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Optimization of Wetland Problems in Physics Learning for Fluid Topic through Contextual Teaching and Learning Approach

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ABSTRACT

This study aims to design and develop high school fluid physics teaching materials based on wetland problems that meet the criteria of valid, practical, and effective. The implementation of the research was carried out in two stages, the design stage of teaching materials and the implementation stage of teaching materials. To see the quality of the validity of teaching materials, a validity assessment was carried out by two validators using a validation sheet, and to see the practicality of teaching materials the implementation of teaching materials was assessed by two observers using observation sheet for the implementation of the lesson plan, and to see the effectiveness of the learning strategy, the implementation of teaching materials conducted on 30 students of PGRI 4 High School Banjarmasin Indonesia as research test subjects and conducted a pretest and posttest to measure students' physics learning outcomes. Analysis of the quality of the validity of teaching materials after the assessment of two validators and the practicality of teaching materials after the assessment of two observers used Percentage of Agreement analysis. Analysis of the effectiveness of strategies in improving students' physics learning outcomes using normalized gain score analysis from the pre-test post-test score. The results of the analysis show that the validity of the teaching material developed according to the validator is valid, the practicality of the teaching material observed with observation sheet for the implementation of the lesson plan is 3.7 in the very good category with reliability 0.807, the effectiveness of the teaching material is effective according to the gain score obtained is 0, 8 in high category. These results indicate that the high school physics teaching material for fluid topics is based on wetland problems through the CTL approach developed to be suitable for use in the learning process.

Key Words: *Wetlands, Fluid Physics, CTL.*

1. INTRODUCTION

Basically, each region has local characteristics or wisdom that can be raised in the learning process in the classroom, both as a source of learning, as well as an object of problems that can increase student learning motivation due to the relevance between the materials they learn with their daily environment. The integration of wetland problems in the learning process will also add insight into the local wisdom of students towards the environment of the wetlands around them. In physics subjects, especially high schools, there is fluid topic that can be related to the condition of wetlands in South Kalimantan. The Province of South Kalimantan Indonesia is well-known for its potential swamps and wetlands that are still untouched and not fully utilized. The wetlands referred to here are swamp ecosystems, including peat swamps which are affected by fresh or brackish water.

In the study of fluid physics, wetlands can be utilized as objects of problem. Integrating fluid material and wetland problems such as the concept of hydrostatic pressure can be attributed to the pressure of the process of building houses using *galam* wood, the concept of substance lift is sought in float events on the river and various other events on wetlands can be raised in the learning process. This of course will be more interesting and better when compared to providing textual problems in the book.

The Contextual Teaching and Learning (CTL) approach is a learning concept that helps teachers associate topic taught with the real-world situation of students and encourage students to make connections between their knowledge and their application in their daily lives. Based on constructivism thinking, that knowledge is built by students little by little, the results of which are expanded through a limited (narrow) context. Knowledge is not a set of facts, concepts, or rules that are ready to be taken and remembered by students but knowledge must be constructed and give meaning through real experience. Therefore, it is seen that the use of the CTL approach is relevant in linking fluid topic physics learning with wetland problems. The observation results in the teaching materials in Hight Schools in Banjarmasin South Kalimantan Province, in general, the teaching materials used are still textual which have not directly touched the wetland environment. Therefore, teaching materials that are addressed with the wetland environment are needed to help the learning process in the classroom that is relevant to the student environment. Physics learning will be more attractive to students because it is done and is associated with environmental conditions.

2. RIVIEW OF LITERATURE

Wetlands are a strategic area for Indonesia. The wetlands referred to here are swamp ecosystems, including peat swamps which are affected by fresh or brackish water. Wetlands are land areas that are flooded or have a high water content, both permanent and seasonal. The ecosystem includes swamps, lakes, rivers, mangrove forests, peat forests, flood forests, floodplains, coastal areas, rice fields, to coral reefs. This land can be in fresh, brackish and salty waters, the process of formation can be natural or artificial. Humans get various benefits from wetlands, both economically, ecologically, and culturally. Therefore, most of the world's population live in wetland areas or close to wetlands. Many cities are built on wetland areas, one of which is the city of Banjarmasin which is located in the Barito River. South Kalimantan Province which has almost all kinds of wetlands certainly provides opportunities for teachers who want to develop learning tools that are adapted to the wetland environment [1].

