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Development and Validation of students' Worksheet Based on Guided-Inquiry to Improve Students' Scientific Literacy Skills of Junior High School on Straight Motion Concept

R.R. Sari^{1*}, Abdurrahman², K. Herlina³.

^{1,2,3}Physics Education, FKIP Universitas Lampung,
Jl. Prof. Dr. Sumantri Brojonegoro No. 1 Bandar Lampung, Lampung, Indonesia.

*ranirsari13@gmail.com

Abstract. The student worksheet that is currently used generally contain material and questions. A student worksheet is only used on certain materials, so it has not been an effective teaching material. This research aims to develop guided inquiry-based worksheets to improve the ability of Scientific literacy in straight-motion material. The method used in this study is research and development. The research design used in this development refers to Lee and Owens with stages consisting of analyzing, design, development, implementation, evaluation. The worksheet developed has very high validity. This can be seen based on the average score on the material expert test of 0.90 with very high validity criteria and the design expert test obtained an average score of 0.90 with very high validity criteria. Based on the readability test obtained an average score of 0.85 with a very good category. The worksheets developed have been able to improve students' scientific literacy abilities. This can be seen from the n-gain test results of 0.8 with high criteria, and sig values. in the paired sample t-test of 0,000. Teachers and students also give a good response to the worksheet. The conclusions of this study are valid guided inquiry-based worksheets to improve students' literacy skills.

1. Introduction

Development of the world in the 21st-century occurs very rapidly following the era of globalization which is marked by the increasingly associated science and technology. The rapid development of science and technology can affect various fields of life, one of which is in the field of education. Especially in the current science education students are directed to be able to prepare for the life to be successful in the 21st century. One of the skills needed by students in the 21st century is scientific literacy [1]

The guided inquiry learning model in research conducted by [2] states that students involved in learning using the guided inquiry model make students more active and Inquiry-based learning enables integration of various disciplines [3]. Guided inquiry-based learning according to [4] emphasizes the active participation and responsibility of students in finding new concepts for students. Guided inquiry-based learning according to [4] is an educational strategy in which students follow the methods and practices carried out by educators to build knowledge. According to [5] guided inquiry can also be defined as a process of finding new simple relationships, by way of students formulating hypotheses and then testing them by conducting an investigation [3].



The use of guided inquiry learning models in the learning process in the classroom according to [6] can practice students' scientific literacy skills in reporting scientifically, designing investigations and summarizing the results of investigations. The guided inquiry learning model can be applied in learning to improve students' scientific literacy abilities [7, 8]. Based on the results of previous studies to improve students' scientific literacy skills, it is necessary to improve the learning process through teaching materials based on guided inquiry, so students are expected to achieve optimal competence.

Pre-research activities conducted by researchers are conducting interviews and distributing questionnaires. Interviews were conducted with 12 students of class VIII and 4 teachers of science subjects aimed at knowing the learning process and learning resources used in schools. The distribution of questionnaires was addressed to 4 natural science teachers in the Semaka sub-district and students in Semaka 1 Middle School class VIII A for the 2017-2018 Academic Year, class VIII A was chosen randomly based on the recommendation of science teachers in the school. Based on the background of the problem, development research has been carried out entitled "Development of Guided Inquiry-Based Worksheets Based on Improving the Literacy Skills of Middle School Students on Straight Motion Materials".

2. Method

This type of research is research and development or research and development with a mixed-methods approach that adapts to [10]. Mixed methods are used to analyze the data of research results conducted in this study by combining qualitative data with quantitative data. The development design used in this research is the development model ADDIE (Analyze, Design, Development, Implementation, and Evaluation) adapted from [11]. The product developed in this study was a guided inquiry-based student worksheet to improve students' scientific literacy skills on straight motion material. In the product development process, a product validation test will be carried out consisting of a material test and a design test.

