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# Developing Web-Students' Worksheet Based On Inquiry Training For Increase Science Literacy

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**Abstract.** Observation conducted by researchers at SMA N 1 Sorong indicate that teacher apply direct instruction model when learning physics. In addition, students tend to play HP and laptop during the lesson. Though the use of technology can be integrated in learning. The purpose of this research is to increase the literacy of science in physics learning by using web-LKPD based inquiry training model. The method used in this research and development 4D (define, design, development and dissemination). The research involved 60 students at SMA N 1 Sorong, each of which 30 students on the control and experiment class. Data were analyzed statistically using SPSS 17 software. The statistics test used Manova. The average pre-test post-tes value eksperiment class are 30 and 83 with N-Gain value 0,76 in high category, while the average pre-tes post-test value are 11 and 59 with N-Gain value 0,53 in medium category. The result of data analysis shows cohen's f value is 0,40 in high effect size which means that the web-LKPD based inquiry training gives a big effect on the ability of science literacy. Value of Hotelling's T2 test known significance value  $0.000 < 0,005$  can be concluded that there is a difference in the average literacy ability of science between students using Web-LKPD-based inquiry training with learning resources commonly used by teachers. Based on data analysis, web-LKPD based inquiry training help to improve science literacy can be an innovation to improve students problem solving ability in high school physics learning.

## 1. Introduction

Literacy skills in the 21st century according to NCREL consists of basic literacy, scientific literacy, economic literacy, technology literacy, visual literacy, information literacy and multicultural literacy [18][14]. This literacy is a literary science and generic skill. Literacy of science in Indonesia is low, seen from the results of PISA [16] published by OECD (organization for economic cooperation and development) shows the average score of 383. Literacy science plays an important role in 21st century learning which in his teaching requires a variety of high-level skills, demanding the ability to always learn in every change, reason, creative thinking, decision making and ability to solve problems [15]. This is supported by the statement, stating that science literacy is the main goal of science education in the world and should be nurtured as early as possible [7]. Basic attitudes as a scientific process for measuring the characteristics of science literacy are (1) adaptation/processing complexity of inventive Thinking, (2)



information literacy, and (3) high-level thinking and reasoning. Indicator of literacy ability of science that want to facilitation, can be seen in table 1 below:

**Table 1.** Indicator of literacy ability of science

| Aspect of Science Literacy                                 | Indicator   |
|--|---|
| 1. Adaptation/ processing complexity of inventive Thinking | 1. Recognize the concept of science to solve scientific problems<br>2. Produce a number of ideas to solve scientific problems |
| 2. Literation of information                               | 1. Identify the phenomenon of science in the media<br>2. Integrate old and new science concept information                    |
| 3. Thinking high level and reasoning                       | 1. Identify evidence<br>2. Recognize scientific questions<br>3. Solve critical questions about the concept of science         |

Physics learning should also improve students' thinking skills so that they are not only skilled in psychomotor but also able to think systematically, objectively and creatively [20][1]. Harwood argues that the need to cultivate learning skills focus on what is taught and how learners learn [8][5]. However, these skills are not well developed. According to the statistics of West Papua's open unemployment rate (TPT), it occupies the third highest national unemployment rate with a percentage of 7.52%. Based on interviews with local teachers, inadequate learning facilities, lack of laboratories, wifi, LCD projectors and books. This makes the inequality of learning optimization, thus making the lack of motivation and declining learning achievement of learners. This shows that learning optimization that develops and science literacy really needs to be improved.

