

# *Development of Student's Worksheet with Inquiry Learning Model on Ecological and Environmental Changes for Class X Senior High School*

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**Abstract** – The results of observations have shown that student learning outcomes in ecological and environmental changes are still low. Students are less motivated and passive in the learning process because the learning process centered on teachers and teaching materials do not help students learn. Therefore, it needs to be designed worksheet with the inquiry approach. Inquiry approach can increase motivation and critical thinking skills of learners. The purpose of this study was to produce a worksheet with inquiry approach about the ecological and environmental changes. This study was designed as a research and development by using models of IDI, which consists of three phases, the definition, development and evaluation. Data were collected through validity by lecturers and teachers, the practicalities by teachers and students, the observation by the observer for the assessment of affective, psychomotor and cognitive. The results of this study are worksheets with inquiry approach about ecological and environmental changes are very valid and very practical. Learning outcomes is effective in critical thinking skills, affective, psychomotor, and cognitive competencies in excellent categories. Based on the results, it can be concluded that the worksheet with the inquiry approach about ecology and environmental changes are valid, practical, and effective.

**Keywords** – Development, Worksheet, Inquiry Models, Ecology, Environmental Change.

## I. INTRODUCTION

Education has an important role in the intellectual life of the nation. The purpose of education contained in UU RI No. 20 Year 2003 Article 1, paragraph 1 of the National Education System. Education is a conscious effort planned to create an atmosphere of learning and the learning process so that learners are actively developing the potential to have the spiritual power of religion, self-control, personality, intelligence, noble character, and skills that needed for himself, the community, the nation and the State (Permendikbud No. 22, 2016).

Each school institutions must use National Education Standards (NES) to achieve the educational goals. The curriculum is one of the essential components contained in the NES. Rusman (2011:1) said that curriculum is one of the important elements to realize the development process of the quality of students. The curriculum prevailing in Indonesia at this time is 2013 curriculum

Biology is one of the subjects that relevant with the 2013 curriculum. Suharno (2014:14) states biology including one

of the subjects in the implementation of scientifically-based learning with creative model learning. To execute creative learning process, it takes the role of a teacher. A teacher must be creative to design, manage, and assess learning outcomes of students.

A teacher must make arrangements before they start the learning activities so that the learning process becomes systematic, effective and engaging for learners. One of the components that teacher must be prepared before starting a learning activity is teaching material. Teaching materials can facilitate learners to have the competencies is students worksheet. Ozmen and Yildirim (2005:44) states that students worksheet is a sheet containing the work or materials that make learners more active in taking the meaning of the learning process so as to increase the competence of learners, namely cognitive, affective and psychomotor.

The third addition to the competence, critical thinking is an inseparable part of education. This is supported by research and Synder Synder (2008) which states that the

ability to think critically is important, because if someone able to critical thinking, he would be able to resolve simple or complex problems in everyday life.

Observations from SMAN 3 Payakumbuh, SMAN 4 Payakumbuh, and SMAN 5 Payakumbuh, showed that learners are already using worksheet as one of the supporting learning biology. Based on observation, the students were less interested in reading worksheet. This is supported by information obtained through interviews with some of the learners, that worksheet used already assist them in learning, but learners want attractive, has pictures and vivid colors worksheet in order to assist them in understanding the material and motivated.

Results of interviews with biology teachers at SMAN 3 Payakumbuh shows that, worksheet used is good, it been prepared based on indicators and learning objectives, but have yet to lead and guide the learners in structured learning activities. Worksheet is better used to guide and direct the students in learning activities through measures systematic learning so that learning objectives can be achieved and thought processes learners can thrive. The measures contained in the worksheet activities have yet to lead learners to discover their own understanding through structured activities like problem formulation, hypothesis formulation, testing hipotes, data processing, and conclusion and so on. This led to the development of the thinking process to be slow learners.

Evaluation assessment contained in worksheet has cognitive level C1-C3. This has implications for the lack of critical thinking skills possessed by learners. In addition, more than 50% of students do not reach the minimum completeness criteria (KKM) set by the school.

To achieve the competence and good critical thinking skills necessary efforts to create the atmosphere of active learning. The learning approach that can create an atmosphere of active learning is through inquiry learning model. Inquiry learning model chosen because it can improve the competence of learning and critical thinking skills of students, because the learners guided by inquiry learning to think critically and analytically to look for and find their own answer to the problem in question (Sanjaya, 2011: 196).

The use worksheet with inquiry learning model in the learning process is expected to enhance students' critical thinking skills and help participants achieve the desired competence. As revealed by Bieber et al. (2016:2) that worksheet can be used to enhance the critical thinking skills of learners, because worksheet contain activities that engage learners in the process of investigation and problem solving to achieve competence to be achieved.

