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# DEVELOPMENT OF STUDENT WORKSHEET BASED ON GUIDED INQUIRY MODEL WITH KIT INSTRUMENT ON REACTION RATE MATTER TO TRAIN THE SCIENCE PROCESS SKILLS IN XI GRADE SENIOR HIGH SCHOOL 1 CERME

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## Abstract

This research aims to produce the student worksheet that feasible to training the science process skills to student. Student worksheet which developed complemented by the KIT instrument as auxiliary media based on the phases of the guided inquiry learning model to train the student Sciences Process Skills (SPS). The type of this research is using 4-D model development research with 12 students of XI MIA 6 Senior High School 1 Cerme. The data obtained was analyzed descriptively. The results showed that the theoretical feasibility of student worksheet with each criterion obtained a percentage of 80.55-89.58% with very good/very decent category. Empirical feasibility of student worksheet developed based on response result and observation result of student activity. The result of students response showed that student worksheet got positive response because it got the percentage of 86.11-91.67% with very good/very decent category. Observation results of student activity at the first meeting is categorized good because it was obtained on the range of the percentage that is 72.22-94.44% and at the second meeting the range of the percentage that is 80.56-94.44%. The improvement of science process skills of students got from the pre-test and post-test score of science process skills of student, which is the students get the range score of 18.75-43.75 in the pre-test while the post-test gets in range score of 81.25-93.75. The improvement of SPS students after using the developed student worksheet has a 64.58 -97.92% completeness percentage with n-gain ranges from 0.50 to 0.91 with medium to high category.
**Keywords:** Student Worksheet, Guided Inquiry, Science Process Skill, Reaction Rate.

## PRELIMINARY

Education is one of important factor that determine the quality of a nation. Human resources in the modern era like today, Indonesia is required to be able to produce the next generation of quality, intelligent, independent, creative and innovative. One effort that can be done in order to form a quality generation is through education. Education process is a system consisting of input, process, and output. Input is a learning activity undertaken by learners, the process is an activity of teaching and learning while the output is the result of the process undertaken. The condition of learning is that the teacher is no longer the only source of learning, and his role has shifted more towards as a facilitator [1]. The expected system of learning is a teacher-centered learning system being student centered, (b) one-way learning system being interactive, (c) passive learning system being active learning seeking [2]. The factors that support the success of the learning process include teachers, students and educational tools. Educational tool is any form of facilities that can be used in teaching and learning process one of them is teaching materials and learning media [3]. Teachers as an educator are expected to provide learning innovation as well as provide an interesting learning media and can support teaching-learning activities centered [4]. One of the learning media that can support teaching and learning activities is the student worksheet. Student worksheet are sheets containing tasks that must be done by students. Student worksheet will contain at least; title, basic competence to be achieved, completion time, equipment / materials needed to complete the task, brief information, work steps, tasks to be done, and reports to be done. The developed of student worksheet must be feasible to use so it needs to be calculated feasibility. The feasibility of student worksheet contains at least four aspects, namely the feasibility of content, language, presentation, and graphic [5].

The learning process in the educational unit is organize in an interactive, inspiring, fun, challenging, motivating students to participate, active, and provide sufficient space for initiative, creativity and independence based on talent, and physical and psychological development of students. With the fun learning is expect to affect the activity of students in a learning. Activity of students in a learning will make learning becomes

more meaningful, easy to remember and understood by the students. Fun learning can include learning by forming small groups or doing an experiment related to the material being taught. Exciting learning can include learning by forming small groups or performing an experiment related to the subject matter [6].

The learning model according to the condition is one of them is inquiry. The inquiry model much corresponding to the cognitive, affective, and psychomotor aspects in a balanced way, so that learning through this learning model is considered more meaningful [7]. The inquiry learning model, requires students to conduct investigations with the Skills Process of Science student worksheet both basic and integrated. The approach of the process is a learning approach that emphasizes the learning process, activities, and creativity of students in acquiring knowledge, skills, values and attitudes, and apply them in everyday life [8].

SPS is also defined as an adaptation of the skills used by scientists to construct knowledge, think problems and make inferences [9]. Science process skills are gained through "observing, asking, trying, reasoning, cheating, and creating" activities. Thus, in the inquiry model the students are not only thrilled to master the subject matter, but also about how they can use their potential [7].