Determination and use of appropriate Learning models will have an impact on good learning outcomes. The model of inquiry training is an effective model for teaching critical thinking and self-reliance to learners [8][9]. Learning with the Inquiry Training model emphasizes the analytical thinking process, which will compound the change of learners' achievement and motivation [19][10]. Model can improve the physical concept of physics and liveliness of learners, so it is well used to increase the literacy of science and generic skills [11]. Interesting learning with effective learning is derived from the right mix of models and learning resources. Learning resources can be obtained from learning tools that are developed maximally, be it syllabus, RPP, manual, material, worksheet and assessment. Worksheet of learners (LKPD) is one of the learning tools that support effective teaching and learning process. LKPD used in schools has weaknesses, generally compiled by publishers without the preparation of instructional materials adapted to the guidelines of BSNP, so it is not in line with the principles of curriculum. Development of teaching materials (such as LKPD) should refer to guidelines by meeting content standards, developed through needs analysis processes, and development should begin with syllabus and RPP. Another disadvantage is not being able to present movement, sequential events, not giving guidance to learners who have difficulty understanding the concept and can not accommodate learners who have low reading ability [21].

The integration of teaching materials and learning models into an appropriate medium can support multi-user and multi-tasking learning. Web media is believed to be one of the media that can encourage the created ability [17][3][4]. Learning design should include clarity of learning objectives (formulation, realistic), relevance of learning objectives with competency standard (SK)/ competency basic (KD)/

curriculum, coverage and depth of learning objectives, the accuracy of the use of learning strategies, interactivity, motivation, contextuality and actuality, completeness and quality of learning assistance materials, material conformity with learning objectives, material depth, ease of understanding, systematic, coherent, clear logical flow, clarity of description, discussion, examples, simulations, exercises, consistency of evaluation with learning objectives, appropriateness and assessment of assessment tools, and feedback evaluation results [19]. Web can support the learning design because the web has dynamic and interactive characteristics that can bridge two-way communication [6][13][2][12]. The combination of LKPD with the web media can help the effectiveness of the learning process, as well as sustaining 21st century learning. The making should be aligned with the inquiry training model used. Based on this study, this research is oriented to the development of Web-LKPD that can increase science literacy of high school students in physics learning, it is expected that this development also create an effective learning atmosphere, interesting, and physics concept conception on the matter of momentum and impulse easier, can improve student learning outcomes.

## 2. Methods

The research kind used is research and development 4D (define, design, development and dissemination), result product is web-LKPD based inquiry training to improve science literacy. This research was conducted at SMA Negeri 1 Sorong. The population used is all students of class X IPA, the sample is taken with technique saturated sampling and used X IPA 2 is eksperiment class and X IPA 1 is control class. Technique of collecting data using test instrument to know student learning result. Web development diagram LKPD-based Inquiry Training to increase literacy science of high school students in physics learning:

**Table 2.** Step Research 4D

| No | Step Research 4D | Prosedure development   | Result development   |
|----|------------------|---|--|
| 1  | Define           | Product design:<br>1. The material gathering stage.<br>2. The stage of designing the presentation of the material.<br>3. Stage to design the form of learning media | Result of analysis:<br>1. Identify the problem<br>2. Condition of high school students<br>3. Determination of KI, KD, Indicator<br>4. Determination of material<br>5. Determination of learning objectives |
| 2  | Design           | Analysis:<br>1. Pre-research<br>2. Analysis of learners<br>3. Concept analysis<br>4. Analysis of learning objectives  | Product:<br>Initial design of web-LKPD based inquiry training along with data collection instruments   |
| 3  | Development      | Development:<br>1. Instrument Validation  | Development results:<br>LKPD-based end product web-  |

| No | Step Research 4D | Prosedure development   | Result development  |
|----|------------------|---|---|
|    |                  | Data collection<br>a. The expert lecturer,<br>b. Revision<br><br>2. Product ratings Learning<br>a. Assessment of expert lecturers<br>b. Assessment of physics teachers<br>c. Revision<br><br>3. Learning trials<br>a. Trial is limited<br>b. revision | based inquiry training that can increase the literacy of science and generic skills   |
| 4  | Dissemination    | Dissemination:<br>Socialization through the distribution of a limited number of teachers and students   | Result:<br>Product dissemination is done in a limited way in SMA Negeri 1 Kota Sorong |

