

DEVELOPMENT OF PHYSICS STUDENT WORK SHEET (SWS) TO BUILD SCIENCE PROCESS SKILL VALUED CONSERVATION

PENGEMBANGAN LEMBAR KERJA SISWA (LKS) FISIKA UNTUK MEMBANGUN KETERAMPILAN PROSES SAINS BERNILAI KONSERVASI

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ABSTRAK

LKS yang hanya berisi ringkasan materi dan latihan soal tidak melatih siswa melakukan penyelidikan dan mengembangkan nilai konservasi. Tujuan penelitian R&D ini adalah menyusun LKS yang mampu meningkatkan keterampilan proses sains, pemahaman konsep dan nilai konservasi. Nilai konservasi dimunculkan melalui petunjuk kerja dan kegiatan penyelidikan. Ujicoba menggunakan One Group Pretest-Posttest Design. Prosedur penelitian meliputi observasi dan identifikasi kelemahan LKS, perencanaan, pengembangan produk awal dan uji coba lapangan awal. Uji kelayakan dan keterbacaan menggunakan angket dan tes rumpang. Nilai pemahaman konsep diperoleh dari pretest-posttest. Data keterampilan proses sains diperoleh dari hasil observasi selama pembelajaran. Nilai konservasi siswa diperoleh dari hasil angket penilaian diri dan angket penilaian antarteman. Hasil analisis menunjukkan LKS mudah dipahami dan sangat layak digunakan sebagai bahan ajar. Uji gain menunjukkan LKS dapat meningkatkan keterampilan proses sains dan pemahaman konsep, serta dapat digunakan sebagai media untuk mengembangkan nilai konservasi.

ABSTRACT

Student Work Sheet (SWS) which contains only a summary of the material and exercises does not train students to investigate and develop conservation values. The research objective is to also prepared worksheets guided inquiry that can enhance science process skills, understanding of the concept and develop conservation value. Elements of inquiry and conservation value generated through work instructions and investigation. The study was performed by using one group pretest-posttest design. Research procedures include observation and identification of weaknesses worksheets, planning, early product development and initial field trials. Feasibility and legibility using questionnaires and tests hiatus. The value of understanding the concept derived from the pretest-posttest. Data science process skills gained from the observation during the lesson. Conservation values obtained from the students' self-assessment questionnaire and assessment questionnaire between friends. The analysis showed guided inquiry SWS easy to understand and very fit for use as teaching materials. Test gain showed guided inquiry SWS can enhance science process skills and conceptual understanding, and can be used as a medium to develop conservation value.

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Keywords: SWS, science process skills, conservation values.

INTRODUCTION

SWS is one of the teaching materials are often used in learning. According to Trian-

to (2012) SWS is used as a guide to conduct investigations or problem solving. However, research Suyanto, et al (2011) showed that the SWS that circulate in the field mostly just contains a summary of the material and exercises that do not train students to conduct an investigation (inquiry).

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Learning physics is an active process, so in its learning the students should be given the opportunity to explore the understanding, developing thinking skills and science process skills including scientific investigation. One of them is with the inquiry. Inquiry learning model is a series of learning activities that involve maximally throughout the student's ability to search and investigate in a systematic, critical and logical, analytical, so that students can formulate his own discovery (Gulo, 2002: 84-85).

One development of the inquiry model is guided inquiry. Guided inquiry is characterized by the problems that have been identified by teachers and a variety of guiding questions that show step-by-step learning activities (Wenning, 2004). Through guided inquiry, students trained in conducting investigations to develop *self concept*, increasing the intellectual potential of students, extend the memory process and improve students's process skills. Process skills is the ability or skill to carry out an act of learning so produce concepts, principles, laws, and facts or evidence (Yulianti & Wiyanto, 2009: 45). Students can easily explore the concepts are complicated and abstract if it is accompanied by concrete examples, reasonable, situation and condition faced with their own practice as a concept discovery.