## II. THEORETICAL REVIEW

### 2.1 Characteristics of Biology Learning in Curriculum 2013

Learning Biology is basically a fact, concept, principle, and theory. Biology subjects are developed through the ability of analytical, inductive, and deductive thinking to solve problems related to natural events. One of the goals of biology subjects is to develop and train students' reasoning abilities, critical thinking skills and analytical thinking (Kemendikbud 2014: 18) Biology learning should reflect the competence of scientific attitude, scientific thinking, and scientific work skills. Through learning with a scientific approach can develop creativity, communication skills and critical thinking skills.

### 2.2 Teaching materials.

Learning component that can facilitate the teacher to convey the learning information one of them is by using teaching materials. Budiharti, et al (2013: 84) teaching materials are materials or materials compiled by the teacher systematically used learners (students) in the learning. The teaching materials have several functions in the learning process. Prastowo (2011: 24) explains that the function of teaching materials in the learning process is a process of learning to be more effective and efficient, as a teacher guide in directing the learning process, as well as helping the potential of learners to become independent students.

### 2.3 Student Worksheet (LKPD).

LKPD contains a set of basic activities that learners should do in learning activities. Kamalia (2009: 39) states that LKPD is a sheet containing tasks that are usually in the form of instructions and steps to complete a task that includes the title of the experiment, the short theory of matter, tools and materials, procedures, experiments, observation data, and questions as well conclusions for discussion materials.

### 2.4 Learning Using the Inquiry Learning Model.

Learning with inquiry learning model is one of the learning centered on the students. Kunandar (2007: 349) states that learning by using inquiry model encourages learners to actively learn through concepts and principals and teachers help learners in experiments that enable learners to have experience and find principles for themselves.

### 2.5 Critical Thinking Skills.

One of the highest thinking patterns is critical thinking. Chaffee in Johnson (2014: 189) states that critical thinking will equip learners to best meet the information gained, the occurrences experienced, and the decisions made on a daily basis. Facion (2015: 9) reveals four major critical thinking skills: interpretation, evaluation analysis, and inference.

2.6 Product Quality Based on Vitality, Practicality, and Effectiveness.

Validity means the extent of determination and accuracy of a measuring instrument in performing its measuring function. According to Arikunto (2006: 64), the accuracy of the validity of a measuring device depends on the ability of the measuring instrument to reach the desired measurement objectives. The aspect of validity assessment includes 4 components, namely the terms of contentment, construction, technical, and language.

Aspects for the assessment of practicality include ease of use, presentation and timing conformity. Purwanto (2006: 141), states that a test is said to have good practicality if the possibility to use the test is a great mother.

Learning is declared effective if the process of quality learning and learning outcomes have been in accordance with the expected goals. The effectiveness of the learning process is assessed from four aspects of critical thinking skills, cognitive, affective and psychomotor.

III. METHODS

This study is a Development and Research (R & D) model of Instructional Development Institute (IDI). Products produced in the form of student's worksheet with inquiry learning model on ecological and environmental changes are valid, practical and effective. IDI model development applying the principles of the system approach, namely defin, develo, and evaluate.

Subjects tested in this study were the students of class X SMAN 3 Payakumbuh. MIA Class 4 as an experimental class and class MIA 3 as the control class. Selection of test subjects is done by purposive sampling.

The instrument used in this study was the interview sheets, validity instrument of worksheet, practicalities instrument of worksheet, effectiveness instrument of worksheet, assessment instrument consisting of critical thinking skills and competence of learners.

Data validity and practicalities LKPD were analyzed by using the following equation:

$$\text{Value} = \frac{\text{scores obtained}}{\text{maximum scores}} \times 100\%$$

The level of validity and practicality of the products are grouped into several criteria. The resulting product is said to be a valid and practical to meet the criteria for a valid and practical with a percentage of  $\geq 61\%$ .

Efficacy data in the form of cognitive and critical thinking skills of students were analyzed using t-test, whereas the efficacy data in the form of cognitive and psychomotor competencies were analyzed by using U-test.

IV. RESULT

4.1. Define

Based on interviews with biology students and teachers of, it is known that in the learning process of students tend to feel tired and critical thinking skills of students are still low. Based on interview, it is also known that learners want interesting, can hone critical thinking skills, have an image that supports the material worksheet so it helps to understand the lesson. Teachers want materials that can lead learners in the learning process.

The problem above needs a solution in the form of interesting teaching materials and able to assist students in developing the competence of learning and critical thinking skills. According to interviews with students and teachers to consider in developing worksheet with inquiry learning model.

