

Simple Periscope Design as Optical Learning Media

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Abstract: Media is needed in the learning process to support practicum activities. Practicum tools can be made with simple materials, but must meet the standards or eligibility of the tool. This study aims to make a practicum tool in the form of a simple periscope as an optical learning medium in schools. Periscope is an optical instrument used to see objects from hidden places. Usually, periscopes are used on submarines. However, in this study a simple periscope was made from a flat mirror which can be used as a learning medium in schools. This research is experimental research with the stages of preparation, manufacture and testing of tools. The simple periscope that has been designed is a flat mirror periscope made of PVC pipe, L pipe, and a flat mirror. The results of a simple periscope test in the field are being able to see objects clearly as far as the eye can see, the image shape obtained is virtual, upright, and the same size, while the focal length is half of the object distance.

Keywords: Optical instrument; Simple periscope; Focal distance

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Introduction

Physics is a challenge for students in school. They think that physics is one of the most difficult materials to understand. This is due to the abstract concept of physics and learning in class which is less fun. Physics requires observations to improve scientific concepts, facts, and principles through practice, not just theory (Maiyena, 2017; Cahyono, 2018)). Furthermore Egariyewe (2015) stated that the National Training Lab found facts where students could only remember 5% to 10% of what was read in textbooks, but they could remember up to 80% of what they did (Mustami, 2017).

The problem that often occurs is that the teacher only conveys a theory without practice so that students sometimes get bored with too much theory. Even though physics if practiced is very simple. The practicum process will make it easier for students to translate abstract concepts into reality. This statement is supported by (Agustianti, 2015; Arsyad, 2011; Desy et al, 2015) that the use of practicum tools makes it easier for students to better understand scientific concepts in science lessons. In addition, science process skills and

life skills can be improved through an experiment or experiment, so a simple but effective tool is needed to assist teaching and learning activities (Anugrah et al, 2015).

In the practicum process, a supporting learning media is needed. Learning media is an auxiliary media in the teaching and learning process (Matsun et al, 2016; Yuberti & Siregar, 2017; Rezeki & Ishafit, 2017; Astuti et al, 2017). Practicum media can also overcome difficulties in the learning process (Wijaya et al., 2014). Simple practicum media is one part of visual learning media. The purpose of using practicum tools is to increase scientific knowledge and skills, improve scientific attitudes, increase expertise and develop assessments, and provide motivation for students (Dewi, 2015). Practicum tools can also make students more active in participating in a series of learning processes (Azhar, 2018).

Practicum tools can be made with simple materials, but must meet the standards or eligibility of the tool. The eligibility criteria for practicum tools, namely practicum tools according to the concept, research subject, and curriculum, must be attractive and easy to understand

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and easy to use (Afriyanto, 2015). One of the physics materials that requires practicum is optical material about the properties of shadows. This material is abstract, so a tool is needed that can represent the concept (Ismet, 2017). However, in some schools the practicum tools are very limited, or even nonexistent. Thus, making a simple periscope practical tool on optical material is very important to do to help teachers and students to learn more actively, innovatively, applicable and fun.

Method

This research is an experimental research with the stages of tool preparation, tool making and tool testing. The tools used in this study were PVC pipes, L pipes, mirrors, glue, and rulers. The making of the tool was carried out in the Basic Physics building at the Faculty of Mathematics and Natural Sciences, University of Mataram, while the testing of the tool was carried out on the football field at the University of Mataram.

Making a simple periscope device

First cut a pipe with a length of 60 cm and a diameter of 5 cm, and cut an oval mirror. Then cut the outside of the L pipe with a slope of 45°. Attach the mirror using glue and do the same steps with the other mirrors. The L pipe that has a mirror attached is connected to each end of the pipe in the opposite direction. Next try the periscope until the middle is clearly visible. The final step is to insert the sensor through the drilled hole. The simple design of the periscope is shown in Figure 1.

Simple periscope testing

For this periscope test, place an object at a certain distance, then look at the object from a hidden place using a periscope. Measure the distance of the object then write it in the observation table, then calculate the focus distance of the object. Determine the nature of the image based on the results of calculations and observations. Finally, repeat the steps above with the same or different objects and at different distances.

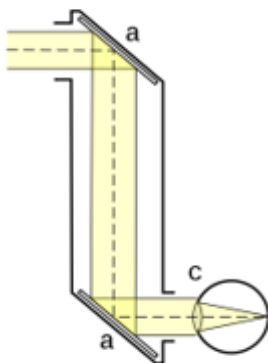


Figure 1. Simple periscope design

Result and Discussion

The following is a simple flat mirror periscope that has been made using a PVC pipe with a tube length of 60 cm and a diameter of 5 cm. Periscope is an optical instrument needed to observe objects at a certain distance or angle. The shape is simple, namely a tube with a mirror at both ends. The mirror is installed by forming an angle of 45 degrees facing each other as shown in Figure 2.



Figure 2. Experimental results of a simple periscope design

Then testing the tool using a simple periscope to see objects from hidden places. Seen in Figure 3 when testing tools and shadows produced by the periscope.



Figure 3. Tool testing process

The way the periscope works is that light enters through the mirror on the top L pipe then the mirror reflects light to the mirror at the bottom. Furthermore, the lower mirror sends light towards the observer's eye, thus the observer can see objects at a considerable distance from the hidden place. Based on table 1, the object can be seen at a distance of 250 m, because the farthest test site is 250 m. This simple periscope is also capable of seeing objects farther than 250 m, that is, as far as the eye can see.

Table 1. Simple periscope test results

Object	Distance (m)	Information
Man	25	It's obvious
Pole	50	It's obvious
Man	100	It's obvious
Wall	200	It's obvious
Tree	250	It's obvious

Table 2. Results of measuring the focal length of a flat mirror

Object	s (cm)	s' (cm)	f(cm)	M
Man	25.00	25.00	12.50	1.00
Pole	50.00	50.00	25.00	1.00
Man	100.00	100.00	50.00	1.00
Wall	200.00	200.00	100.00	1.00
Tree	250.00	250.00	125.00	1.00

Next is to determine the focal length of the flat mirror. In accordance with the nature of a flat mirror that the object distance is equal to the image distance, then the focal length of a flat mirror is half of the object's distance to the mirror. Through the reflection of a flat mirror, this simple periscope can see objects as far as the eye can see. This is because the magnification of the image is 1 and the shape of the image is virtual, upright and the same size. Thus, the nature of plane mirrors can be proven through the working principle of this simple periscope. The properties of a flat mirror are virtual, upright, the same size as the object, the distance from the object to the mirror is the same as the image distance to the mirror, and the sides are exchanged.

Conclusion

The simple periscope that has been designed is a flat mirror periscope made of PVC pipe, L pipe, and a flat mirror. The results of the periscope test are being able to see objects clearly as far as the eye can see, the shape of the image obtained is virtual, upright, and the same size, while the focal length is half of the object distance.

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