The development procedure in this study adapted the ADDIE development model by Lee and Owens. The development procedure consists of five stages, namely analysis (analyze), design (design), development (development), application (implementation), and assessment (evaluation). The instrument used in this study was a matter of pretest and posttest questionnaire and interview guidelines. The data collection technique used in this study is a mix-method that combines quantitative and qualitative approaches simultaneously. Quantitative data were obtained using pretest and posttest questions and questionnaire methods, while qualitative data were obtained using interview methods.

The data obtained in the data collection stage is in the form of qualitative data and quantitative data that need to be analyzed using a mix-method. The mix-method data analysis technique used in this study is by combining qualitative data with quantitative data. Data analysis of the results of interviews was used to determine the responses of teachers and students to the worksheet design that was developed for use in the learning process. The data analysis technique of interview results is carried out using, simplifying, narrating data, drawing conclusions. Quantitative data in this study are the results of questionnaire data conducted by the validator and students, the results of the pretest and posttest answers were analyzed using the normality test, then-gain value, and paired sample t-test.

3. Result and Discussion

The results of this development research are student worksheets based on the guided inquiry on straight motion material that can be used by the teacher as teaching material during the learning process. The first step is analyzing the needs to find out the potential and problems in the school. Based on the results of the needs analysis, the information is obtained that the worksheet is made by the subject teacher and is only used on certain materials, the teacher does not use the worksheet directly because the teacher has no time to make the worksheet. Students have a low ability to do the questions in the worksheet. As many as 60% of students like science lessons using worksheets created by teachers. As many as 77.14% of students stated that they felt difficulty in understanding the contents of the worksheet used now because the arrangement of worksheets was not systematic and lack of instructions for using worksheets.

The second step is the researchers make product designs based on achievement indicators. At this stage, the researcher makes a student worksheet framework design consisting of product design and storyboarding. The researcher also makes an assessment sheet that will be used to assess/test the product being developed. The assessment sheet is in the form of a material expert test questionnaire and a design expert test questionnaire which will be conducted by three validators. This stage resulted in the first draft which is a product that was developed in this study.

The third stage of this research is that the researcher develops the product by conducting a product validation test conducted by three validators. The product validation test consists of a material expert test and a design expert test. The results of the assessment in the material expert test questionnaire can be shown in Table 1.

Table 1. Material Expert Test Results

No	Rated Aspect	Testers' Score	Qualitative Statement
1.	The suitability of the content of the worksheet	0,91	Very high validity
2.	Worksheet Construction	0,89	Very high validity

The results of the assessment on the design expert test questionnaire can be shown in Table 2.

Table 2. Design Expert Test Results

No.	Rated Aspect	Testers' Score	Qualitative Statement
1.	Format	0,86	Very high validity
2.	Attractiveness	0,89	Very high validity
3.	The shape and size of the letters	1,00	Very high validity
4.	Consistency	0,92	Very high validity
5.	Physical quality	0,83	Very high validity

Based on the test results of the material and design experts it can be concluded that in all aspects of the assessment has very high validity so that the product can be used as teaching material in the learning process.

The next step taken at the implementation stage was to conduct a small group trial consisting of the readability test and the effectiveness test by 12 grade VIII students at SMPN 1 Semaka. Every student testing used in the study is given the same treatment. Students are given a product that has been tested by three validators, and then students are given a readability test questionnaire. The readability test questionnaire consisted of 14 questions which were divided into several aspects of the assessment, namely aspects of excellence, convenience, and usefulness of the worksheet. The results of the readability assessment questionnaire test by students of the worksheet developed can be shown in Table 3.

Table 3. Readability Test Results

No.	Rated Aspect	Testers' Score	Qualitative Statement
1.	Victory	0,82	Very Good
2.	Ease of Use	0,84	Very Good
3.	Usage of Use	0,90	Very Good

Based on the score of the readability test results above, it was concluded that all aspects assessed were very good so that the worksheet can be used as teaching material in the learning process. Students and teachers were also asked for their opinions on the guided inquiry-based worksheets by conducting interviews which were then used by researchers as qualitative data.