Figure1.1: Banjarmasin Floating Market, Indonesia

Wetlands have an important role in human life. The ecosystem provides clean water, biodiversity, food, various materials, controlling floods, storing groundwater reserves, and mitigating climate change. This type of land is also the habitat of a large number of plants and animals, relatively more than other types of ecosystems, conditions are getting worse day by day. This makes the United Nations of Educational, Scientific, and Cultural Organization (UNESCO) aggressively hold a convention known as the Ramsar Convention [2]. Each wetland is composed of a number of physical, chemical and biological components, such as water, soil, plant and animal species, and nutrients. The characteristics related to physical, chemical and biological components are not the same between one wetland and another. A land can be called a wetland if it meets one or more of three conditions. First, there are water plants periodically. Second, is an area that is quite wet for a long time. Third, permanently saturated. One of the functions that wetlands prevent the clean water crisis is to carry out the process of cleaning wastewater. The process of reducing pollutants from wastewater if reviewed physically, chemically, and biologically is carried out through filtration of suspension and colloidal materials contained in water, assimilation of pollutants into living plant roots and leaves, binding or exchange of pollutants with wetland soils, living plant material, dead plant material and living algae material.

Fluid is a substance that can flow. The word Fluid includes liquid, water and gas because both of these substances can flow, whereas rocks and hard objects or all solids are not classified into fluids because they cannot flow. Milk, lubricating oil, and water are examples of liquid, and all of these liquids can be grouped into fluids because their properties can flow from one place to another. Besides liquids, gas substances also include fluids. Gas can also flow from one place to another [3-4]. Wind gusts are examples of air moving from one place to another. Fluid is an important aspect in everyday life. Every day humans breathe it, drink it, float or sink into it. Every day the aircraft flies through it and the ship floats on it. Likewise submarines can float or float in them. The water you drink and the air you breathe also circulates in the human body at any time even though it is often unconscious.

Fluid can be divided into two parts, namely static fluid and dynamic fluid. Static fluid is fluid that is in the immovable phase (stationary) or fluid is in motion but there is no difference in velocity between the fluid particles or it can be said that the fluid particles move at uniform velocity so that they do not have a shear force. Examples of static fluid phenomena can be divided into simple and not simple static. An example of a stationary fluid is simply water in a tub that is not subjected to force by any style, such as wind, heat, etc. which causes the water to move. Dynamic fluid is a fluid (can be a liquid, gas) that moves. To make it easier to study, the fluid here is considered steady (has a constant velocity with time), uncompressed (does not change in volume), is not thick, is not turbulent (does not experience rounds).

The CTL (Contextual Teaching and Learning) approach is a learning concept that helps teachers associate the material taught with the real-world situation of students and encourage students to make connections between their knowledge and their application in their daily lives [5-6]. The CTL approach has seven main components that must be applied in its learning, the seven

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components are described as follows: Constructivism is the basis for thinking about the CTL approach. In the constructivist view, 'acquiring strategies' take precedence over how many students acquire and remember knowledge. The inquiry also includes discovery because students must use discovery skills and more, for example: formulating problems, designing experiments, conducting observations and experiments, collecting and analyzing data, drawing conclusions, having objective attitudes, honesty, curiosity, openness and so on; Asking, asking activities are useful for digging up information, checking students' understanding, generating responses to students knowing the extent of students' curiosity, knowing things that students already know, focusing students' attention on something the teacher wants, raising more questions from students, refreshing returning student knowledge; Learning community; the concept of learning community suggests that learning outcomes are obtained from collaboration with others; Modeling, meaning in learning a particular skill or knowledge, there is a model that can be replicated; Reflection, students settle what they have learned as new knowledge structures, which are enrichment or revision of prior knowledge. Reflection is needed because knowledge must be contextualized so that it is fully understood and widely applied; Authentic assessment, the process of collecting various data that can provide an overview of the development of student learning to ensure that students experience the right learning process. An overview of student learning progress is needed throughout the learning process so assessment is not carried out at the end of the period, but carried out simultaneously with the learning process.

3. METHODS

This research is a development research that aims to design and develop high school physics fluid teaching materials based on wetland problems that meet the criteria of valid, practical, and effective. The implementation of the research was carried out in two stages, the design stage of teaching materials and the implementation stage of teaching materials This development research refers to the design of Wademan and McKenney's research model [7] with the steps of problem identification, identification of tentative products and design principles, tentative products and theories, prototyping and assessment of preliminary products and theories, problem resolution-advancing theory.

