

Development of Student Worksheets Based on Guided Inquiry in Biology Learning to Improve the Scientific Literacy of Class X High School Students

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Abstract. The research aims to determine the feasibility and effectiveness of guided inquiry-based worksheets. This type of development research with the Borg & Gall model. Test the effectiveness of LKPD using pre-experimental research. The test subjects were class X students. Data collection techniques included observation, interviews, questionnaires, and test questions. Data analysis technique using descriptive analysis. The results showed that the developed guided inquiry-based LKPD was stated to be very good or very feasible based on the results of validation of material experts, validation of learning design experts, biology teachers, individual group trial results, small group trial results, large group trial results, and improvement students' scientific literacy in the medium category. The results of the effectiveness test using the paired sample test obtained a sig value of $0.00 < 0.05$ so that the Guided Inquiry-based LKPD is effectively used in the learning process and can increase students' scientific literacy.

Keywords: Development, LKPD, Guided Inquiry, Biology, Science Literacy

1 Introduction

The implementation of the 2013 Curriculum, especially in biology subjects in high school, has changed the paradigm and learning from teacher-centered to student-centered learning. Student-centered learning, the 2013 curriculum mandates five basic learning experiences, namely; observing; asking; collect information; associate; and communicate [1] Biology learning also refers to the nature of science which contains four elements, namely: processes (scientific processes), products (scientific products), attitudes (scientific attitudes) and technology [2]. So teachers need to provide teaching materials that support more active teaching and learning, one of which is Student Worksheets which are used for students in more focused learning activities. The inquiry learning model is in line with the characteristics of the 2013 curriculum, namely scientific [3].

The implementation of the 2013 curriculum as a guide for implementing the educational process is an effort aimed at meeting the demands of 21st century education, including training students to develop all their potential, so that they can become graduates who are competent, have character, are skilled, and have literacy skills. Scientific literacy is the ability to solve problems based on a person's scientific knowledge [4]. According to [5] it is very important for teachers to provide students with scientific literacy skills, with the aim of making students become people who have an understanding of science and can develop the ability to think creatively, think logically, think critically, be able to master technology, and can adapt to developments over time (OECD, 2015). [6] stated that to achieve the demands of scientific literacy indicators optimally, the learning process of students needs to be facilitated with appropriate teaching materials, one of which is the Student Activity Sheet [LKPD].

Student activity sheets are assignment sheets accompanied by assignment completion guidelines in them [7]. Teaching materials in the form of LKPD are prepared or designed to achieve certain learning objectives or competencies set out in the 2013 curriculum. Based on National Education Ministerial Decree number 24 of 2007 concerning facilities and infrastructure, LKPD itself is included in the category of library facilities as a learning resource for students in learning activities. Student activity sheets used in learning will provide maximum results and can practice scientific literacy skills if accompanied by the use of appropriate learning models [8] The use of LKPD will not provide satisfactory results without the application of a particular learning model as a reference. One of the existing learning models that supports the 2013 curriculum is Inquiry Learning . Inquiry, in English to inquiry, means participating, or being involved, in asking questions, seeking information, and carrying out inspection investigations [9]. As stated by [3] the inquiry learning model is in line with the characteristics of the 2013 curriculum, namely the scientific approach. This is in line with [10] statement that guided inquiry is a type of inquiry learning model intended for students who are not used to learning with discovery learning , because guided inquiry provides more direction for students who are not ready to solve problems with inquiry without assistance due to lack of experience and knowledge.

Based on the results of interviews that were also conducted with several biology subject teachers at SMA Negeri 1 Tigalingga, it was found that the teaching materials used during the lesson, namely textbooks and worksheets used only contained a summary of the material and a list of questions. The LKPD used also does not fully contain steps that train and accustom students to carrying out scientific processes such as being able to formulate problems, hypothesize, analyze, observe, and make conclusions, so that they do not reflect the scientific approach that currently should have been applied in accordance with the 2013 Curriculum criteria. The findings from the observations and interviews were also supported by the results of the student needs analysis questionnaire given to 66 class X students who stated that they had never used inquiry-based student worksheets (LKPD) in biology learning as much as 100%, and needed to use LKPD in biology learning as much as 80%, and the need to use guided inquiry-based LKPD in biology 7 learning as much as 87.7%.

