

## **The Effectiveness of Physics Interactive Modules Based on Problem Solving Models with SETS (Science Environment Technology society) insight in developing students' scientific literacy.**

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**Abstract:** The purpose of this research was to see the effectiveness of the use of interactive physics modules based on problem solving models with SETS insight in developing students' scientific literacy. Science literacy was observed in aspects of scientific competence and scientific knowledge. The study used a descriptive method with respondents in class XI students of SMAN 9 Padang. The instrument used was a questionnaire with a Likert scale. Data were analyzed with descriptive statistics. The results showed an interactive physics module based on problem solving models with SETS insight effectively developed the scientific literacy skills of students. Scientific competence which includes aspects of the ability to explain phenomena scientifically with an achievement of 93.07%, the ability to design and evaluate scientific investigations at 87.97%, the ability to interpret data and facts in a scientific manner 94.22%. Scientific knowledge includes aspects of scientific knowledge with 92.22% achievements and reasoning knowledge aspects with 89.97% achievements. The interactive physics module based on problem solving models with SETS insight could be used by teachers to develop students' scientific literacy.

*Keywords: Interactive Modules, Problem solving, SETS, Scientific literacy*

## **INTRODUCTION**

Technological advances influenced the development of the curriculum in the 21st century. According to Oktaviani et al (2017) technological advances in the 21st century had encouraged more interesting and effective learning approaches. Johnson (2009) stated that adopting a 21st-century curriculum should also incorporate knowledge, thought, skill innovation, media, Information and Communication Technology (ICT) literacy, and real-life experiences in context of core subjects Academic.

The Indonesian government changed the curriculum to achieve 21<sup>st</sup> century skills

and scientific literacy. Hasana (2017) stated the 21<sup>st</sup> century was characterized by the current globalization, resulting in intense competition that requires knowledge and skills to be able to compete. Ball (2016) also expresses knowledge and skills in learning and innovation (e.g. creativity, critical thinking, collaboration); Information, and technology must be owned to compete in the global era. Sari (2012) also said the demands of the globalization era that must be answered by the world of education was the Global competition. One of them was an interactive learning method, duly directed on how to form a relationship that was interactive, dialogical and open in the learning process and scientific literacy skills.

Scientific literacy becomes very important to students as a provision to face the challenges of the 21<sup>st</sup> century. Treacy et al., (2010) suggests that scientific literacy was directly correlated to building a new generation of strong scientific thinking and attitudes that could effectively communicate knowledge and research results to public. A person with scientific literacy was a person who uses the concept of science, had the skills of a science process to assess in making daily decisions when dealing with others, the community and his environment.

Scientific literacy skill having by students was useful for creating quality education. High-quality scientific literacy was related to the reasoning ability and communication skills, where each individual student was able to define the problems surrounding them, hypothesize, experiment, and make conclusions (DeBoer, 2000); (Herlanti et al. 2012). One of the subjects that make up scientific literacy was physics.

Physics was one of the branches of natural science that underlies the development of advanced technology and the concept of living harmoniously with nature. Physics learning must contain facts, concepts and procedures that we will teach to students. The nature of physics was as a product of knowledge, physics as a scientific attitude, and physics as a process of demonstrating knowledge (Santoso, 2014). The learning process of physics in 2013 curriculum for all levels was implemented using scientific approach. Learning with scientific approach using a 5M (observing, examining, reasoning, associating or analyzing and communicating (Ghaliyah et al., 2015:149).

The quality of Indonesian education which was used from the various scientific literacy research showed that the natural science learning process at school had not been good mostly. As it was discovered by Monk (2018) that some factors which influenced the low learning outcomes was the natural science teaching material was not optimal. The research conducted by Millers (Hobson, 2008) Expresses scientific literacy was very low globally.

Research results of the Programme for International Students Assessment (PISA) with a focus of competency of science, indicating that the ability of scientific literacy in Indonesia was still relatively low. The report of the results of PISA for the scientific literacy of Indonesian students from 2000 to 2009, always ranked top 10 from below. In 2000 Indonesia was ranked at 38 from 41 countries, 2003 commemorates to 38 from 40 countries, 2006 ranked 50 from 57 countries, and year 2009 ranked 60 from 65 countries. The results of the PISA test in 2013 Indonesia ranked 64 from 65 countries. The results showed that the ability of Indonesian students to literacy on science and technology was still very lacking.

Some factors that caused low scientific literacy skills were the learning process and learning resources that had not emphasized students to be more active. Lack of teaching materials that could shape scientific literacy skills to low. Then this was in line with Puspitasari Research (2015) The lack of scientific literacy skills in Indonesia was influenced by the limited learning media that supports the success of science learning. The teaching materials found were more focused only on the material, less contextual and tend to be monotonous and lack of scientific knowledge in solving problems of teaching materials.

The student package book provided by the school had not only been limited but also had not yet led to the students' scientific literacy. Kurdiantoro (2014) stated the limitations of the outstanding teaching materials, which had not supported proportionally all aspects of scientific literacy, making each student difficult to understand the individual lessons of physics. Parmen (2012) also stated that the developed teaching materials must relate between facts and concepts and learning procedures. Teaching materials that could train students' scientific literacy by selecting teaching materials based on scientific learning steps.

