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# Preliminary Study in the Development of Simple Machine Kit as Maritime-Based Science Instructional Media for Junior School Students in Coastal Area

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**Abstract.** In order for science learning to be more useful for students, it must be related to the context around them. For this reason, learning must integrate the contexts of students' daily lives with what they are learning in classroom. This preliminary study aims to identify maritime elements that can be integrated into junior high school science learning in coastal areas. The science lesson topics that we are concern in this study are Work and Simple Machine. This topic is taught in grade 8 of junior high school. The results of the field survey found that marine elements that could be integrated with simple machine kits included: boats, oars, pulley to raise the sail of the traditional ship, pulleys for containers, inclined planes for raising passengers and goods, and traditional ship anchor lifters. These elements then form the basis for the design of a maritime-based simple machine kit that will be used in classroom.

Keywords: coastal areas, maritime-based science learning, simple machine kit.

## 1. Introduction

Although learning with a scientific approach has been announced several years ago by the government, but this method is still not optimally implemented by teachers. One of the classic problems in science learning faced to this day is the lack of student involvement in scientific activities (Zulirfan, et al. 2018). In fact science lessons must be taught with a scientific approach because the dimensions of science itself are processes, knowledge, and attitudes. This is in line with the opinion of Yasar and Anagun (2009) which states that teaching science in schools emphasizes three dimensions of learning outcomes namely scientific knowledge, science process skills, and scientific attitudes. In learning with a scientific approach, students learn to apply scientific methods directly, from observing, asking questions, collecting data through experiments, analysing the data, to communicating the results of investigations.

To be able to carry out this scientific method properly, students must have science process skills. Walter and Soyibo (2001) argue that science process skills must be possessed by students both basic process skills and integrated process skills. According to Ergul et al. (2011), science process skills help students solve problems, think critically, make decisions, make conclusions, and answer their curiosity.

Kipnis and Hofstein (2007) argue that inquiry learning in school laboratories (the experimental method) provides opportunities for students to practice metacognitive skills which are considered important objectives of teaching science. Meanwhile, Ergul (2011) found that direct experience experienced by students in inquiry-based teaching would improve science process skills and scientific attitudes, as well as make a positive contribution to academic achievement in science, scientific literacy, and attitudes towards science.

In accordance with the opinion of Schafersman (1994), science is a way of finding out about nature, a way to get to know nature so as to obtain reliable scientific knowledge. In other words, science is a way of getting knowledge about nature. Bern and Erickson (2001), state that contextual learning and teaching are defined as innovative teaching concepts that help students relate learning content to the life context in which it is used.

The context of student life depends on the area where students live. Students who live in mountain areas will observe things related to mountains, ranging from plant species, rock and soil types, wind, waterfalls and so on. Students who live in urban areas will always observe motor vehicle traffic, towering buildings, street lights, colorful garden lights, road jams, and so on. Meanwhile, students who live in coastal areas will be accustomed to observing matters relating to the sea such as: sailboats, ferries, ports, fishermen, seawater, coastal land, mangrove plants, and so on. This daily view of students can be related to science subject matter at school and make science lessons more interesting and useful for them

Considering the importance of learning is related to the context of student life and the importance of learning with a scientific approach, we try to explore maritime elements in the coastal area that can be integrated into learning. As a pilot project, the topic of science lessons that became the focus of this research was Work and Simple Machine. This topic is taught in grade 8 in Junior High School (SMP) in accordance with the applicable Curriculum 2013. In this topic, students learn the concepts of Work and its application in everyday life and Simple Machine and their application. Simple Machine consist of levers, incline, axle wheels, and pulleys. In this preliminary study, we identified maritime elements that could be integrated in the learning of the work and simple machine.

## 2. Methodology

The survey was conducted in Desa Mengkapan and Desa Lalang, Sungai Apit District, Siak Regency. Both are located along the east coast of Sumatra Island which is a coastal area. Figure 1 shows the location of the study.



**Figure 1.** Survey Location

Figure 1 shows that the two villages or desa are located on the edge of the Lalang Strait and in front there is Padang Island, Meranti Islands Regency. The livelihoods of residents in this region are farmers, fishermen, traders, port workers, and a small portion of Kondur oil company employees and teachers.