Based on the questionnaire data of science process skill of students in the observing component shows that as many as 40% of students are able to observe a phenomenon well, for the next basic SPS component such as determining the variables, formulating the problem, and making the hypothesis is still low as evidenced by 40% students capable of determining variables; 50% of students were able to formulate the problem correctly; students hypothesized skills are still low as evidenced by 25% of students able to make the hypothesis correctly. Advanced SPS shows 50% of students who are able to plan research such as writing tools and materials while 75% of students have not been able to make research procedures; student's skill in collecting data is still low ie 25%; skills in analyzing trial data by 30% of students who are able to do it right, and skills to make conclusions from an experiment was still low at 30%. Based on the pre-research questionnaire data, it can be concluded that the students are not accustomed to solving problems, thus causing SPS in observing, determining problem formulation, controlling variables, and making hypotheses, planning scientific investigation, conducting investigation, collecting data, analyzing data, and making conclusion. The research that I conducted this time will train the process skills in the learning process through the development of KIT Student worksheet.

Based on the background description, the authors propose research entitled Development Of Student Worksheet Based On Guided Inquiry Model With KIT Instrument On Reaction Rate Matter to Train The Science Process Skills In XI Grade Senior High School 1 Cerme. The formulation of the problem in this research is how the feasibility result of Student Worksheet Based On Guided Inquiry Model With KIT Instrument On Reaction Rate Matter to Train The Science Process Skills that developed?. The general problem formulation is described as (1) How is the theoretical feasibility of the student worksheet based on guided inquiry model with KIT instrument on reaction rate matter to train the science process skills based on the suitability of content, presentation, language, and graphics ?; (2) How the empirical feasibility of student worksheet based on guided inquiry model with KIT instrument on reaction rate matter to train the science process skills based on response, student learning outcomes, and student activities at the time and after use; (3) How the improvement of the science process skill (SPS) of students after using student worksheet based on guided inquiry model with KIT instrument on reaction rate matter to train the science process skills?.

## METHOD

The type of this research is the development research which using 4-D model by Thiagarajan and Semmel [10]. The 4-D model consists of four stages: Define, Design, Development and Disseminate, but in this research doing until the development stage. The target of this research is student worksheet based guided inquiry with KIT instrument on reaction rate material and can be used to trained science process skill in grade XI students. Sources of research data are 12 students of grade XI in senior high school 1 Cerme, chemistry lecturer and chemistry teacher as reviewers and validator.

The research design was developed using a 4-D model. The research and development design used is modified as needed. This research uses a 4-D model that is limited to the develop stage. At the stage of the research conducted review, revision, and trial of limited use.

Instruments used in this study include a review sheet, validation sheet, student response questionnaire, observation sheet, and science process skill test instrument.

The results of the study data were used to improve the product draft, while the validation data were analyzed descriptively. Validation data were analyzed by Likert scale in Table 1:

**Table 1** Likert Scale Criteria

| Score | Criteria |
|---|---|
| 4 | Very Good |
| 3 | Good |
| 2 | Enough |
| 1 | Less |
| 0 | Bad |

[11]

The value obtained is calculated by the percentage of eligibility using the formula (1):

$$P(\%) = \frac{(total\ score\ gained)}{(Score\ total)} \times 100\%$$

With description:
P(%) = precentage (%).
Then, the percentage obtained was interpreted by using the Likert scale criterion in Table 2:

**Table 2**. Likert Scale Category

| Precentage | Category |
|---|---|
| 0%-2% | Very Bad |
| 25%-40% | Bad |
| 41%-60% | Medium |
| 61%-80% | Good |
| 81%-100% | Very Good |

The validity of the Student worksheets developed was considered feasible if each component gets a percentage of ≥ 61% [11].

Student response data was analyzed using Guttman Scale in Table 3:

**Table 3** Guttman Scale

| Score | Answer |
|---|---|
| 1 | Yes |
| 0 | No |

[11]

The obtained data was calculated to get the percentage of student response result by using formula (2):

$$P(\%) = \frac{F}{N} \times 100\%$$

Explanation:
P (%) = precentage (%)
F = Answer total "yes"
N = Respondents Total

The result of the percentage obtained was interpreted according to Table 2. Based on Table 2, the practicality of student worksheets is developed based on the student response questionnaire when obtaining a percentage of ≥ 61% [11].

