

## DEVELOPMENT OF STUDENT WORKSHEET BASED ON GUIDED INQUIRY MODEL ON ELECTROLYTE AND NON ELECTROLYTE SOLUTION MATTER TO TRAIN THE SCIENCE PROCESS SKILLS IN X GRADE SENIOR HIGH SCHOOL

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### Abstract

This research aims to develop a guided inquiry based student worksheets that are feasible to train the science process skills in electrolyte and nonelectrolyte solution matter. This research used research and development Four-D Model which consists of Define, Design, and Develop, and Disseminate stage. But in this research limited only in the develop stage. The data sources of this research are 12 students XI grade of senior high school, chemistry lecturer, and chemistry teacher. The feasibility data was analyzed by quantitative descriptive. The result of this research stated valid corresponded by the result of student worksheet 1 in the content criteria of 84.4%, the presentation criteria was 86.7%, the graphic criteria was 83.3%, the linguistic criteria was 88.9%, student worksheet 2 on content criteria 85.5%, presentation criteria 88.3%, 86.7% graphic criteria, linguistic criteria 88.9%. It was known that the student worksheets based on guided inquiry to be feasible to train the science process skill in the material of electrolyte and non electrolyte solution in class X grade and stated valid in terms of the validity of the content 84.44% and the validity of the constructs 86.7%, the student worksheet was stated practically in terms of response students with percentage 82.50%, also student worksheet declared effective from science process skills 91.67%.

**Keywords:** *Students Worksheet, Guided Inquiry, Science Process Skills.*

### PRELIMINARY

The curriculum 2013 is a curriculum has been used in the current education system. The purpose of Curriculum 2013 which aims to prepare Indonesian people to have the ability to live as individuals and citizens who are faithful, productive, creative, innovative and effective and able to contribute to the life of the nation, the state and the civilization of the world. Based on that it is expected that learners can have a spiritual attitude, social, responsible, and knowledgeable [1], so from the goal is very appropriate with the condition and direction of education today. Especially the chemistry lessons in which there are characteristics there are concepts, phenomena, facts, and labs used to prove the concept. One way to realize the curriculum 2013 is by providing learning strategies.

Learning strategies that should be used with some consideration that is based on the characteristics of students and the characteristics of chemistry are taught. Students tend to memorize the concept of matter due to abstract chemical material and which will be studied very much. So that the need for innovation in learning so as to facilitate students to understand a concept. The guided inquiry learning model is thought to be able to train science process skills. Inquiry learning is an inquiry learning model which in the

implementation of the teacher provides guidance or extensive instruction by the teacher. Inquiry learning model is a learning model developed based on the way of thinking that is discovery and emphasizes on field experience such as observing the symptoms and students are required to find a concept independently [2]. The situation of the problem presented can lead the students to prepare the solution so that it can help develop the thinking [3].

Student worksheet was developed in this research not only ordinary student worksheets but must be able to train students analytical skills [4], and is one of the part in lesson plan. The student worksheet that given to the students was a collection of tasks in the form of theory or practice. Student worksheet was often used by teachers in the school that is student worksheet has been packaged in such a way that students are expected to learn the teaching materials independently, assist students in developing concepts and train students in finding and developing science process skills [5].

Science process skills in chemistry learning need special attention because this is often ignored in a lesson, during this process of learning chemistry takes place more emphasis on the product. Science processes skills student ability to apply scientific methods of understanding, developing and discovering science [6]. Inquiry

based activities might raise student motivation due to the fact that they give students freedom in making their choices, provide them with opportunities to carry out self regulation and to take part in projects they are interested [7]

Based on the results of interviews with chemistry teacher class X, stated that 50% of the learning process that takes place in the classroom is teacher center or teacher centered learning process, this is because if the learning process is not centered on the teacher, students will more difficult to accept and understand the material delivered. One of the teaching materials used in the learning is the student worksheet that has been prepared by the teacher team that contains the material summary and exercise questions, but there is no phenomenon in daily life (guided inquiry learning model) and the science process skill component. Students in receiving chemistry lessons are experiment very rarely because of time constraints and tools and experiment materials that are not yet available in the school laboratory, this causes the skills training process are not maximum, from the survey results seen that during this learning activities have not invited students to study independently and find their own concepts, thus causing less trained students to develop reason of solving problems and applying the concepts that have been learned so that the science process skills obtained by students are not maximum.