The survey is directed at the exploration of equipment used by the people of this region in their daily activities. This activity can be observed at the harbour, on the beach, and at sea. In addition to direct

observation of objects, we also conducted focus group discussions with 4 junior high school science teachers in both villages. Things discussed include: science lessons material that can be associated with coastal elements. The results of this exploration serve as recommendations in designing the intended maritime-based science kits.

### 3. Result and Discussion

The results of a survey of objects directly and the results of focus group discussions with science teachers, it can be mapped marine elements that can be integrated with science learning in coastal junior high schools. The results of the exploration are shown in Table 1.

**Table 1.** Community activities related to marine objects

Community Activities	Related Marine Objects
Traditional rowing canoes use two paddles	Traditional sampan paddle
Raise passengers to the Ferry when the ship floor is higher than the port	Serrated board that is mounted tilted as a ladder
Lowering and raising anchor barges or traditional board ships using special tools	Tool for raising and lowering wooden ship anchors
Lifting things using pulleys, broaching flags, broaching sailboats	Pulleys on containers, sails and flag hoists

Table 1 shows that there are four community activities that use equipment that can be associated with Simple Machine material. The relationship between maritime objects with material and learning objectives is shown in Table 2.

**Table 2.** Integration of marine objects with learning

Marine Object	Related Lesson Material	Learning objectives
Traditional sampan paddle	Simple Machine: Levers	<ul style="list-style-type: none"> <li>- Investigate the use of levers on the boat through experiments</li> <li>- Calculate the mechanical advantages of traditional rowing boats through experiments</li> </ul>
inclined mounted plane that serves as a ladder for passengers who board the ship	Simple machine : Inclined plane	<ul style="list-style-type: none"> <li>- Investigate the use of inclined plane through experiments</li> <li>- Calculate the mechanical advantage of an inclined plane through experiments</li> </ul>

Tool for raising and lowering wooden ship or traditional ship anchors	Simple machine: Axle wheel	<ul style="list-style-type: none"> <li>- Investigate the use of axle wheels through experiments</li> <li>- Calculate the mechanical advantages of axle wheels through experiments</li> </ul>
Pulleys on containers, sails and flag hoists	Simple machine: Pulleys	<ul style="list-style-type: none"> <li>- Investigate the use of pulleys through experiments</li> <li>- Calculate the mechanical advantage of a pulley through experiments</li> </ul>

Table 2 shows the links between maritime objects that have been identified with the subject matter and learning objectives. Based on the formulated learning objectives, it appears that learning is carried out with the experimental method as expected in scientific learning. The learning objectives are formulated together with the learning objectives in general, but in this learning objective explicitly written learning experiences and maritime-based media. Thus, students will learn simple airplane material directly on maritime object models that they already know or objects that they normally observe in everyday life.

Zulirfan, et al. (2018) emphasized that the process of teaching science should be contextual, meaning that scientific activity is directed to observe the natural phenomena that are around it. This is also supported by the opinion of Jean Piaget in Arends (2017), that children have innate curiosity and they will continue to try to understand the world around them, that curiosity motivates them to construct their understanding actively through representations in their minds that related to their daily experiences.

This preliminary study provides recommendations for us to design and develop science experiment media on maritime-based of simple machines material in the form of experimental kits. We hope that this maritime-based experiment kit can help students learn science scientifically. The research results of Bibin Rubini et al. (2018) showed that using experimental kits in science learning can improve the quality of scientific work.

Science experiments in learning that are oriented to the context of students' lives make students able to link what they observe in their daily lives with what they learn in the pursuit of science. Taber (2011) states that the experience gained from observing an object or event in the student learning environment will be interpreted so that meaning can be built. Correspondingly, the results of the study of Fitri Mardotillah et al. (2018) shows that learning science (physics) based on local wisdom can improve student learning outcomes.

#### 4. Conclusion

Many objects of science in the daily activities of coastal area communities can be explored as objects of science learning. The objects of science can be associated with science learning media. Among the maritime objects that can be integrated with science learning on Work and Simple Machine materials are traditional canoe paddles, inclined planes for passenger ladders, ship anchor lifters, and goods lift pulleys at ports. The integration of these maritime objects in science learning media can give a sense that science learning interesting and giving benefits to the students.

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