Student Activity Sheets (LKPD) based on guided inquiry on biology material are LKPDs which are arranged using the syntaxes of the guided inquiry learning model [11] Guided inquiry-based student activity sheets developed in biology learning are expected to be able to help students improve their scientific literacy skills. According to [12] the use of guided

inquiry-based worksheets in the learning process can train students to carry out scientific activities and develop scientific literacy skills and students' thinking skills.

Based on this, it is very supportive if learning uses learning resources in the form of LKPD which can make students active and understand concepts. So a Student Worksheet [LKPD] based on guided inquiry was developed for biology learning in class X semester 2 which can increase scientific literacy to help teachers and students in learning activities. This research aims to produce guided inquiry-based LKPD that is suitable for use to increase the scientific literacy of class X MIA students at SMA Negeri 1 Tigalingga in semester 2 biology material through validity and effectiveness testing. This is in line with the statement by [13] that Student Worksheets Based on Guided Inquiry on Fungi Material for Class And [14] stated that the guided inquiry-based LKPD that was developed was practical and effective, through limited trials showed that the implementation of learning obtained a minimum score of 79, student activities obtained a minimum score of 77, with minimum good criteria; and student learning outcomes based on N-gain calculations obtained a minimum score of 79 with minimum high criteria.

2 Method

This type of research is development [research and development]. As stated by [15] states that development research is a process used to develop products and validate products. This study uses the development model from Borg and Gall adopted by Sugiyono. The products developed will be tested for validity and effectiveness. In this research, the development stage of Borg and Gall will be carried out until the 7th stage, namely preliminary studies, planning, developing initial product formats, initial product validation, initial product revisions, field trials and revisions to field trial results. The researcher simplified the ten stages into seven stages, namely only until product revision after field trials were carried out, namely the implementation of worksheets in the biology learning process to find out the increase in students' scientific literacy. This is in line with Borg's opinion in Wina Sanjaya that these ideal stages can be simplified without reducing the value of the research and development itself [16].

The research subjects used in this study were students of class X MIA SMA Negeri 1 Tigalingga. This trial was to find out students' responses to the developed guided inquiry-based LKPD. Product trials were carried out by means of individual group trials, small group trials and limited group trials. The experimental design used by researchers is Pre-Experimental Designs [non-designs]. In this experimental design there is no control variable [control class] and the sample is not randomly selected [15]. Design in the form of One Group Pretest Posttest or before-after design. In this design, at the beginning of the study a measurement was made of the dependent variable that had been owned by the subject after being treated, measurements were made again with the same measuring instrument.

Data collection techniques were carried out by observation, interviews, questionnaires and test questions. The instruments used were interview lists, validation questionnaires, response questionnaires and scientific literacy test questions. Validation is used to obtain data on the validity of LKPD, response questionnaires and test questions are used to obtain data on the effectiveness of LKPD based on increasing students' scientific literacy. The validity

instrument includes instruments that are adjusted to the data to be obtained based on research needs. Without the right instruments, research will not produce anything as expected [17].

Data analysis techniques obtained in this study were analyzed using descriptive analysis techniques. The descriptive data that will be obtained in this research is research data obtained from material expert validation questionnaires, learning design expert validation, biology teacher and student response questionnaires made in the form of a Likert Scale equipped with scores. Next, the data will be analyzed descriptively by calculating the percentage score for each criterion on the LKPD which is created using a formula. From the results of calculations using the formula above, the numbers are obtained in the form of percent (%). Then the scores are described with qualitative sentences. Testing the effectiveness of LKPD is carried out by analyzing the scientific literacy achieved by students. The test was carried out in two ways, namely the t test and the N-Gain test for students' achievement of scientific literacy.