Based on the responses or opinions of teachers and students to inquiry-based worksheets, it can be known overall that the worksheets developed are already good and can be used as teaching material in class. The effectiveness test is carried out to determine the effectiveness of the product. All students who will conduct effectiveness tests are given a valid guided inquiry-based worksheet. The treatment

given to students is to do a pretest, do learning using worksheets, do a posttest, and fill out the readability test questionnaire. The pretest and posttest questions gave consisted of five questions with the type of questions being a reasonable multiple choice. The indicator used in the problem is an indicator of the ability of scientific literacy. Pretest and posttest answers were assessed using the rubric of scientific literacy ability assessment according to. The results of these answers were tested using a normality test to determine whether the data distribution was normal or not. The normality test is carried out with the help of the SPSS 22 program. The results of the normality test can be shown in Table 4.

Table 4. Normality Test Results

Data	Sig.	Information
<i>Pretest</i>	0,966	Normal
<i>Posttest</i>	0,586	Normal

Based on the value of sig. obtained on the pretest data, which is equal to 0.966 and sig. in the posttest data of 0.586 it can be said that the results of the pre-test and post-test answers are normally distributed. The data is then analyzed to find out the increase in students' scientific literacy skills using n-gain. The n-gain value is obtained with the help of the Microsoft Excel program. the results of calculations using n-gain can be shown in Table 5.

Table 5. The Result of N-Gain Value of Scientific literacy ability

\sum Score		\sum N-Gain Score	Criteria
\sum Pretest	\sum Posttest		
41,00	87,33	0,8	High

Based on the results of the average n-gain value, which is equal to 0.8, it can be seen that students experience an increase in the ability of scientific literacy with a high category. Test the improvement of students' scientific literacy skills (test hypotheses) that can be done by a paired sample t-test. The paired sample t-test was carried out with the help of the SPSS 22 program. Data of paired sample t-test results can be shown in Table 6.

Table 6. Paired Sample T-Test Results

Data	Mean	T	Df	sig.
<i>Pretest posttest</i>	-46,33	-24,748	11	0,000

Based on the paired-sample t-test results obtained sig. of 0,000 which means there is an increase in the ability of scientific literacy after using guided inquiry-based worksheets. This can be seen in the value of sig. obtained <0.05 so that H1 is accepted. The average increase in scientific literacy ability is 46.33.

The last step is the evaluation phase used to measure the feasibility of the worksheets that are developed. Based on the results of the validation test of the material and design test, the worksheets developed were already feasible to use. This can be seen from the average score of material expert test validity of 0.90 with very high validity criteria. The results of the design expert validity test get an average score of 0.90 with very high validity criteria. Based on the practicality test student worksheet that was developed was interesting, easy, and useful. This can be seen from the average score on the attractiveness aspect of 0.82 with very good criteria. The ease of use aspects of student worksheet gets an average score of 0.84 with very good criteria. Aspects of the use of student worksheets get an average score of 0.90 with very good criteria. Based on the effectiveness test, the worksheets developed effectively can improve students' scientific literacy skills. This can be seen from the n-gain value of 0.8 with high criteria, and the value of sig. in the paired T sample test of 0,000.

The discussion on the development of inquiry-based worksheets is guided in the material of straight motion, which outlines the suitability of worksheets developed with the aim of development and explains the advantages and disadvantages of worksheets. This development aims to produce guided

inquiry-based worksheets to improve students' scientific literacy skills. This worksheet is expected to be used as teaching material in class.

The resulting guided inquiry-based worksheets have several advantages and disadvantages. The advantages of the worksheets developed, which are interesting to read, there are everyday phenomena that are easily found. Worksheets are designed to be done in groups, especially in experimental activities so students are easier to solve problems. This worksheet also has drawbacks, that is, this worksheet is one of the print media making it less practical to carry.