The analysis is then followed by analysis of the curriculum that aims to determine whether the material being taught in accordance with KI and KD, as well as helping to formulate indicators and learning objectives to be achieved in worksheet. Analysis and review of literature aims to look at the appropriateness of the worksheet contents, manner of presentation, activities sheet of learners and evaluation sheets with the syllabus applicable. Analysis of learners aimed to determine characteristics of learners that will serve as a research subject.

4.2. Develop

Phase IDI's development model starts from designing Biology worksheet. Components that designed were the worksheet including the front cover, its preface, and instructions for use it, learners' worksheets, evaluation sheets and bibliography.

The front cover is designed with a green background. The components contained in the front cover are the title of worksheet, the target, and the author's identity. Examples of the display cover showed in Figure 1. Worksheet learners apply inquiry approach. Display the worksheet can be seen in Figure 2.



Figure 1. Cover Display



Figure 2. Worksheet Display

The worksheet developed and printed to be validated by experts. Expert validation results are presented in Table 3.

Table 3. Validation Results LKPD Strategist

No.	Components Assessment	Validity Value	Criteria
1.	Construction Aspect	87	Very Valid
2.	Eligibility contents Aspect	84	Very Valid
3.	Technical Aspects	87.7	Very Valid
4.	Language Aspects	88.7	Very Valid
Average Value Validity		88	Very Valid

After validity, tested by the practicalities of teachers and learners. The trial results practicalities of the teacher can be seen in Table 4.

Table 4. Test Results practicalities of Teacher

No.	Aspects assessed	Practicalities value (%)	Criterion
1	Ease of Use	87.5	Very Practical
2	Presentation	87.5	Very Practical
3	Efficiency	87.5	Very practical
Average		87.5	Very practical

Practicalities of learners can be seen in Table 5.

Table 5. Test Results practicalities of students.

No.	Aspects assessed	Practicalities value (%)	Criterion
1	Ease of Use	86.2	Very Practical
2	Presentation	86.2	Very Practical
3	Efficiency	84.8	Very Practical
average		86	Very Practical

### 4.3. Evaluate (Step Rate)

At this stage efficacy trials worksheet, aspects assessed the effectiveness of critical thinking skills, cognitive competence, competence, affective, and psychomotor competencies.

#### 4.3.1. Critical thinking skills and cognitive competence.

Data critical thinking skills and cognitive competencies learner's receipts were analyzed by t-test. The results of the t-test calculation of critical thinking skills and cognitive competence of students can be seen in Table 6.

Table 6. Results of t-test calculation Critical Thinking Skills and Cognitive Competence

Class	Average Value	
	Critical Thinking Skills	Competency Cognitive
Experiment	73.6 *	84 *
control	64.4	74

\* Significant at real level 0.05

From table 6 it can be seen that the test results of the difference in value of critical thinking skills and cognitive competencies of learners have sig <0.05. Can be concluded that Biology worksheet use the inquiry learning model effect on critical thinking skills and cognitive competencies learners

#### 4.3.2. Affective and Psychomotor Competency.

The data analysis affective and psychomotor competency done using Mann Whitney U test. The results of the analysis are shown in Table 7.

Table 7. Results Calculation Competency Test-U Affective and Psychomotor

Class	Average Value	
	Affective Competency	Psychomotor Competency
Experiment	85.5*	85.94 *
Control	77.9	77.05

\* Significant at real level 0.05

From Table 7, it appears that the competence of affective and psychomotor learners have sig <0.05. It can be concluded that Biology worksheet with inquiry learning model are significant to competence affective and psychomotor learners.

## V. DISCUSSION

### 5.1. Validation

The worksheet declared invalid following four aspects meet construction requirements, contents eligibility requirements, technical requirements and language requirements. Based on the validity of the tests that have been done, Biology worksheet with inquiry learning model on ecosystems and environmental changes that are designed obtain very valid category.

Judging from the aspects of construction, worksheet already contains clear instructions to learn, so it can be used as a guide for teachers and learners in using it in the learning process. Majid (2013: 374) states that worksheet must contain all the necessary instructions to students, the manual is written in a simple form with short sentences and vocabulary appropriate to the age and ability of the user. The worksheet that developed in accordance with KI, KD, Indicators, and the learning objectives contained in the curriculum of 2013.

Judging from the content aspect, worksheet that produced using this type and font size are proportional, the images presented are correct and can be seen clearly, as well as the layout and use of attractive colors. Overall, the worksheet display can attract learners to learn. This is in accordance with the opinion Sadiman (2006: 28) states that the picture serves to attract attention, clarify ideas, illustrate, or decorate a fact that may be quickly forgotten or ignored. Based on

these opinions, images provide a great influence in the appearance of a medium that can attract the attention of learners to learn.

