

## DEVELOPMENT OF WORKSHEET STUDENTS ORIENTED SCIENTIFIC APPROACH AT SUBJECT OF BIOLOGY

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This study is a research and development models where the development of students' worksheet is oriented based on scientific approach of Biology subject, which aims at producing the students' worksheet which fulfill the criteria of validity, practicality, and effectivity. The development procedure of students' worksheet which oriented on scientific approach referred to the development model of Thiagarajan, Semmel and Semmel (4-D) which consisted of 4 stages, namely defining, design, development, and dissemination stages. The results students' worksheet development which oriented on scientific approach reveal that: (1) in general, students' worksheet which oriented on scientific approach (draft I) is valid. Validation analysis result of students' worksheet  $M=3.47$ ; (2) in general, the result of limited trial draft II has already met the practical criteria. The observation result of the students' worksheet oriented on scientific approach during the trial test  $M=3.34$  (mostly conducted), (3) in general, the trial result of draft II has already met the criteria of activeness. The observation results during the learning which employed scientific approach are: (a) the percentage of students' positive responds toward the students' worksheet is 63.89%, (b) the percentage of students' positive responds toward the learning activity is 52.78%, (c) the students' learning result with the total completeness percentage is 86,11%, meaning that the students' learning result has already met the individual completeness criteria with the minimal score of 70 and classical completeness is 80% minimally of the students' minimal completeness criteria.

**Keywords:** Students' Worksheet, Scientific Approach, Biology

### INTRODUCTION

In the world of education, the teacher is defined as an educator, mentor, coach, and curriculum developers who can create conditions and an atmosphere conducive learning, the learning atmosphere of fun, and exciting, giving a sense of security, providing space for students to active thinking, creative, and innovative and in exploring the elaborate his ability (Rusman, 2010: 19). However, according to Agustin, (2011: 81) the learning process that conducted in institutions of formal education is still widely used conventional learning model. Further Agustin (2011: 83) suggest that schools in Central Java, nearly 80% of educators are still using conventional learning approaches. As a result, the learning process is not running in a creative, effective and fun. Meanwhile, according to Sani (2014: 9) in the future, we will face some challenges and changes that require changes in traditional educational paradigm that has been applied by educators in Indonesia. Learners at this time should be used to search for information themselves, to be able to identify and formulate a problem, to work effectively in groups and build a network and have high creativity.

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Addressing these issues, Sudarma (2013: 74-75) reveals that the increase in the creativity of educators, both the academic competence, as well as pedagogical, must be promoted and enhanced. Creativity in question is the utmost efforts of educators to find ways and / or new learning strategies, which could be developed to improve education services in each educational unit. Moreover, according Sudarma (2013: 87) the existence of a media or a learning tool should be designed and used optimally in order to improve educational services.

Biology is one of the subjects studied in high school. Biology study of living things and their environment. According to the Ministry of Education (2003: 6) biology concerned with the way to find out and understand the nature systematically, so that, biology subjects is not only a mastery of knowledge in the form of a collection of facts, concepts, principles, but also a process of discovery.

Biology subject contains four main elements, firstly: the element of attitude, curiosity, natural phenomena, living beings, and the causal relationship that will create new problems that can be solved through proper procedures, so that science is open ended. Secondly: the process, the troubleshooting procedure through scientific methods. Thirdly: the product, in the form of facts, principles, theories and laws; and the fourth is the application, the application of scientific methods and concepts of science in everyday life (Ministry of Education, 2006: 5).

One approach in learning biology that can be used by educators in the current context is the scientific approach. According Sujarwanta (2012: 76) learning approach to scientific require the student to be able to use scientific methods ie gain knowledge through observing, classifying, predicting, designing, implementing experiments, communicating his knowledge to others using thinking skills, and use scientific attitude like curious, careful, objective, and honest.

According Prastowo (2011: 209) in facts, the educators still use Worksheet Students are ready to use, just bought, and without efforts to plan, prepare, and organize the worksheet it selves. The worksheet only contains practice questions and tasks that cause learners are not motivated to work at once is not motivated to learn. These habits are not in related with the current educational context. Where education in the context of the 21st century should learners should be directed so that they get used to seek information, analyze, think critically, communicate, have a scientific attitude, and is able to resolve the issue. Therefore it is necessary to develop teaching materials in the form of worksheets learners oriented scientific approach to the subjects of biology that meet the criteria for a valid, practical, and effective.