Based on the results of pre study on the field was obtained data that as many as 64% of students have difficulty in the material of electrolyte solution. The data was supported with the mean score of the students learning outcomes of the subjects of electrolyte and non electrolyte solution of class X was 68% before the improvement test, from the data it can be concluded that the value of student learning outcomes is still low if not remedial or test improvement compared with a minimum grade in completeness. As many as 76%, students stated that in learning often use student worksheet and 84% stated that student worksheet is very helpful in learning. Besides the science process skill less train in learning chemistry, this is evidenced by questionnaire data, which are about component science process skills are formulate problem 16%, make hypothesis 24%, determine variable 20%. These results indicate that students not completely trained in science process skills in learning.

Based on the background have aims, it was necessary for an action that is to develop a learning media in the form of a student worksheet based on guided inquiry that appropriate to use for the

science process skill. Learning using student worksheet developed helps students to understand the material of electrolyte and non electrolyte solution and science process skills can through activities that are based on everyday problems.

Some of the problems that can be used as a reference to determine the feasibility of the developed student worksheet are: 1) the validity of the student worksheet based on guided inquiry activities of students in order to train the science process skills on the material of electrolyte and non electrolyte solution in X grade senior high school. 2) Practicality of Student worksheet based on guided inquiry to train the science process skill on the material of electrolyte and non electrolyte solution in X grade senior high school. 3) the effectiveness of Student worksheets based on guided inquiry to train the science process skills on the materials of electrolyte and non electrolyte solution of X grade senior high school.

## METHOD

This research is a development research have aims to develop student worksheet by using Four-D Model. Which is limited in Develop stage. Trial of worksheets developed was conducted on 12 students of class XI MIA SMAN 2 Kota Mojokerto, in November 2017.

The objective of this research are student worksheet based on guided inquiry to train science process skills in electrolyte and non electrolyte solution matter.

Instrument was used in this research were the reviewer sheet, validation sheet, student response questionnaire, student observation sheet and science process skill sheet. Data collection methods of this study using questionnaire and test methods. The questionnaire method consisted of a review sheet, validation sheet, and student response sheet questionnaire and in the test method used to determine the ability of the student science process skills through the student worksheet developed.

The results of the reviewer data are used to improve the product draft, while the validation data questionnaire was analyzed descriptively. Validation data was analyzed with Likert scale ranging from 1 (bad); 2 (less); 3 (enough); 4 (good); 5 (excellent) [8]. The value obtained is calculated by the percentage of eligibility using formula:

$$P(\%) = \frac{(\text{total score of data collection})}{(\text{score criteria})} \times 100\%$$

With description:

P(%) = percentage (%).

Score criteria =  $\frac{\text{highest score} \times \text{number of aspects}}{\text{number of respondents}}$

Then, the percentage obtained was interpreted by using the score interpretation criteria in Table 1:

**Table 1.** Interpretation criteria Skor

Percentage(%)	Categories
0-20	Bad
25-40	Less
41-60	Enough
61-80	Good
81-100	Excellent

[8]

The validity of the student worksheet developed was considered feasible if each component gets a percentage  $\geq 61\%$ . [8]

Student response data was analyzed by using Guttman Scale in Table 2:

**Table 2.** Guttman Scale

Score	Answer
1	Yes
0	No

[8]

The obtained data was calculated to get the percentage of student response result by using formula:

$$P(\%) = \frac{\Sigma Y}{\Sigma MY} \times 100\%$$

Information:

P (%) = percentage (%)

$\Sigma Y$  = number of answers "Yes"

$\Sigma MY$  = maximum number of answers from all students "Yes"

The result of percentage that obtained interpreted according to Table 2. The student worksheet state completely the feasibility criteria to be used in the learning process if the percentage reach  $\geq 61\%$  [8].

Test data to be obtained in the form of tests of material understanding and process skills, assessed using the Guttman Scale criteria. The value of mastery assessed in the form of numbers and letters, in the range from 4.00 to 1.00 for a number that is equivalent to the letters A to D and with a minimum predicate is B-.