3 Results and Discussion

Based on the results of observations, the results of interviews with teachers and the results of student questionnaires, as well as literature/field studies of the teaching materials used, student activity sheets, learning processes, and evaluation of learning outcomes in class X Semester 2 biology learning, a Student Worksheet was developed (LKPD) which is designed using a guided inquiry learning model to increase students' scientific literacy in biology learning for class X MIA. The LKPD that has been designed is tested for feasibility through validation by experts in the field and trials to see its practicality and effectiveness.

3.1 Material Expert Validation Results

Guided inquiry-based LKPD validation was carried out with 2 material expert lecturers. The summary of the results of the feasibility assessment of the guided inquiry-based LKPD is presented in Table 1. below.

Table 1. Material Expert Validator Results

No.	Validator	Assessment Aspects			Total Score	Percentage
		Contents	Presentation	Language		
1.	Validator 1	30	38	34	102	88.70%
2.	Validators 2	31	37	34	102	88.70%
	Amount	61	75	68	204	
	Total score	70	80	80		
	Percentage	87.14%	93.75%	85%		88.70%
	Criteria	Very good/ very worthy	Very good/ very worthy	Very good/ Very worth it		Very good/ Very worth it

Table 1 shows that the results of the material expert validator in the form of assessment scores relating to learning material consist of 3 component aspects, namely content aspects, presentation aspects and language aspects, indicating that the feasibility of guided inquiry-based LKPD is 88.70% which is included in the very good category/ worthy.

3.2 Learning Design Expert Validation Results

Guided inquiry-based worksheet validation was carried out with 2 learning design expert lecturers. The summary of the results of the feasibility assessment of the guided inquiry-based LKPD is presented in Table 2. below.

Table 2. Results of Learning Design Expert Validators

No.	Validator	Assessment Aspects				Total Score	Percentage
		Didactic	Construction	Technical	Guided Inquiry		
1.	Validators 1	15	23	39	34	111	96.52%
2.	Validators 2	13	21	32	35	101	87.82%
	Amount	28	44	71	69	204	
	Total Score	30	50	80	70		
	Percentage	93.33%	88%	88.75%	98.57%		92.17%
	Criteria	Very good/ Very worth it	Very good/ Very worth it	Very good/ Very worth it	Very good/ Very worth it		Very good/ Very worth it

Table 2 shows that the results of the learning design expert validator in the form of related assessment scores consist of 4 component aspects, namely didactic aspects, construction aspects, technical aspects and guided inquiry aspects, indicating that the feasibility of guided inquiry-based worksheets is 92.17% which is in the very good category /worthy.

3.3 Results of Biology Teacher Responses

Evaluation from teachers in the field of biology studies on the development of guided inquiry-based worksheets was carried out with 2 biology teachers. The summary of the results of the feasibility assessment of the guided inquiry-based LKPD is presented in Table 3 below.

Table 3. Results of Biology Teacher Responses

No.	Validator	Assessment Aspects				Total Score	Percentage
		Appearance	Quality of material presentation	Quality of student activities	Guided Inquiry		
1.	Validators 1	23	23	17	30	93	93%
2.	Validators 2	21	22	18	26	87	87%
	Amount	44	45	35	56	180	
	Total Score	50	50	40	60		
	Percentage	88%	90%	87.5%	93.3%		90%
	Criteria	Very good/ Very worth it	Very good/ Very worth it	Very good/ Very worth it	Very good/ Very worth it		Very good/ very decent

Table 3 shows that the biology teacher's assessment is in the form of an assessment score for 4 aspects of the assessment consisting of: (1) LKPD display; (2) quality of material presentation; (3) the quality of student learning activities; and (4) the guided inquiry-based learning component, showing that the feasibility of guided inquiry-based worksheets is 90% which is in the very good/proper category.