Semarang State University on 12 March 2010, declared as the University of Conservation, has a strategic significance in character development. Meaning conservation is not just a physical connotation, but greater is the value and culture (Masrukhi, 2012). Conservation values manifested in the interactions of everyday life, with three important pillars, namely the *protection, preservation, and suitable use*. The values are framed in the three pillars of conservation will emit aspects of life that can be used as the basis of character development. Conservation values can be applied not only in universities but also can be applied in schools. Thus, it is expected within the students will be embedded conservation values as capital undergoing respective profession in the future.

This research aims to get a SWS of guided inquiry static fluids material that contains the value of conservation as teaching materials class XI SMA, determine the feasibility and legibility SWS of guided inquiry, knowing improvement of science process skills, understanding of the concept and development of conservation value.

METHODS

The research was carried out in SMA Negeri 1 Jakenan, Pati regency with the research subject class XI IPA 7 academic year 2014/2015. Research procedure includes four stages, namely the preliminary research, planning, early product development, early field trials.

The preliminary study begins with the observation at school and identify weaknesses SWS that used in learning. The planning stage is done by drafting / design worksheets that starts from the analysis of the curriculum, preparing maps SWS needs, and determine a title SWS. Draft / initial framework developed into guided inquiry SWS. After making a complete SWS, SWS feasibility test conducted by lecturers, experts and physics teacher. Feasibility test consists of content, presentation, language, and the integration of conservation values. SWS then performed repairs on the advice of the validator. Initial field trials carried out in two phases, namely a small-scale test (test of legibility) and large-scale test. The research design used is *the One-group pretest-posttest design*.

Data collection methods used in this study include (1) documentation, to determine the research subject, (2) test hiatus, to determine the readability, (3) test essay, to obtain data on learning outcomes in the form of understanding of the concept before and after using the SWS guided inquiry, (4) a questionnaire, to determine the feasibility and value of conservation, (4) observation, skills assessment process for students.

RESULTS AND DISCUSSION

Characteristics Guided Inquiry SWS

Guided inquiry SWS consists of 42 pages, starting from the cover, preface, table of contents, introduction, instructions for use worksheets, instructions inquiry, learning objectives, content, concept maps and bibliography.

The paper size used in guided inquiry SWS is A4 (21 cm x 29.7 cm), 80 grams. The use of this measure adjusted to the ISO standards. Simple typeface sizes are making the students do not get bored and tired of reading. Typeface used in guided inquiry SWS diverse, among others: Jokerman size of 12pt for the title of each section, Hobo Std size of 14pt

for a specific title, Kristen ITC size of 10pt for writing the preface, table of contents, instructions for use worksheets, instructions investigation, and map concept, *Comic Sans MS* with size 10pt-12pt for penulian part of each section. SWS cover design using harmonious color. Images used reflects the title guided inquiry SWS is application of static fluid concept in everyday life.

SWS content section consists of six sections and each section contains a seven-point activity that is a blend of guided inquiry aspects and aspects of science process skills. The seventh part is foreseen, planned research, interpreting, communicate, classify, observe and apply.

This guided inquiry SWS equipped with a concept map on the last page before the bibliography, page 41. It is intended for performing an evaluation of the discovery of the concept during the trial or the investigation and evaluation of students' understanding of the concept.

Guided inquiry SWS includes educational value of conservation, namely discipline, responsibility, care for the environment, saving water, and paperless. Fifth conservation values are raised through illustrations, work instructions, and investigation activities. Conservation values integrated on guided inquiry SWS so that students are able to know and understand the positive messages contained in it and can apply it as well as useful in everyday life

SWS feasibility

The results of due diligence analysis guided inquiry SWS are presented in Table 1.

Due diligence questionnaire analysis

showed that guided inquiry SWS to improve the conservation values of science process skills in a very worthy criteria are used as a source of learning physics class XI SMA. Feasibility studies include four aspects, namely the feasibility of the content, presentation, language, and the integration of conservation values.

Feasibility of Contents

The results of the feasibility analysis of each aspect of the content presented in Table 2.