Test data to be obtained in the form of concept comprehension test and science process skill test Data test of science process skill will be analyzed and then interpreted with the completeness table of each core competence in table 3 below:

**Table 3.** The value of mastery of each core competence

| In Scale 0-4 | In Scale 0-100 |
|---|---|
| 3.85-4 | 96.25-100 |
| 3.51-3.84 | 87.75-96 |
| 3.18-3.50 | 79.5-87.5 |
| 2.85-3.17 | 71.25-79.25 |
| 2.51-2.84 | 62.75-71 |
| 2.18-2.50 | 54.5-62.5 |
| 1.85-2.17 | 46.25-54.25 |
| 1.51-1.84 | 37.75-46 |
| 1.18-1.50 | 29.5-37.5 |
| 1.00-1.17 | 25-29.25 |

[12]

Based on table 3, then the student stated to be complete when reaching predicate B. Minimum completeness of student learning outcomes in chemistry lesson in SMA Negeri 1 Cerme is 3.00 or ≥75. So that students can be stated to have achieved individual mastery if the average score obtained is 3.00 or ≥75 [11].

The results of pre-test and post-test then analyzed using gain score to see the improvement of students science process skill between before and after use of student worksheet [13]. Gain score is calculated by the formula (3) below:

$$<g> = \frac{\%<G>}{\%<G>max} = \frac{(\%< S_f > - \%< Si >)}{(100 - \%< Si >)}$$

Furthermore, the number obtained will be converted to the range of category scores as in table 4 below:

**Table 4** Gain Category

| Gain Score | Category |
|---|---|
| $g > 0.7$ | High |
| $0.7 > g > 0.3$ | Medium |
| $g < 0.3$ | Low |

[14]

Based on the gain category, student worksheet based on guided inquiry model with KIT instrument on reaction rate matter to train the science process skills said to be feasible if there is an increase of gain score with medium or high category [14].

## RESULT AND DISCUSSION

### Reviewer of Student Worksheet

The results of the research include making student worksheet training. The training student worksheet must provide complete information on the student worksheet that will be used next. The training student worksheet should also be used as guidelines for working on the actual student worksheet. It is very much in line with the guided inquiry learning model in which students obtain the guidelines as required. In the early stages more guidance is given, and gradually reduced, in accordance with the development of the student experience [8].

The results of the review given by the reviewers in general student worksheet developed was good because they have followed the syntax of inquiry learning model and have trained the process skills, only need some improvement of sentence structure, and the writing used in the student worksheet. Student worksheet that have been reviewed then revised for the next given to the validator to be assessed and tested on 12 students of class XI MIA 6 senior high school 1 Cerme Gresik.

### Theoretical Feasibility

The feasibility of theoritical is based on validation data showing that the average percentage obtained for the four feasibility criteria student worksheet based on guided inquiry model with KIT instrument on reaction rate matter to train the science process skills that developed in the very feasible category with a percentage of ≥81% with each criterion obtained percentage with a range of 80.55-89.58%. The four criteria assessed are the content criteria, presentation criteria, linguistic criteria, and graphic criteria.

In the content criteria obtained the average percentage range from the aspect 84.54 - 88.10% with criteria very feasible for student worksheet 1-4 based on the Likert scale criteria table [11]. Presentation criteria for student worksheet 1-4 obtained an average percentage in the range 87.50 to 89.59% with very reasonable criteria according to Likert scale [11]. The linguistic criteria for student worksheet 1-4 obtained an average percentage in the range of 83.33% to 87.47% with very reasonable criteria according to Likert scale [11]. The linguistic criteria for student worksheet based on guided inquiry model with KIT instrument on reaction rate matter to train the science process skills that developed has fulfilled the validation of criteria of graphic. It is shown in student worksheet 1-4 that the average percentage is obtained in the range of 80.55% to 86.11% with proper criteria - very feasible according to Likert scale [11].

### Empirical Feasibility

Empirical feasibility based on student response result, ability test result, and student activity observation result. Student responses to the use of student worksheet during general learning are included in very good criteria for each aspect of each criterion presented in the student response questionnaire. The student's response from the developed student worksheet obtained a percentage range of 86.11-91.67% with very good/very feasible categories according to Likert scale [11].

The result of the science process skill test, student science skill test, pre-test of student science process skill, the score of 12 students has not fulfilled criteria complete minimum with value ≥ 75 (3.00). The range of values they get between 18.75-43.75 (on a scale of 100) or 0.75–1.75 (on a scale of 0-4), from the range of values it can be said that the 12 students are uncomplete. In contrast to the post-test results after using the developed student worksheet, the students were given the same problem as the pre-test questions, and the post-test results showed an increase in which 11 students were complete and there was 1 student who are uncomplete Completed students score with a range of 81.25-93.75 (on a scale of 0-100) or 3.25-3.75 (on a scale of 0-4).