### **Research Method**

This research is R & D Models in the form of the development of worksheets learners (worksheet) oriented approach to scientific adapting development model learning device of Thiagarajan known as 4-D is define, design, development, and

disseminate. Worksheet test results conducted on the development of Senior High School I student class X of academic year 2014/2015. Quality of worksheet is expected in this study was measured by instruments based on quality aspects, among others: (a) the validity based on the judgment validator expert, (b) Practicality based on feasibility assessment of learning through observation oriented learning keterlaksanaan scientific approach using worksheet, and (c) Effectiveness is determined through analysis of student learning outcomes, and response learners. Analysis of the data used in this study is in the form of descriptive statistical analysis techniques.

### **Research Result**

This study was conceived and developed based on a 4-D Thiagarajan Model, which consists of four stages: define, design, develop, and disseminate. The results of the activities performed at each of the stages are as follows:

#### **1. Define Stage**

Define stage in this study consists of:

##### **a. Pre-Post Analysis**

- 1) worksheet used educators in school most of the worksheet purchased or stay put. The contents of the worksheet limited practice questions in the form of multiple choice tests and essays without equipped with scientific activities and moral messages. As a result, students feel the saturation and passive, not creative, and motivated to learn. Whereas the national curriculum expects that learners are always active in the learning process is mainly used to make observations, ask and seek information.
- 2) In the present matter, educators only prioritizes the understanding of the concepts and theory. Whereas Biology science itself consists of three components, namely: products, processes and attitudes.
- 3) The existence of a monotonous pattern of teaching in cognitive ability, this is due to lack of knowledge and experience of educators on the method and the appropriate learning approaches, and the lack of availability of learning tools to suit the purpose and subject matter.

##### **b. Material Analysis**

Analysis of the material aims to map out the major parts on the subject of animalia will be studied at each meeting with a time allocation has been determined based on core competencies and the basic competency in the national curriculum.

##### **c. Analysis of Task**

Task analysis performed to identify the key skills required to design tasks that must be possessed of learners in the following study is based on analysis of

the material (concept). Results of the analysis contained in the worksheet tasks that must be undertaken and completed by learners in the learning process. In the worksheet, there is a task in the form of scientific approach which consists is watching, ask, and gather information.

d. The Formulation of the Learning Objectives

The formulation of learning objectives is done for analytical purposes to convert the material into specific learning goals. Preparation of the learning objectives or indicators of learning achievement based on basic competencies and indicators listed in the national curriculum.

## 2. Design Stage

The activities carried out at this stage, namely (1) the preparation of the test; test learning results generated in this study in the form of multiple choice tests and essays. (2) the selection of media adapted to school facilities include laptop, LCD, power point, and preserved animals / plants, (3) the choice of format consists of the first part, the content (material), practicum, and the final section, (4) the preliminary design referred to as the draft I.

## 3. Develop Stages

Worksheet student oriented scientific approaches that have been developed (draft I) validated by two experts. The assessment worksheet aspects: (1) the construction of contents, (2) presentation techniques, (3) the completeness of the presentation, (4) time, (5) language, (6) the benefits and usefulness. The validation results of worksheet student oriented scientific approach at Table 1.

TABLE 1: VALIDATION RESULTS OF WORKSHEET ORIENTED SCIENTIFIC APPROACH

No	Aspects of assessment	$\bar{x}$	Specification
1	Construction contents	3,28	Valid
2	Presentation techniques	3,36	Valid
3	Completeness of presentation	3,50	Very valid
4	Time	3,50	Very valid
5	Language	3,71	Very valid
6	Benefits	3,33	Valid
	Mean	3,47	Valid

Based on the description of the results of the above analysis, the average value of the total validity worksheet is  $x = 3.47$  of an ideal score 4. According to the criteria of validity (Nurdin, 2007), this value is expressed in the category of "valid" ( $2.5 \leq M \leq 3.5$ ). So in terms of the overall aspect, the worksheet otherwise meet the criteria of validity. However, there is some expert advice to keep in mind. These suggestions include: lay out the images need to be adjusted, the image is

added information, should be seen as a clear step-by-step scientific approach, and questions tailored to the lab results.

Data of worksheet practicality obtained from the data analysis worksheet feasibility test results were observed by the observer. Summary results of the feasibility worksheet data analysis can be seen in the summary Table 2.