The data analysis showed that the content of eligibility criteria guided inquiry SWS in a very worthy. This is because in the selection of learning materials on guided inquiry SWS attention to some of the principles according to the Ministry of Education (2006), they are the principles of relevance, consistency principle, the principle of adequacy and accuracy principles. The principle of relevance is applied when drafting guided inquiry SWS. The principle of consistency or regularity, demanding guided inquiry SWS developed in accordance with a predetermined material indicators and indicators of the development of conservation values. The material developed not too little and not too much, so in accordance with the principle of adequacy. The accuracy of the visible principle of the preparation of worksheets that use guided inquiry library accurate and reliable. Some libraries are used as a reference is a physics textbook for class XI SMA and some other supporting books that contain static fluids material.

Feasibility Presentation

The results of the feasibility analysis of each aspect of the presentation is presented

Table 1. Feasibility Analysis Each Validator

Validator	Percentage (%)	Criteria
1	93.91	Very worthy
2	79.13	Worthy
3	87.39	Very worthy
4	94.35	Very worthy
5	88.70	Very worthy
The average percentage	88.70	Very worthy

Table 2. Results of Feasibility Analysis of Contents

No.	Feasibility aspects of Contents	Score (%)	Criteria
1	Suitability Matter	88.00	Very worthy
2	The accuracy of the material	83.20	Very worthy
3	Material recency	88.00	Very worthy
4	Characteristics of Guided Inquiry	93.33	Very worthy
5	Process Skills	90.43	Very worthy
Feasibility average of Contents		88.68	Very worthy

in Table 3.

Feasibility presentation criteria is very worthy because of the completeness and technical presentation of the learning that has been good. Part of each section is presented in a systematic and consistent. Guided inquiry SWS also comes with illustrations and drawings in accordance with the material being studied. According Muslich (2010: 312), the illustration serves to clarify the matter or the text so as to increase the understanding of students on the information submitted. The research was also supported by Wibowo (2010) that one of the functions of the illustration is to add charm and embellish the pages of teaching materials.

Illustrations and images plays an important role in SWS. SWS that looks interesting will make students more motivated to learn and not get bored. Depictions the right situation to make the message has given more concrete to help students understand the lesson is in progress. This is consistent with the statement Salirawati (2006) that a good SWS has a combination of images and text. A mix of images, color, and a balanced text that makes LKS guided inquiry is visually more appealing.

Feasibility Linguistic

The results of the feasibility analysis of each aspect of the language is presented in Table 4.

The feasibility analysis of language suggests that guided inquiry SWS in a very worthy criteria. That is the language used to describe and instruct activity in the SWS easily understood by students. This can be seen in the choice of words and sentence structure that is clear, simple, and according to the abilities of high school students, thus simplifying the delivery of messages and instructions to students. The language used in writing the SWS made attractive, understand, effective, does

not pose a double meaning, and are commonly used in written communication Indonesian. Words and phrases used in guided inquiry SWS refers to the rules of Indonesian and guided by Spelling Enhanced.

Reflection of language on guided inquiry SWS can be exemplified by the use of the word *you* as a greeting to the students to appear familiarity between the writer and the reader. The use of the second person as a greeting based on the opinions raised by Muslich (2010: 168) that the teaching material is said to be dialogical and interactive style of writing when placing the author as the first and the student (reader) as the second.

Feasibility Integration Value Creation

The feasibility of the integration of conservation values percentage reached 81.60%, which means that the integration of conservation values in guided inquiry SWS in a very decent criteria. Illustrations or images contained in SWS not only support the concept or the material being studied, but also contains moral messages are positive, namely value of discipline, responsibility, care for the environment, saving water, and paperless. Integration of conservation values in guided inquiry SWS aims to make students able to know and understand the positive messages contained in them so useful in everyday life. Through conservation education, will be embedded in students' personal conservation values that can contribute to the life of the nation, and when they graduate will be a cadre of conservation as capital in carrying out their own profession at a later date (Masrukhi, 2012) ,

Readability

Results of analysis of test data readability using hiatus tests showed that the percentage of legibility guided inquiry SWS is 80.00%. Based on the criteria Bormuth readability, the guided inquiry SWS to improve the