4. Conclusion

The conclusions of this study are as follows: The worksheets that are developed are valid and appropriate to use. This can be seen in the material expert test obtaining an average score of 0.90 with very high validity criteria, the design expert test obtaining an average score of 0.90 with a very high validity criterion. The worksheets developed are interesting, easy and useful. It can be seen the average score of attractiveness aspects of 0.82 with very good criteria. The average score of the aspects of ease of use is 0.84 with very good criteria. The average score of aspects of the use benefit is 0.90 with very good criteria. Worksheets developed effectively can improve students' scientific literacy skills. This can be seen from the n-gain value of 0.8 with high criteria and sig values. in the paired t sample test of 0,000 which means there is an increase in students' scientific literacy abilities. This development research suggests that teachers should have used innovative student worksheets in learning and the methods to be used.

References

- [1] OECD PISA 2015 Draft Mathematics Framework 2013.
- [2] H. Komikesari 2016 Peningkatan Keterampilan Proses Sains Dan Hasil Belajar Fisika Siswa Pada Model Pembelajaran Kooperatif Tipe Student Team Achievement Division *J. Kegur. dan Ilmu Tarb* **01** 1 15–22
- [3] S. Latifah 2016 Pengembangan Lembar Kerja Peserta Didik (LKPD) Berorientasi Nilai-Nilai Agama Islam melalui Pendekatan Inkuiri Terbimbing pada Materi Suhu dan Kalor *J. Ilm. Pendidik. Fis. Al-Biruni* **5** 1
- [4] Liu, W. Steve Chi, S.-C., Friedman, R., & Tsai, M.-H 2009 Explaining Incivility in the Workplace: The Effects of Personality and Culture. *Negotiation and Conflict Management Research*. **2** 2 164–184.
- [5] Matthew, Bakke M., & Kenneth, Igharo O. 2013 A Study on the Effects of Guided Inquiry Method on Students Achievement in Logic. *International Researchers*. **2** 1 135-140
- [6] Jong & Joolingen. 1998. Scientific Discovery Learning with Computer Simulation of Conceptual Domains. *SAGE Journals*. **68** 2 1179-201.
- [7] Kaselman, Alla. 2003 Supporting Inquiry Learning by Promoting Normative understanding of Multivariable Causality. *Wiley Online Library*. **40** 9
- [8] Pedaste, Margus. Maeots, Mario. Siiman, Leo. Jong, Ton de. Riesen, Siswa A.N. Van. Kamp, Ellen. Manoli, Constantinos. Zacharia, Zacharias C. Tsourlidaki, Eleftheria. 2015. Phase of Inquiry-Based Learning: Definitions and the Inquiry Cycle. *Educational Research Review* 14 47-61
- [9] Gormally, C., Brickman, P., & Lut, M. 2012 Developing a test of scientific literacy skills (TOSLS): Measuring undergraduates' evaluation of scientific information and arguments. *CBE Life Sciences Education* **11** 4 364–377
- [10] Lelawati, Nur 2015 Penerapan Model Pembelajaran Inkuiri untuk Meningkatkan Literasi Sains Siswa pada Konsep Sistem Pertahanan Tubuh Kleas XI di MAN Babakan Ciwaringin.
- [11] Nehru, N., & Syarkowi, A. 2017 Analisis Desain Pembelajaran Untuk Meningkatkan Literasi Sains Berdasarkan Profil Penalaran Ilmiah. *WaPFi Wahana Pendidikan Fisika* **2** 1 20–24.
- [12] Shellawati, S., Sunarti, T., Fisika, J., & Surabaya, U. N. 2018 Penerapan Model Pembelajaran Inkuiri Terbimbing Untuk Meningkatkan Kemampuan Literasi Sains Peserta Didik Sma. *Inovasi Pendidikan Fisika* **7** 3 407–412.

- [13] Creswell, John W. 2014 *Research Design: Qualitative Quantitative, and Mixed Methods Approach*. SAGE Publication, United States of America. 4.
- [14] Lee, W. W., & Owens, D. L. 2004 *Multimedia-Based Instructional Design*. Pfeiffer, San Francisco h. 4

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