TABLE 2: ANALYSIS RESULTS OF WORKSHEET IMPLEMENTATION ORIENTED SCIENTIFIC APPROACH

<i>No.</i>	<i>Aspects of assessment</i>	<i>Observations average</i>	<i>Category</i>
1.	Syntax Scientific Approach	3,38	Good
2.	Social interaction	3,22	Good
3.	Reaction principle	3,42	Good
	Total Average	3,34	Good

Results of the analysis can be concluded that on average the observations of each aspect is based on the observation by the observer,  $M = 3.34$ , which means the entire worksheet performing well ( $2.5 \leq M < 3.5$ ).

Worksheet effectiveness analysis conducted by the indicators (1) responses of learners and (2) achievement test. The results of the effectiveness analysis are:

- a. Worksheet oriented scientific approach developed has met the criteria of effectiveness.

Summary data from the learner's response can be seen in Table 3.

TABLE 3: ANALYSIS RESULTS OF QUESTIONNAIRE RESPONSE STUDENTS

<i>No.</i>	<i>Response</i>	<i>Response Students to</i>	
		<i>Worksheet %</i>	<i>Learning Activity %</i>
1.	Very positive	36,11	47,22
2.	positive	63,89	52,78
3.	negative	0	0

In Table 3 shows that the percentage of learners who respond very positively to the worksheet that is 36.11%, 63.89% positive response and negative response is 0%. The percentage of learners response to the application of learning is very positive 47.22%, 52.78% positive response, while a negative response 0%. These data indicate that the response of students to the learning device worksheets are in the category of very positive and positive.

- b. Data of study after the test was obtained by using achievement test consisting of 30 multiple choice questions and the number 6 number about essay.

The summary of the results of the data analysis of student learning outcomes can be seen in Table 4.

TABLE 4: ANALYSIS OF LEARNING OUTCOMES OF STUDENTS

<i>No</i>	<i>Category</i>	<i>Frequency</i>	<i>Percentage (%)</i>
1.	Complete	31	86,11
2.	Incomplete	5	13,89
Completeness in the classical (T tot $\geq$ 80%)			Complete

Table 4 shows that the percentage of category mastery learning outcomes of students is 86.11% with a frequency of 31. This value indicates that the learning outcomes of students achieve mastery in classical. Under the provisions of completeness that a learner declared successful individually if obtaining a minimum value of 70. Learners classically is successful if at least 80% of students achieved a score of at least 70.

#### 4. Disseminate Stages

Based deployment is done on a limited basis after producing worksheet oriented scientific approach to the subjects of biology that meet the criteria for a valid, practical and effective to get a positive response from teachers and learners.

#### Discussion

1. **Validity:** According Nurfathurrahmah (2012: 120) learning device is said to be valid, if the expert judgment shows that the development of the device is based on the strong theory and has internal consistency, which occurred interconnections between components in a device developed. Based on the results of 2 validator expert assessment, the result that the general overall learning device in the form of a worksheet oriented scientific approach in general is valid ( $M = 3.47$ ), the data can be seen in Table 1. The worksheet developed can reach the criterion validity because the develop process based on a strong theoretical rationale and has internal consistency.

Although the overall learning tools developed have met the criteria of validity, but there are several components that need to be revised a little to the improvement of such devices. Revisions to the worksheet include: lay out the images need to be adjusted, the image is added captions, should be seen as a clear step-by-step scientific approach, and questions tailored to the lab results. According Arsyad (2014: 25) media / devices should involve students learning either in mind or mental or in the form of real activity so that learning can take place. The materials must be designed in a more systematic and psychologically in terms of the principles of learning in order to prepare the effective instruction. In addition, learning media must be able to provide an enjoyable experience and meet the needs of individual learners. Abidin (2014: 270) adds the selection and determination of teaching materials intended to meet one of the criteria that should be interesting teaching materials, can

help learners to achieve competency. Therefore the teaching materials are made according to the needs and compatibility with the basic competencies to be achieved by learners.

Based on these opinions, and based on the advice of the validator, the revision or improvement. The results, there is a need to repair worksheet is (1) lay out the image has been adjusted (removed), (2) images of animals already equipped with information, (3) measures the scientific approach consists is watching, ask and collect information, and (4) most questions on the worksheet has been adapted to the lab results.