Judging from the aspects of language, developed worksheet has easily understood language that is and use the Indonesian language properly and in accordance with the Spelling Enhanced (EYD). The use of appropriate language learners' understanding and clarity of the information presented in worksheet assist learners in mastering the concepts of material on ecology and environmental changes.

### 5.2. LKPD practicalities

Data analysis indicates that the practicalities of worksheet with inquiry learning model categorized as very practical. Their learning instructions allow teachers to use the worksheet with inquiry learning model. Additionally, it helps learners understand and associate the concept of ecology and environmental changes with everyday life so that when faced with the same problems the students can apply their skills.

Judging from the aspect of the presentation, the worksheet with inquiry learning model has very practical criteria. It contains issues relating to the everyday life of learners and the problems that are happening at this time and learning activities in accordance with the syntaxes contained in the inquiry learning model. It is seen that the worksheet has facilitated learners in discovery activities, formulate hypotheses, data processing is presented each activity.

The images in the worksheet can also direct students to discover concepts on material ecological and environmental changes. In addition the use of a simple Indonesian made this worksheet easy to understand. According Arsyad (2010: 81), one of the characteristics of learning media is media that contains and carries the message or information to the learners.

Viewed from the aspect of learning time efficiency, the worksheet with inquiry learning model has very practical criteria. This shows that worksheet with inquiry learning model has been able to deliver benefits in terms of time efficiency of learning. This is in accordance with the opinion of Sukardi (2017: 52) states that practicality can be looked upon from time implementation should be short, quick, and precise.

The results of the data analysis by the practicalities of learners show that worksheet with inquiry learning model categorized as very practical. Judging from the aspects of ease of use, the worksheet with inquiry learning model has very practical criteria. The existence of clear instructions facilitates learning students use the worksheet with this inquiry learning model. In addition, the use of a simple Indonesian creates this worksheet easy to understand. This is in accordance with the opinion of Ministry of Education (2008: 24) states that the language and concepts used in worksheet should be easily understood by learners.

### 5.3. Effectiveness

Based on statistical analysis, it is known that the learning process use Biology worksheet with inquiry learning model give effect to the competence and critical thinking skills of learners.

Differences in learning outcomes between the experimental class and control class indicates that the use of biology worksheet with inquiry learning model with a positive impact. Differences in learning outcomes happens because in the experimental class learners are given the opportunity directly in building knowledge through the steps contained in the inquiry. This is in line with the opinions Jaya (2014: 8) that the learning process of inquiry provide direct experience of the learners start to observe, ask questions, gather information, associates or processing information, and communicate the results obtained.

This is in line with the results Abriyanti (2013: 94) which shows that of all the learners, 25 learners scoring above KKM, while 5 learners scored under the KKM. Mastery learning is caused by the use of worksheet with inkuri in learning activities.

The attitude of students were observed during the learning process is the attitude of participating in the observation, meticulous in observing the attitude, the attitude of working with the group and the attitude of curiosity learners. The observation of learners' affective domain competence, competence affective scored learner's experimental class is higher than the control class. Pratama (2016: 7) states that learning by inquiry learning model can learn attitude because it can meet the necessary things in learning to develop an attitude.

Learners' psychomotor assessed the skills to prepare tools and materials, observation skills, skills and skills present observations presented the results of observations. The high acquisition psychomotor competence of students in the experimental class is the positive influence of the use of Biology worksheet with inquiry learning model. Learners are asked to present their work to the creativity of students to be growing. In accordance with the opinion of Hosnan (2014: 344) emphasizes inquiry learning on the development of cognitive, affective and psychomotor, so that it can create meaningful learning.

The results of critical thinking skills of analysis showed that the average acquisition value of critical thinking skills of learners' experimental class is higher than the control class learners. Differences in the average value of these two classes, due to the experimental class learners are trained to identify problems, make observations, make hypotheses, testing hypotheses and make decisions in the form of conclusions which eventually empties into the critical thinking process. Anggareni, et al (2013) states that the activities of observation, formulate questions, make hypotheses, collect data, and concluded will be able to

improve critical thinking skills and understanding of the concept of learners.

#### AUTHOR'S BIOGRAPHY



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#### VI. CONCLUSION

Based on the results and discussion, we can conclude:

- Biology worksheet with inquiry learning model that has been developed have valid, practical and effective category.
- Biology worksheet with inquiry learning model developed is effective in improving the competence and critical thinking skills of learners.

#### ACKNOWLEDGMENTS

In this study, researchers got a lot of help from various parties. To the researchers would like to thank Dr. Abdul Razak, M.Sc., and Dr. Violoita, M.Sc., as a mentors, Prof. Dr. Lufri, MS, Dr. H. Azwir Anhar, M.Sc., and Mrs. Dr. Yerizon, M.Sc., who has provided advice and criticism for the perfection of this research.

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