Table 3. Feasibility Analysis Results Presentation

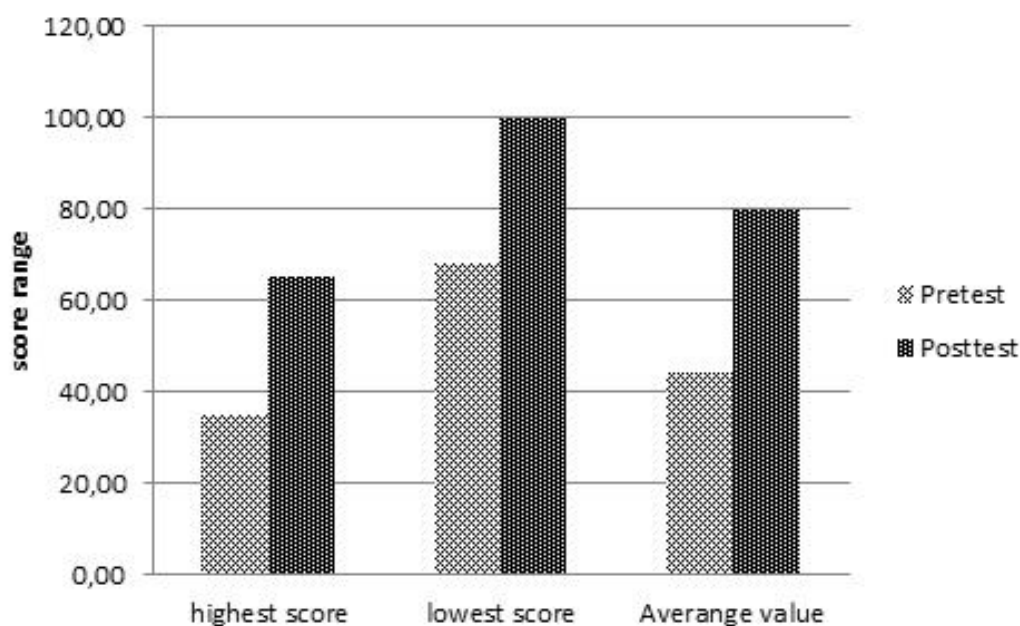
No.	Feasibility aspects Presentation	Score (%)	Criteria
1	Presentation Techniques	90.00	Very worthy
2	Presentation of Learning	92.00	Very worthy
3	Completeness Presentation	92.00	Very worthy
	Feasibility average of Presentation	91.33	Very worthy

Table 4. Results Feasibility Analysis Linguistic

No.	Aspects of Linguistic Eligibility	Score (%)	Criteria
1	Businesslike	85.33	Very worthy
2	Compliance with the rules of Indonesian	86.00	Very worthy
3	The use of terms, symbols, or icons	94.00	Very worthy
4	Communicativevv	92.00	Very worthy
	Feasibility average Linguistic	89.33	Very worthy

Table 5. Recap observations science process skills.

No.	Science Process Skills element	Each average percentage Meeting (%)		
		Meeting 1	Meeting 2	Meeting 3
1	Foresee	50	62	76
2	Research plan	58	68	79
3	Interpret	58	66	75
4	Communicating	59	67	76
5	Subsume	57	67	77
6	Observe	63	71	80
7	Apply	50	62	76

**Figure 1.** Average value pretest - posttest grade test SWS usage guided inquiry.

science process skills conservation value subject static fluids included in the criteria easily understood by students. This indicates that the writing guided inquiry SWS using appropriate language abilities of high school students, communicative, as well as the use of words and sentence structures are clear. Choice of words are easy to understand and use simple sentences that will facilitate the delivery of messages and instructions to students. Legibility aspects related to the ease of language (vocabulary, sentences, paragraphs, and discourse) both in text and in making the order for students to conduct learning activities. In addition, the writing material on SWS also use a type and font size adjustable typography rules.