Model implementation in the test it self as follows:

**Table 3.** Model Implementation practice

| Class      | Test            | Implementation   | Test             |
|------------|-----------------|--|------------------|
| Experiment | <i>pre-test</i> | <i>Modeling and Implementation (web-LKPD based inquiry training)</i> | <i>post-test</i> |
| Control    | <i>Pre-test</i> | <i>Conventional learning</i>   | <i>Post-test</i> |

The data were analyzed statistically using SPSS 17 software. Then the data obtained from the instrument of student learning outcomes compared with the value of Minimum Exhaustiveness Criteria (KKM) is 75. The learning is said to be complete if the percentage of classical completeness is above 80% or is in good category.

### 3. Result and Discussion

Development Results: The visual features of the components contained in Web-LKPD based inquiry training on momentum and impulse materials are: (1) LKPD website home page which contains, (2)

home, (3) LKPD, (4) material, (5) phet and (6) developer profile. The following components displayed in the web-LKPD include the following:

**Table 4.** visual Web-LKPD

|                               |                           |                           |                                |
|-------------------------------|---------------------------|---------------------------|--------------------------------|
|                               |                           |                           |                                |
| <p>Front view of web-LKPD</p> | <p>View of web-LKPD 1</p> | <p>View of web-LKPD 1</p> | <p>Phet simulation display</p> |

Project learning activities explain the learning stages conducted by teachers and learners in accordance with the learning model used. So there needs to be a step adjustment from the standpoint of the scientific approach (5M) in the 2013 curriculum as well as the syntax of inquiry learning model. Summary of learning activities are presented in Table 1 below:

**Table 5.** Model of learning inquiry training with web-LKPD guided by Phet simulation

| Fase saintifik   | approach | Fase inquiry based learning in web-LKPD | Aktivites teacher                   | Students   | Media           |
|------------------|----------|---|-------------------------------------|--|-----------------|
| <b>Beginning</b> |          |   |                                     |  |                 |
| Looking          |          | Presenting the problem                  | Moderator of the discussion         | Pay attention to the problems presented by the teacher     | Video           |
| Question         |          | Collect and review issues               | Presenter of the project assignment | Discuss making hypotheses according to the problem on LKPD | <i>Web-LKPD</i> |
| Trying           |          | Organize, formulate, formulate, explain | training and                        | Scientific inquiry: PhET simulation                        | PhET            |
| Associate        |          | Analyze                                 | training                            | Discuss and answer questions on LKPD                       |                 |
| Communication    |          | Communicating the conclusion            | Moderator of discussion             | Present and discuss simulation results                     |                 |
| Close            |          | Evaluation                              |                                     |  |                 |

The data in this study is the value of students' knowledge obtained from pre-test and post-test in two dependent class. The test is given to class X IPA 1 and X IPA 2. The material pre-test and post-test is the same only the numbers and calculated variables are replaced so that learners not only answer because memorized only. The items of pre-test and post-test are 7 science literacy questions in the form of description. Item has different cognitive levels according to Bloom's revised taxonomy. The items on the pre-test and post-test are at C1-C4 level. So in scoring also use model politomus with different value weight. Participants are declared to pass if they are in minimal completion criteria (KKM) that is used that is 75. Based on scoring of learning result data learners obtained information as follows:

**Table 6.** Value pre-test and post-test

| No | Class       | Average  |           |        |
|----|-------------|----------|-----------|--------|
|    |             | Pre-test | Post-test | N Gain |
| 1  | Eksperiment | 30       | 83        | 0,76   |
| 2  | control     | 11       | 59        | 0,53   |

Table 4 shows that science literacy in class X IPA 2 as experimental class get average pretest value of 30 and mean posttest value equal to 83 and value of gain equal to 0,76 in high category. This suggests that there is an increase in science literacy during learning by using Web-LKPD. While class X IPA 1 as control class get average pretest value of science literacy equal to 11 and mean of posttest value equal to 59 and gain value equal to 0,53 in medium category.