The classical completeness achieved when on the test 75% of students in the class reach individual completeness [9]. The calculation of student scores on each test was done in the following way:

$$\text{value} = \frac{\text{score gained}}{\text{maximum score}} \times 4$$

Classical mastery obtained by the formula:

$$\text{classical mastery} = \frac{\Sigma \text{students complete}}{\Sigma \text{students}} \times 100\%$$

Minimum completeness of the students learning outcomes of chemistry subjects in high school is set with a mean score of 2.67. Students said to achieved complete individuality if the average score obtained is 2.67.

## RESULT AND DISCUSSION

### Validity

Validity of student worksheet based on guided inquiry to train the science process skill on the material of electrolyte and non electrolyte solution in class X grade senior high school can be shown in Table 3:

**Table 3**

Aspect	Worksheet 1	Worksheet 2
	(%)	(%)
Content criteria	84,4	85,5
Presentation	86,7	88,3
Graphics	88,9	88,9
Language	83,3	86,7

The criteria content of student worksheet based on guided inquiry developed have fulfilled the criteria of content contents with very good category on student worksheet 1 with percentage of 84.4%, and on student worksheet 2 with percentage of 85.5%. This indicates that the developed student worksheet has been in accordance with several things, consists of the basic competencies presented and the material presented in accordance with the syllabus of the curriculum 2013 is electrolyte and non electrolyte solution. The description or explanation in the student worksheet is easy to understand, the short material corresponding to the indicator, as well as any phenomenon that is in the student worksheet can provide student understanding by applying the electrolyte and non electrolyte solution in daily life in accordance with the characteristics of guided inquiry learning model. The existing exercise activities have been in accordance with the guided inquiry activities that lead to the science process skill component. Guided inquiry activity consists of five stages of activity that is confrontation with the problem; data gathering-verification; data gathering experimentation; organizing, formulating, and explanation; analysis of the inquiry process. Such activities can provide an opportunity for students to be busy in process skill activities involving scientific processes and scientific attitudes [10]



The student worksheet presentation criteria developed based on several aspects including the presentation of student worksheet systematic and logical, conceptuality, suitability of illustrations with material in chapters, readability in terms of font size, motivation or attraction and completeness of information [11]. The student worksheet based on guided inquiry that developed have met the feasibility criteria in the presentation aspect with the percentage of 86.7% in the student worksheet 1 and 88.3% in student worksheet 2, based on the Likert scale of Table 2 can be said very well because the percentage is at interval 81-100%. This is because the developed student worksheet has been in accordance with the standards of writing, the student worksheet is composed of title, study guide, competence to be achieved, supporting information, tasks and work steps, and assessment [11].

The graphics criteria in student worksheet consist of usage and ease of reading, the suitability of the layout of the student worksheet component, the image illustrations that can improve the motivation and understanding of the concept, and writing a bibliography in accordance with the applicable rules [11]. Based on the validation result in table 1, it has fulfilled the feasibility criteria in the presentation aspect with the percentage of 88.9% in the students worksheet 1 and 2, based on the scale of Likert Scale Table 2 the suitability of students worksheet graphics developed has very good category due to several things such as the use of fonts that make it easier for students to read, in addition to the different font selection within the student worksheet based on guided inquiry aimed at emphasizing different points on each section of the students worksheet, as well as the use of the illustrations presented have improved the students learning motivation.

The linguistic criteria of the student worksheet based on guided inquiry have fulfilled the feasibility criteria on the presentation aspect with the percentage of 83.3% in student worksheet 1 and 86.7% in student worksheet 2, this can be categorized very well as the percentage included in the interval is 81-100%. This indicates that the student worksheet based on guided inquiry that developed have met the linguistic feasibility criteria, the criteria include writing the student worksheet using the appropriate term and easily understood by the students, having the regularity of the language or regularity between chapters, paragraphs and sentences, as well as the writing of student worksheet using the term or symbol appropriately. As well as in the developed student

worksheet has covered a language that is communicative, interesting, not confusing students and easy to understand [11]. This is also supported by student questionnaire results in the linguistic criteria in item number 10 with an average percentage of 75%, and included in either category.