Science Process Skills Students

Science process skills of observation results are presented in Table 5. Based on the analysis of the gain test, known to increase science process skills are in low and moderate criteria. This increase is due to the seven ele-

ments of science process skills through the development of grooves discovery raised the concept in every learning process. Students are given questions that provoke thinking skills so that they can follow the flow of the guided inquiry SWS. This is in accordance with the National Science Teachers Association (2004), which states that the purpose of teaching science is to focus on the skills of investigation, finding, for all children, stimulate interest in science and develop scientific berliterasi citizens.

Based on the analysis of the data showed that learning by using guided inquiry SWS can enhance science process skills. It is appropriate Sabahiyah research (2013) which states that guided inquiry learning model can improve the science process skills of learners, as with follow steps guided inquiry learning students can perform aspects of the science process skills. The results of appropriate research is also done by Brickman *et.al* (2009) which revealed that activity in the inquiry learning can

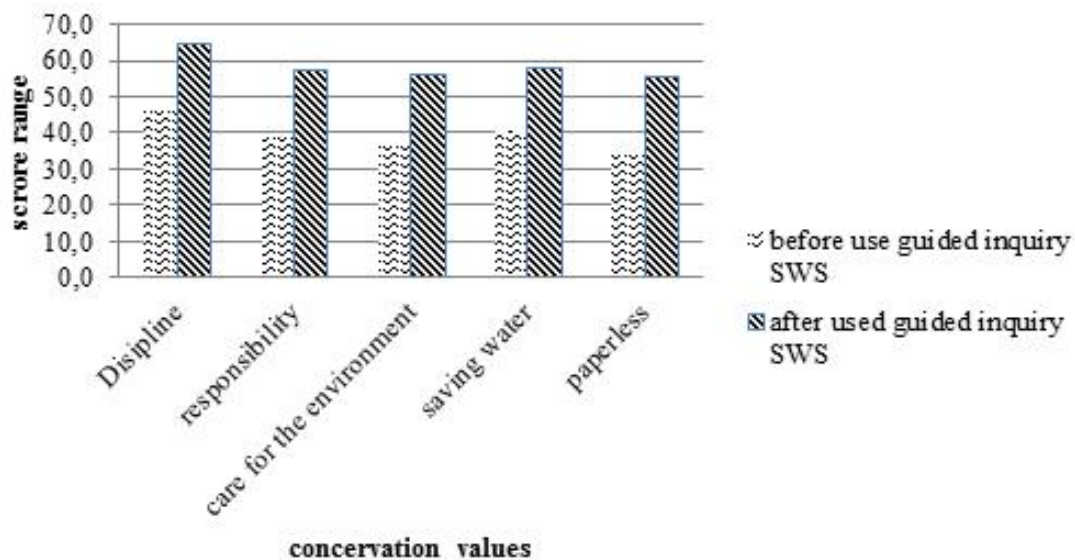


Figure 2. Increasing Students' Conservation Values

enhance students' skills and independence of the process. So also the result of research conducted by Amir (2012) proves that learning with practical method using inquiry-oriented worksheets can improve students' science process skills.

Students Concept

Understanding the concept seen from the cognitive learning (pretest and posttest) before and after using the guided inquiry SWS in learning. The average value of pretest and posttest values fluid material static test graders use SWS presented in Figure 1.

Increased understanding of the concept can be seen from the results of mastery learning, both individually and classically. Otherwise completed when the learning outcomes of students scored at or above 75. Data *pretest* values indicate have not students who achieve mastery learning. While the *posttest* value data showed that 26 of 34 students declared to have reached mastery learning, mastery learning means klasikal peak at 76.47%.

Based on analysis of test gain, increased understanding of the concept in the criteria of being with a gain of 0.6. This increase is due during studying is made differently than usual. If the learning is usually still centered on the teacher and the students just listening to the teacher and given a worksheet that contains practice questions alone, on learning that is now applied, students are given guided inquiry worksheets that can lead students to discover the concept of static fluids of the problems presented in a guided inquiry SWS. Thus, the learning will be centered on the student and the

student's attention towards learning will much trigger the involvement of students in each learning activity. Learning this kind will train students to conduct an investigation in order to develop self concept and invented the concept, as well as extend the concept of physical memory that are found are not easily forgotten.

