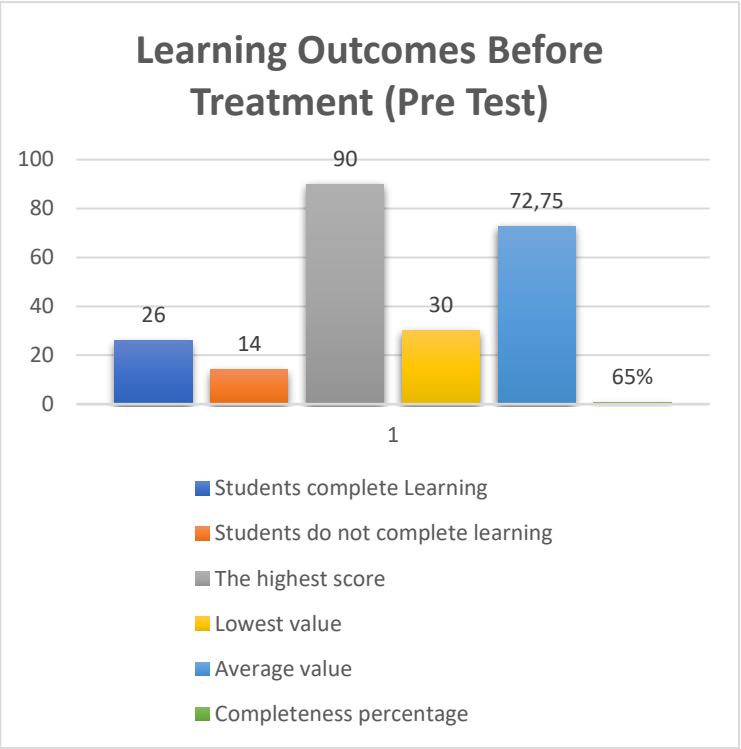

Figure 1 Learning Outcomes of Experimental Treatment Activities

Based on the results of observations on activities before the treatment of learning outcomes and student interest is still lacking in the learning process. As for the obstacle, namely the learning outcomes in teaching and learning activities before the treatment showed that only 65% of students completed the fairly good category, this shows that the desired learning outcomes were still below expectations or in the low category. Classically students have not completed less than the desired percentage of completeness, which is equal to 75%, therefore treatment is needed to improve student learning outcomes.

Results After Treatment (Post-Test)

Seeing the results of the activities before the treatment that is less than optimal below expectations, to maximize the desired results, follow-up treatment activities are carried out. Before carrying out learning improvements in treatment activities, in this principle the researcher prepares and determines the steps for improving the

next stage of learning, namely changing the learning method and experimental method.

Stepping into the experiment, the researcher introduced the materials and tools used and explained the work function of each material and the steps of the experiment through demonstrations. In presenting the experimental treatment it was carried out in 1 meeting with a time allocation of 3 x 45 minutes with the stages: After the teacher enters the room, the teacher/researcher conveys the learning objectives, and after that, the teacher begins to divide students into heterogeneous groups consisting of 4-5 student.

During the experimental activities, the researcher observed that the students were so effective and enthusiastic, and the number of questions asked both to each other and other groups and researchers were compared to previous classical activities before the experimental treatment. The results of observations of experimental treatments were recorded in the observation sheets that had been prepared by the researchers. Observation of treatment activities obtained the following results: 90% complete classically in learning using the experimental method.

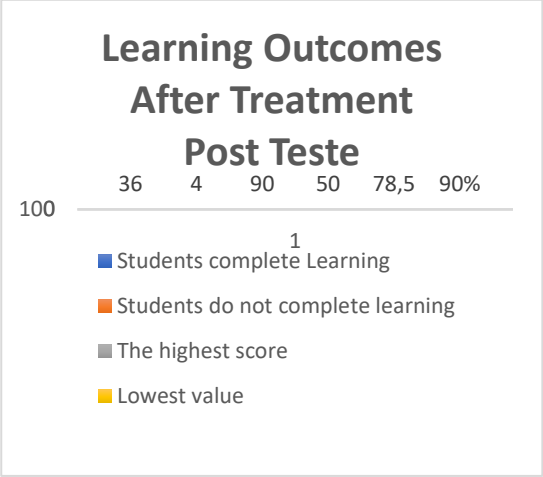

Figure 2 Results of Learning Activities After Experimental Treatment

Based on the results of observations, the increase in learning outcomes and activities is a benchmark to determine the level of success of students in the teaching and learning process. The teaching and learning process is said to be good if the process can generate effective learning activities.

This increase was marked by an increase in the learning outcomes obtained by

students through observation during experimenting activities and discussion after discussion. Based on the results of observations and discussions between researchers and students, it was shown that most of the students were very enthusiastic and very interactive during the experimenting activities. This is evidenced by the learning outcomes obtained from the post-test there is an increase in learning completeness from 65% to 90%.

This increase is in line with what was said (Afandi, 2013), that the experimental method is a way of teaching, where students experiment on something, observe the process and write down the results of the experiment, then the results of the observations are conveyed to the class and evaluated by the teacher. The experimental or experimental method is an efficient way of teaching and learning that involves students being creative, experiencing, and proving for themselves the process and results of the experiment.

Therefore, by learning physics in secondary schools students can learn and develop concepts, principles, and laws of the universe, as well as applications in everyday life and technology. Therefore, physics material places more emphasis on teaching and learning activities with direct experience through practical or experimental activities that will develop the scientific competence of students.

CONCLUSIONS

Based on the results of the discussion above, it can be concluded that: The application of the experimental method can improve learning outcomes in geometric optics for ESG St. Madalena de Canossa Manleuana Dili Academic Year 2022. This can be proven by the results of student learning tests in the after-treatment activities. In the activities before the treatment with a completeness percentage of 65%, there was an increase with a completeness percentage of 90%.

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