#### **Practicality**

The practicality of student worksheet developed can got from the data of student response and observation activity. The students give the answer or opinion to student worksheet based on guided inquiry that have been using student response questionnaire. Data response results of the students are presented in Table 4 as follows:

**Table 4.** Response results

Criteria	Percentage
Content	100%
Presentation	76,7%
Graphics	83,3%
Language	75%

Based on Table 4 it can be seen that the content criteria get the percentage of 87.2%, and on the graphics criterion get percentage of 83.3% if the criteria of content and criteria of abercrombie on average fulfill the percentage of feasi above 81% so included in the criteria very well. In the presentation criteria get a percentage of 76.7% and the linguistic criteria get a percentage of 75% if the average presentation criteria and linguistic criteria get a percentage above  $\geq 61\%$  so that included in the criteria good. This indicates that the student worksheets based on guided inquiry to train the science process skills developed get positive response from the students.

The data included in the practicality of the student worksheet developed in addition to the student response questionnaire is the observation sheet of student activity, the result of student activity observation said to have practically fulfilled the criteria by getting the percentage of 61% and included in very good category. Questionnaire activity observation sheets given to four observers while doing learning activities using student worksheet developed. The data are analyzed descriptively can be seen from percentage of observer who have answered "YES" in every aspect. There are 9 aspects that must be evaluated by the observer, all aspects of the observation of student activities got very good category, but on the aspect that students read the learning objectives contained in the student worksheet developed, the observer gave the answer "No" to the three students, this because students do not do reading activities learning objectives, then obtained the

average results of student activity observation is 90.74% with very good category.

### Effectiveness

The effectiveness of the student worksheet developed can be seen from the science process skill tests. The results of the science process skill test given before and after trial using the student worksheet developed. It aims to know the science process skills of students before and after trained science process skills by using student worksheet developed. The components of science process skills that are trained include observing, formulating the problem, making hypotheses, creating variables, planning investigations, collecting data, analyzing data, and making conclusions. The data was obtained from 12 students who have followed the limited trial when given pretest there are students is not complete, because students get a score of less than 2.67, with the score of classical completeness is 0%, this is because students have never done a problem with type, so students find it difficult to determine each component of the science process skills. After doing the learning process using student worksheet developed, students are given the problem of posttest get percentage of classical feasibility equal to 91,67%. There was a significant increase between classical completeness before and after learning using the student worksheets developed.

The result of the science process skills test said be able to trained when it filled the rubric criteria of the science process skills [12]. Pretest results on observing skills of 0.89; skill of formulating problem 1.33; skill of hypothesis 1.22; skill to make variable 1,22; skill of designing experiment 1.33; skill to collecting data 2,33; skill of analyzing 2,33; skill to make conclusion 1.78. This shows that all students are poorly trained with the skills component of the process. In result of science process skills of each component after posttest of student have improvement with result of posttest on observing skill 2,67; skill of formulating problem 3,56; skill of hypothetical 2.67; skill of controlling variable 3,33; skill of designing experiment 3,89; skill to collecting data 3,67; skill of analyzing 3,89; skill to make conclusion 2.67. This shows that the student said to be complete in every component of science process skills, and has achieved the average mastery of score obtained at least 2.67.

### CLOSING Conclusion

Based on the formulation of the problem and the results of research, it can be concluded that the feasibility of the student worksheet based on guided inquiry to train the science process skills on the material of electrolyte and non electrolyte solution in class X grade senior high school namely:

1. The validity of the student worksheet is considered feasible in terms of the content and presentation criteria with the feasibility percentage of the content criteria of 84.44% and the presentation criteria of 86.7%.
2. The practicality of the student worksheet is considered worthy of the students response with the percentage of 82.50% and observation results of student activity in general show categories above the standard, only on the component of observing, making hypotheses, and make conclusions with good category.
3. The effectiveness of the student worksheet developed can be reviewed from the science process skills, the students showed an increase after using the student worksheet develop in terms of classical completeness is 91.67%.

### Suggestion

Suggestions given for further research include:

1. Research is only done until the development stage (develop), so that for the improvement in subsequent studies is expected to be done until the stage of dissemination
2. Science process skills study conducted only 8 aspects in subsequent research is expected to train aspects of other science process skills.

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