The value can be analyzed manually or using SPSS software. Based on the analysis using SPSS with mahalanobis test that the sample comes from a population that is normally distributed. Impact of use Web-LKPD-based inquiry training on differences in literacy improvement in science by using effect size. The results of cohen's calculations are summarized in the table 7.

**Table 7.** Value *Cohen's f*

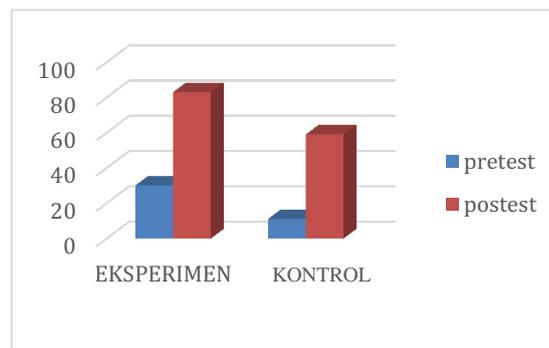
| No | Variable         | Eta Squared | Cohen's f | Interpretasi            |
|----|------------------|-------------|-----------|-------------------------|
| 1  | Science literacy | 0,376       | 0,40      | <i>high effect size</i> |

Based on the analysis, obtained the value of Cohen's f with the interpretation of high effect size on the science literacy variables, meaning that Web-LKPD-based inquiry training gives a big effect on the ability of science literacy.

**Table 8.** Result Hotelling's T<sup>2</sup>

| Statistic test             | F      | Sig   |
|----------------------------|--------|-------|
| Hotelling's T <sup>2</sup> | 26,022 | 0,000 |

Based on Hottelling'T2 analysis obtained sig value  $0.000 < 0.005$ , then H0 is rejected, can be concluded that there is a difference in the average literacy ability of science between students using Web-LKPD-based inquiry training with learning resources commonly used by teachers. The analysis of Hotelling'T2 it shows that there is a difference in both the science literacy capability of the experimental class and the control class shown in Figure 1.



**Figure 1.** increased science literacy

Based on the data analysis, web-LKPD based inquiry model can be an innovation to enhance students' achievement in learning Physics at senior high school. The results obtained that the use of web-LKPD-based inquiry training can improve the ability of science literacy in line with research conducted by Cara Gormally [11] and Peggy [18], which shows that learning literacy skills will increase with independent learning and have appeal in deepening the material when students have gained confidence. Likewise also with research by Danner [12], LKPD developed web-based that is easily accessible and enriched with the phenomenon that is displayed in narration as well as video in the presentation of materials and work of students, so as to attract students to be more interested in reading, trying and adding information as the initial concept in working on the problem. Other research that is in line with this research Peggy [18] which states that there is a relationship between creative learning with the web where by using the web students can improve thinking ability. the development of worksheet with guided inquiry approach can optimize the science process domain of learners with very good criteria and worksheet support learners learn achievement because by using worksheet the learning process will take place good and interesting [22][20].

#### 4. Conclusion

Web-LKPD based inquiry training on momentum and impuls lesson successfully developed and effective to applied in physics learning in senior high school. This is shown by the calculation of cohen's  $f$  of 0.40 with the category of high effect size. Based on the learning result using web-LKPD on momentum and impuls lesson, it was found that there is a significant difference related to literacy science between the experimental class using web-LKPD based inquiry training and the control class that did not used. Web-LKPD based inquiry training can be used by students anytime and anywhere. The animated features and simulation on this app can attract students' learning interest and improve their understanding of momentum and impuls lesson. Furthermore, web-LKPD based inquiry training can be one of the students' self-regulated learning resources and increased literacy science. These web-LKPD based inquiry training

can be implemented in physics learning or used independently by students. In addition, further research on the effect of other academic performance variables can also be practiced.

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