On student activity observation, 12 students were divided into four study groups and each group was observed by one observer. Observation of student activity had done to observe student activity relevant with learning done so that can prove and support result of student post-test data after learning using student worksheet developed. In the first meeting the percentage of student activity on learning is categorized as good to very good because the percentage range of each student is 72.22-94.44%. The second meeting obtained a high activity percentage range which is 80.56-94.44% with very good category.

### Improvement of Students Science Process Skill

The increase in SPS after using the developed student worksheet has a percentage of 64.58-97.92% completeness with n-gain range from 0.50-0.91 medium to high category. The result of students SPS test showed an increase of learning result after experiment limited although there are still students who have not completed. This is because the student does not attend the training at the second meeting so that it is still confused on the science process skill that trained,

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so that students do post-test with less confidence and true to the answer. However, the student still experienced improvement with n-gain score is 0.50 with medium category. The increase of score from pre-test to post-test shows the influence of student worksheet that developed toward student learning outcomes. The increase can be seen in the diagram1 below:

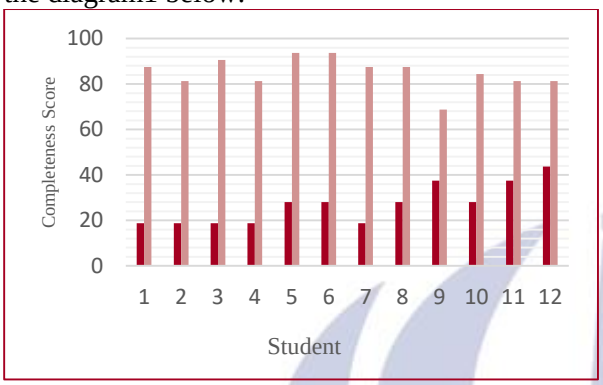


**Figure 1** Diagram of pre-test and post-test results of each student SPS

And supported by percentage table completeness of each component of SPS student. Can be seen in table 5 below:

**Table 5.** Percentage of mastery of students' science skill component on each component

| SPS Component | *Pre-test (%)* | *Post-test (%)* |
|---|---|---|
| Observing | 64.58 % | 64.58% |
| Formulating Problem | 68.75% | 64.58% |
| Making Hypothesis | 43.75% | 85.42% |
| Making Variable | 18.75% | 79.17% |
| Planning Investigation | 20.83% | 93.75% |
| Making Data Table | 0% | 95.83% |
| Analyzing | 0% | 97.92% |
| Making Conclusion | 0% | 97.92% |

## CLOSURE

### Conclusion

Based on the fit between the results of research with the formulation of the problem can be concluded as follows:

1. Student worksheet based on guided inquiry with the KIT instrument in terms of the theoretical feasibility of the reaction rate matter to train the science process skill is deemed very feasible. This is based on the validation results with the percentage of each criterion in the range of 80.55-89.58%.
2. Student worksheet based on guided inquiry with the KIT instrument in terms of the theoretical feasibility of the reaction rate matter to train the science process skill is deemed feasible. This is based on the questionnaire results with the percentage of each criterion in the range of 86.11-91.67% with very good/very decent category. Observation result of student activity at first meeting with range 72.22-94.44% and at second meeting with range 80.56-94.44% with activity category to learning well until very good.
3. Improved Skills of Scientific Processes (SPS) of students after using Student worksheet based on guided inquiry with KIT instrument at computed reaction rate matter. This is evidenced from the increase in pre-test results to the post-test calculated by n-gain score. Completeness percentage range of 64.58-97.92% with n-gain score range 0.50-0.91 with medium to high category.

### Suggestion

Suggestions that can be given to the next researcher are as follows:

1. Research is only done until the development stage, so that the next research is expected to be done until the dissemination stage.
2. Process skill study conducted only 8 aspects in subsequent studies is expected to trill aspects of other process skills.
3. This research only lasted for 2 meetings so it is expected that the next researcher can trained the SPS for longer. Because SPS that are repeatedly trained can form habits so that the rest is more skilled in doing the SPS.
4. Knowledge of the name of the tools and materials is important in doing the lab, so it is expected that the next researcher can pay attention to the students' knowledge about the tools and materials.

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