Based on the results of data analysis proves that the use of guided inquiry worksheets in learning can improve understanding of the concept. This is consistent with research Yildirim *et al.* (2011) which showed that student achievement of learning using the worksheets that get better than without using worksheets. Development of SWS is one way to improve learning outcomes. Development of SWS with guided inquiry learning model is helpful in mastering the concepts of physics (Asmawati, 2015). This is in line with the results of research Amir (2012: 132) that prove that learning by using inquiry-oriented worksheets can improve the understanding of the concept.

Conservation Values

Guided inquiry SWS of static fluids material integrates five conservation value, value of discipline, responsibility, care for the environment, saving water, and paperless. Conservation value generated through work instructions and investigation activities. Fifth conservation values are implemented on learning activities through the worksheets in order to grow and can be applied in everyday life. Increased conservation values are presented in Figure 2.

Results of the data analysis questionnaire conservation values indicates that there

is an increase in the value of discipline before and after using the SWS. This suggests that guided inquiry worksheets can be used as a medium to develop the value of discipline. The research result Amelia *et al.* (2013) suggests the use of SWS integrated character physics effectively used in learning to develop character values of discipline. Results of research conducted by the same Khoirunnisa (2013) that the learning model based inquiry SWS can develop the discipline character to category entrenched. This shows that from the beginning the students have demonstrated timely arrival, using uniforms and attributes according to the rules of the school, obey the procedure or instructions of learning in SWS, and take or return the equipment used during an experiment in an orderly manner, so that at the end of the lesson, the students have started aware and familiar with applied learning.

The question and problem presented in a guided inquiry SWS should lead in student training for searching their answer from multiple sources to increase their knowledge. Therefore, students are always familiarize themselves to be serious in various activities.

Learning activities are not only performed in door (in the classroom and in laboratory), but also carried out door (outside the classroom). Either indoors or outdoors, the students always keeping the environment clean and do not damage equipment or existing plants. This shows students' awareness about the environment continues to grow. Research Zainuddin (2014) proved that the implementation of inquiry learning can form the characters become better environmental care. This is in line with research conducted Afiyanti (2013) states that learning by inquiry, attractive and can increase environmental awareness.

Water is a basic requirement for all living things on earth, not only humans but animals and plants also need water to survive. Because it is so vital role of water for life, it is required to maintain and conserve water. This value appears when students use enough water while doing lab work, do not let the faucet on, and use of excess water which is suitable to be used for watering the plants around their class.

Conservation values in the fifth integrated SWS guided inquiry is paperless. Paperless raised so that students can be directly involved in the degradation and prevention efforts to reduce global warming that threatens the safety of the earth. Paperless itself is done

by minimizing the use of paper that will reduce the felling of trees. Earlier, students used paper full potential, both for the record, do chores, or just scribble when empty hours. After getting used SWS guided inquiry learning, students began to reduce the use of paper by utilizing technological developments instead. The draft report was collected in the form sofffile and sent via e-mail.

Based on data analysis, there is an increase in the average score of students conservation values after using guided inquiry SWS of static fluids material. This suggests that guided inquiry worksheets proven can be used as a medium to develop conservation value.

CONCLUSION AND SUGGESTION

SWS compiled based on the characteristics of guided inquiry, combined with aspects of process skills. The results of due diligence consisting of feasibility content, presentation feasibility, appropriateness of language, and the integration of conservation values showed a guided inquiry SWS is very decent to support learning for physics resource in high school. Readability test results showed guided inquiry resource of static fluids material easy to understand students. Guided inquiry SWS of static fluids material can enhance science process skills and understanding of concepts students. Guided inquiry SWS can be used as a medium to develop conservation values, particularly the value of discipline, responsibility, care for the environment, saving water, and paperless.

Guided inquiry SWS requires strict time management, therefore the allocation of time must be considered. Development of conservation values are progressive, indirect unchanged as expected, but evolve over time. So as to obtain an increase in high of conservation values must be sustainable.

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