2. **Practicality:** According Nurfathurrahmah (2012: 122) assessment of a learning device is said to be practical, if it meets two criteria, namely: (1) devices that are developed can be specified in the judgment of the experts, (2) devices that are developed can be applied in real terms in the field. This is supported by the results of validation for each device on average in the category is valid, as well as the results of the overall validation of the instrument (observation sheet implementation learning device, the questionnaire responses of learners, and the test results of learning) are in the category of valid and very valid. The practicality indicators derived from the analysis of trials of learning-oriented approach to scientific observation in the classroom are in very good category. This suggests that components of the assessment in the lesson plan (RPP) has been accomplished entirely by achieving practical use in scientific learning, especially in the animalia lesson. Although the overall device has been found to comply with the criteria of practicality, but there are some things to consider such as the social interactions of learners in work in groups/active learners in cooperative groups, with some learners tend to not listen when friends talk group.

### 3. Effectiveness

- a. **Response learners:** The response given to the learners' that learning device oriented scientific approach can be seen from the results of the analysis of questionnaire responses achievement of students in Table 3.3. Devices that rated a worksheet, in addition learners are expected to provide an assessment of the learning activities by applying scientific approaches. Results of the questionnaire responses of learners is a supporter of the effectiveness of the learning tools used in learning to see the response of students maximum are in positive category and class responded to more than 50%. Based on the analysis worksheets are in the category of very positive 36.11% and 47.22% of learning activities. A positive response on the worksheet 63.89%, and 52.78% of learning activities. Negative response to both of these components is 0%. These data indicate that the response of students to both of these components are in the category of very positive and positive.

- b. Learning Outcomes: Learning outcomes will reflect the ability of learners to meet a stage achievement of the learning experience, to achieve a basic competency learning outcomes serve as clues about behavior changes that will be achieved by learners in relation to learning activities are carried out, in accordance with the basic competencies and the material studied, the results of this study could form the knowledge, skills, and attitudes. One of the efforts is through achievement test given to students at the end of the trial (meeting of seven), to determine the level of mastery of the material that students have learned. Table 3.4 shows that the percentage of category mastery learning outcomes of students is 86.11% of learners who achieve classical completeness of 36 learners, but there are 5 students who did not complete, this is due to lack of attention of learners in receiving the material presented by educators, less active in conducting observations and answer the questions in the worksheet, the ability of students to understand the material less and less readiness of learners in learning.

Such criteria refer to the terms of mastery learning is a learner declared successful individually if obtaining a minimum score of 70 on the subjects of Biology. Learners said successful classical if at least 80% of students achieved a score of at least 70. The values obtained by learners are then linked to the achievement level of mastery of the subject matter in accordance with its intended purpose, it is the same as the explanation of Ministry of Education (2004b: 22) which explains that the “assessment of learning in a competency-based learning system is basically a determination process to ensure learners whether competent or not. The determination is done by comparing the evidence of learning obtained a learner with the criteria that set the standard of competence “.

High attainment classical completeness (86.11%) gave greatly donation to the success of students in understanding the subject matter through a scientific approach. According to Abidin (2014: 27), the approach scientific essentially a learning approach that is based on a scientific approach to learning that is oriented in order to foster the ability of learners to solve the problem through a series of activities inquiry that demands critical thinking skills, creative thinking, and communication in order to improve the understanding of participants learners. Meanwhile Daryanto (2014: 53) says learning approach to scientific has the following characteristics: (1) centered on the learner, (2) involves the process skills of science in constructing concepts, laws or principles, (3) involves the cognitive processes that potential in stimulating the development of intellect, especially high-level skills of learners, and (4) be able to develop the character of students.

The success of the scientific approach in improving learning outcomes supported by the results of research Machin (2014) that the implementation of the scientific approach in teaching and learning positive effect on the cognitive learning, affective and psychomotor learners. It is also supported by the results of research Fauziah



(2013) that the lesson plan development through a model-based approach to scientific problem based learning, received a positive response from teachers and students, so that a positive impact on the increase in hard skills and soft skills of learners.

### Conclusion

Based on the results of data analysis and discussion, it can be concluded that: the development of learners' worksheets oriented scientific approach consists of three stages, namely: the definition, design, development, and dissemination. Moreover, the quality of learners' worksheets oriented approach has met the criteria of scientific validity, practicality, and effectiveness.

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