3.4 Student Trial Results

After obtaining the results of the assessment from the biology study teacher, this research was continued by assessing the responses of the X MIA class students at SMA Negeri 1 Tigalingga. The first assessment is carried out individually. Individual group trials were carried out on 3 class X MIA students consisting of 1 (one) high ability person, 1 (one) medium ability person, and 1 (one) low ability person. After conducting individual group trials, it is continued with small group trials. The small group trial was carried out in class X MIA 2 with a total of 12 people. After that, it was continued with a large group trial carried out on all students in class X MIA 2, totaling 36 people. The summary of the trial results of the guided inquiry-based LKPD is presented in Table 4 below.

Table 4. Results of Student Trials

Assessment Aspects	Individual Group	Small Group	Big Group
Appearance	84%	81.67%	81.44%
Quality of material presentation	86.67%	79%	82.56%
Quality of student activities	88.33%	82.50%	80.69%
Guided Inquiry	90%	85.56%	84.81%
Percentage	87.33%	82%	82.58%
Category	Very good/ Very worth it	Very good/ Very worth it	Very good/ Very worth it

Table 4 shows that the trial results are in the form of assessment scores for 4 assessment aspects consisting of: (1) LKPD display; (2) quality of material presentation; (3) the quality of student learning activities; and (4) the guided inquiry-based learning component, showing that the feasibility of guided inquiry-based LKPD is 82.58% which is in the very good/proper category.

3.5 Results of LKPD Implementation

After making improvements to the guided inquiry-based worksheets that have been developed according to suggestions and input from material expert validators, learning design expert validators, as well as responses from teachers and students. Then LKPD is implemented in the process of teaching and learning activities in schools to measure effectiveness through increasing students' scientific literacy. The effectiveness of guided inquiry-based worksheets can be seen from the results of the pre-test and post-test during field tests or large groups. Effectiveness can be seen from the students' activities, student responses and the level of mastery of the students' material which can be seen from the increase in student learning outcomes through the pre-test and post-test [18]. This is relevant to research conducted by [14] that the results of observing the effectiveness of the learning tools developed are seen from the assessment of student learning outcomes and scientific literacy.

On the results of scientific literacy, the normality test showed 0.219 for the pretest and 0.226 for the posttest which indicated that $\text{sig } 0.219 > \text{sig } 0.05$ and $0.226 > 0.05$ so it can be

concluded that the pretest and posttest data were normally distributed. Then proceed with the pretest and posttest data homogeneity test with the help of SPSS Statistics version 22. The results of the data homogeneity test get a sig value of $0.290 > 0.05$ meaning that the data have the same variance so the researcher uses parametric statistical techniques for data analysis, because the results of the normality test shows that the data is normally distributed and the data homogeneity test has the same variance. The next step, the researcher calculated the average difference in the pretest and posttest results using the paired sample t-test with the help of SPSS Statistics version 22. The results of the test using the help of SPSS Statistics version 22 obtained a significance value of less than 0.05, namely $0.000 < 0.05$. These results show that H_0 is rejected and H_a is accepted. Thus, there is a significant difference between students' scientific literacy before and after using guided inquiry-based worksheets. So it can be concluded that guided inquiry-based worksheets are effectively used in the learning process and can improve students' scientific literacy.

This is in accordance with [14] whose research results show that guided inquiry-based worksheets are used effectively because in limited trials, there is an increase in students' learning outcomes and science literacy scores before and after learning using the inquiry learning model. Overall the pre-test mean score was 21.65 and the post-test mean score was 78.5, resulting in an N-gain score of 0.72. This result is in the range > 0.7 , meaning the criteria for learning with high gain. This was also reinforced by [19] which stated that the developed guided inquiry-based worksheets were effective for improving science process skills with an average N-Gain score of 0.77 and were effective in increasing learning outcomes with an average N-Gain score. 0.79.

4 Conclusion

That the guided inquiry-based LKPD that had been developed could be used to increase scientific literacy in biology learning for class worthy. The guided inquiry-based worksheets that have been developed are effective for increasing students' scientific literacy.

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