One of the recommended scientific studies of the 2013 curriculum was the model of learning problem solving. Model Learning

Problem Solving was a model of learning that carries the theory of constructivism. Permanasari (2010) suggests that integrated contextual learning was a learning problem solving. (2014), stating that learning with a problem-based learning model solving a high impact on improving scientific literacy in NATURAL SCIENCE learning. Toharudin (2011) stated that Learning with the model problem solving built students' scientific literacy. Fosnot (2005) and (Brooks and Brooks 1999) stated that learning with the problem solving model was consistent with the widely used constructivist learning theory as the basis for education programs for educators, forming students or build up their knowledge through interaction with their environment.

Students' scientific literacy skills were required to be able to analyze and solve problems related to life and the environment, thus being simplified with the insight of SETS (Science Environment Technology Society). SETS was one of the approaches that emphasized science relationships with the environment, technology and society. According to Supriyono in Yulistiana (2015) SETS approach could increase the activity and motivation of students to learn. The Subratha (2004) also added that STM learning was effective in enhancing students' scientific literacy.

Many teaching materials had been made as problem-based solving and SETS-based in the form of e-books. Products existing, still separates the development of problem solving with SETS. Research on Rahmawati et al (2015) natural science integrated books based on problem solving and scientific literacy. Handayani (2018) SETS-based Physics module development to improve scientific literacy skills. From the existing research, nothing combined the two in an interactive module teaching material.

Researchers developed the teaching materials of SETS problem solving interactive model. According to Prastowo (2015) interactive teaching materials were teaching materials that combine multiple learning

media (audio, video, text, or graphics) that were interactive.

Suprawoto (2009) also stated that interactive teaching materials were means, methods, students' objectives based on basic competencies or competency achievement indicators that gave students chance to test themselves through exercises that Presented in an interactive module.

Based on the explanation above, researchers aim to see the effectiveness of the use of interactive modules based on physics solving model problem with developing scientific literacy. Scientific literacy was observed in the competency aspects of science and science knowledge of grade XI students at SMAN 9 Padang

## METHOD

The method used in the research was quantitative descriptive. That was research aims to illustrate the ability of students' scientific literacy after using an interactive module based on the physics solving model problem. The respondent was a student of class XI SMAN 9 Padang.

This research instrument was a poll. This poll contains 2 aspects of scientific literacy namely science competencies that include: the ability to explain the phenomenon based on scientific approach, the ability to design and evaluate scientific investigation, the ability to interpret data and facts scientific and knowledge of science covered: identifying materials, the ability of knowledge of science and reasoning in science. How to analyze the data was done with the steps i.e. providing a score for each item, the answer strongly agrees (4), Concur (3), disagrees (2), and strongly agrees (1). The total score for the entire indicator was used with the formula:

$$E = \frac{f}{N} \times 100\%$$

Description:

- E = Final value of effectiveness
- F = Score Accrual
- N = Maximum Score

## RESULT AND DISSCUSSION

Based on the results of this study it was obtained that student scientific literacy data as shown in table 1.

**Table 1.** Scientific literacy

Aspects	Indicators	%
Scientific Competency	Ability to explain scientific phenomenon	93.07
	Ability to design and evaluate scientific investigation	87.97
	Ability to interpret data and facts based on scientifically	94.22
Scientific Knowledge	Scientific Knowledge	92.22
	Reasoning Knowledge	89.97
Average		90.52

Table 1. Scientific literacy illustrated the competence of science and scientific knowledge. Scientific competence in the ability explained the scientific phenomenon by 93.07%, the ability to design and evaluate scientific investigation by 87.97%, and to interpret the data and facts Scientifically by 94.22%. Scientific knowledge of science knowledge and reasoning knowledge gained a flat score of 91.1%. The results of scientific literacy obtained the effectiveness value with an average of 92.02%.

The category of effectiveness in accordance with the criteria Riduwan (2010) in the range of 65-80 of a product could be said to be effective.. Nieveen (2013) said the effectiveness of models in development research refers to the degree of consistency in the knowledge of students in learning scientific literacy.

The results of the study was in line with previous researchers Rahmawati et al (2015) developed an integrated Problem-solving-based Natural Science books and scientific literacy for grade VII students of junior high school . Giving results that the developed natural science books had valid criteria and very practical to use for students.

Kurnia et al (2014) had also developed the physics teaching material of high school scientific literacy, it was found that scientific literacy category showed an average percentage occurrence of 59.62% for scientific literacy category as core of knowledge, 33.57% for category Scientific literacy as a way to investigate, 5.73% for scientific literacy categories as a way of thinking, and 1.08% for the category of science interaction and technology with society. Rahmawati et al (2015) develops an integrated problem-solving-based natural science book and scientific literacy for grade VII students of junior high school. Giving results that the developed natural science book had valid criteria and very practical to use for students

## CONCLUSION AND RECOMMENDATION

The conclusion of this study was the scientific literacy skills of SMAN 9 Padang students in a very effective category of the competency aspect scientific which includes the ability to explain the scientific phenomenon 93.07%, the ability to design and evaluating the scientific investigation by 87.97%, the ability to interpret scientific data and facts 94.22%, and scientific knowledge 91.1%. So the effectiveness of the use of interactive modules based on SETS problem solving model toward scientific literacy was very effective in studying physics.

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