To see the quality of the validity of teaching materials, validity assessment was carried out by two validators using a validation sheet, and to see the practicality of teaching materials, the implementation of teaching materials was assessed by two observers using the observation sheet for the lessong plan. Analysis of the quality of the validity of teaching materials after the assessment of two validators and the practicality of teaching materials after assessment of two observers used Percentage of Agreement Analysis (R) to assess interobserver agreement [8]:

$$R = \left[1 - \left\{\frac{A-B}{A+B}\right\}\right] \times 100\% \quad \text{--------------} \quad (1)$$

With:
R: reliability / practicality reliability coefficient
A: highest score from validator / observer
B: lowest score from validator / observer

To see the effectiveness of the learning strategy, the implementation of teaching materials was carried out on 30 students of PGRI 4 High School Banjarmasin as the subject of research. The instrument used to collect data is the instrument test of physics learning outcomes. Pretest and posttest were conducted to see the effectiveness of strategies in improving students' physics learning outcomes and using normalized gain score analysis. Normalized gain score analysis is based on the formula used by Hake [9]:

$$\langle g \rangle = \frac{\%\langle S_f \rangle - \%\langle S_i \rangle}{100\% - \%\langle S_i \rangle} \quad \text{--------------} \quad (2)$$

with:
$\langle g \rangle =$ Normalized gain
$\langle S_f \rangle =$ Pre-test value
$\langle S_i \rangle =$ Post-test value

The data obtained in the implementation stage are consulted in Table 1 to see the effect of teaching materials developed during learning on improving student physics learning outcomes.

Table 1. Reference Gain Value [9]

Scale	Criteria
(<g>) > 0.7	*High-g*
0.7 > (<g>) > 0.3	*Medium-g*
(<g>) < 0.3	*Low-g*

4. RESULTS AND DISCUSSION

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High school physics teaching materials fluid topics based on wetland problem through a contextual teaching and learning approach that has been developed, validated and tested in class to determine its feasibility. The results of the development of teaching materials that are used to support the learning process at the high school are in accordance with the characteristics of fluid topic, and the characteristics of the eleventh grade high school students. In this study developed teaching materials using the contextual teaching and learning approach (CTL) for Archimedes law and Bernoulli principles topic. The teaching material developed was validated by two experts/ practitioners. The teaching materials developed include lesson plans, student worksheet, learning achievement test instruments, and fluid teaching material.

Tabel 2. Teaching Material Validity

Teching Materials	Validity	Reliability Scores
Lesson Plan	Very Good	0,903
Student Worksheet	Very Good	0,818
Intrument Test	Very Good	0,750
Fluid Teaching Material	Very Good	0,938

The practicality of teaching materials that use CTL learning approaches to fluid topic can be seen in the implementation of the learning plan, both in Archimedes' low topic and Bernoulli principle topic, wherein there are two observers in learning activities to assess the implementation of the lesson plan. Based on the feasibility of the lesson plan, Archimedes' low topic obtained an average score of 3.9 in very good category with reliability of 0.750 in sufficient categories, and for Bernoulli principle topic, the average score was 3.4 in very good category with reliability of 0.864 in high category. The mean score for the implementation of the learning plan for the two topics is 3.7 excellent categories with 0.807 high category reliability.

The effectiveness of the teaching materials developed can be known through student learning outcomes in this study, measured from pretest and posttest in the form essay test. The average pretest at the first and second meetings is 6.29 and the average posttest at the first and second meetings is 79.38 thus the effectiveness of the student learning test through pretest and post-test is calculated using N-gain the whole is 0.8 in the high category.

The four teaching materials that were developed which included lesson plans, student worksheets, learning outcome test instruments, and fluid teaching materials showed that the validity in the good category with reliability scores were above the 0.750 value, this indicated that the topic-based fluid physics teaching materials Wetlands can be implemented in class. The importance of the successful implementation of a learning implementation plan which certainly has an impact on the effectiveness of achieving learning goals. The learning process is not only limited to the process of knowledge transmission, but also the success of classroom settings by teachers who run it based on the lesson plan. The impact of practical learning implementation (in accordance with the lesson plan) resulted in an increase in students' physics learning outcomes from an average of 6.29 for pretest to 79.38 for posttest with a n-gain score of 0.8 or in high category.

5. CONCLUSION

Based on the results of the study, it was concluded that: High school physics teaching materials on the topic of fluid based on wetland problem through the CTL approach were developed suitable for use in the learning process. This is supported by the following findings: (1) The validity of teaching materials developed according to the validator is valid. (2) The practicality of teaching materials observed with the learning implementation sheet is 3.7 in very good category with reliability of 0.807. (3) The effectiveness of teaching materials developed is considered effective, as seen from the gain score obtained is 0.8 which is in the high category.

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