

## **THE DEVELOPMENT OF GUIDED INQUIRY-BASED STUDENTS WORKSHEET TO INCREASE CRITICAL THINKING SKILLS OF SENIOR HIGH SCHOOL STUDENTS**

**Ella Kurnia Oktaverina and Madlazim**

Physics Department, Faculty of Mathematics and Natural Sciences, State University of Surabaya  
Email: ellaoktaverina@mhs.unesa.ac.id

### **Abstract**

Student worksheet is procedural sheets which are often used in learning as guide in the form of tasks or activities undertaken by learners. Besides, guided inquiry is learning model which aims to give space for the students so they are able to construct their thinking skills, one of them is critical thinking skill. This study aims to (i) determine the validity of guided inquiry based student worksheet to increase the students' critical thinking skills, (ii) determine the practicality of guided inquiry based student worksheet to increase the students' critical thinking skills, and (iii) determine the effectiveness of guided inquiry based student worksheet to increase the students' critical thinking skills. This study is a development study using ADDIE Model (Analysis, Design, Development, Implementation, Evaluation) with subject of trial as many as 24 students in 10th science class, Senior High School 1 Sampang. From this study, it was found that (i) guided inquiry based student worksheet to increase critical thinking skills that has been developed is very valid to be used in learning with percentage in general 86,1%, (ii) the student worksheet is practical in terms of the learning activities result and the students' activities with percentages respectively 90,6% and 84,5%, and (iii) student worksheet which has been developed is effective in terms of critical thinking skills test result with n-gain score 0,78 which belongs to high category and the students' responses with average percentage 88,6%.

**Keywords:** Student worksheet, Guided Inquiry, Critical Thinking Skills.

### **INTRODUCTION**

Indonesia has changed its curriculum several times, started from Curriculum 1947 to the latest one, Curriculum Revised Edition 2013. Curriculum 2013 is a curriculum which aims to train the students' soft-skills and hard-skills through attitude, knowledge, and skills competences.

Curriculum 2013 aims to develop students' potential in accordance with inquiry learning model. Joyce (2000) stated that in inquiry learning model, students are engaged in real problems in which they will investigate and teacher helps the students to identify conceptual or methodological problems and ask them to find how to solve the problems. Guided inquiry is a learning model that prepares the students in a situation where they are going to do experiment so the students can observe what is happening, are motivated to find the answers by themselves and relate an inquiry or a discovery with others. Critical thinking skills are trained directly in guided inquiry learning model. Critical thinking skills need to be implemented in physics learning because physics is a rational knowledge. Critical thinking skills can be trained using critical thinking skills test (Haladyna, 2005). In 21 centuries, critical thinking skills have become very important because in this era, human beings need to have certain quality potential and skills in order to compete globally. If education process has certain

quality, human resources will also have certain quality.

Preliminary studies have been conducted by giving a test to find students' critical thinking skills in Newton's Laws topic. The test of critical thinking skills consisted of five questions which are adapted from Astuti (2016) and being tested to X Science 2 students in Senior High School 1 Sampang. Based on preliminary studies, the percentage of students who were able to answer C2, C3, C4, and C5 question are 100%, 60%, 20%, and 0% respectively. Besides, a fact has been found that in the first semester, the students only did experiment once in physics subject, it indicates that they did not get used of learning with the integration of scientific approach. From this preliminary study, it can be concluded that students' critical thinking skills belong to low category in average.

Besides, because students being able to get knowledge by themselves from learning activities is the characteristic of guided inquiry learning model, supporting teaching materials is needed to be a reference between students and teacher (Belawati, 2000). Teaching materials can be text book, module, or students worksheet. Generally, students worksheet consists of activity sheet, topic summary, and exercises. It is a guide so learning activities can be conducted (Arafah, 2012). By implementing students worksheet

in learning, the students are expected to be able to learn to be independent, understand, and do something written (Majid, 2000).

Based on the interview which has been conducted with physics teacher and several students, it is found that the students worksheet used in school only consists of topic summary, question examples, and exercises. It does not guide the students to experience discovery and it also does not train critical thinking skills. It makes the students less interested and less engaged in the learning.

One of the alternatives to resolve the problem is implementing guided inquiry-based students worksheet. By using guided inquiry-based students which is integrated using critical thinking skills, the students can do learning activities based on inquiry learning model. Aligned with steps of guided inquiry learning model, the solution of the problem shown in the learning can be found by the students. Besides learning motivation, critical thinking skills can be increased through guided inquiry learning.

To decide the quality of learning instruments development which in this case is guided inquiry-based students worksheet, there are three criteria that should be considered, namely validity, practicality, and effectiveness (Nieveen, 2010). Validity is considered whether developed learning instrument is based on knowledge state of the art and whether the components within the learning instrument is consistent one another. Practicality is considered whether the experts reckon that the developed learning instrument can be applied in normal condition and whether in the implementation, it gives the expected result. Meanwhile, effectiveness is considered from learning outcomes and students' responses.

Based on literature study about previous studies in term of guided inquiry-based students worksheet, it is found that students' critical thinking skills can be optimized using students worksheet with guided inquiry approach (Damayanti, 2013). Furthermore, guided inquiry-based students worksheet met eligibility as teaching material because it can increase students' activities and critical thinking skills in the category of high (Siahaan, 2017), and it also gets positive responses from students (Rasulun, 2017).

Based on the problems that have been stated above, the title of The Development of Guided Inquiry-Based Students Worksheet to Increase Critical Thinking Skills of Senior High School Students is chosen.

## METHODS

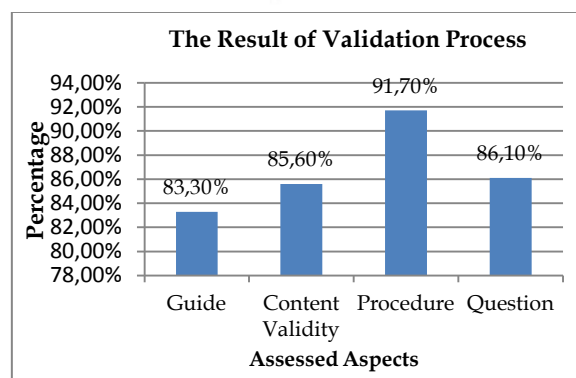
This study is a study of students worksheet development by using ADDIE model. ADDIE Model consists of the following 5 steps, (1) Analysis, (2) Design, (3) Development, (4) Implementation, and (5) Evaluation (Sink, 2014). After being developed, students worksheet is implemented using one group pre-test post-test design.

The implementation of students worksheet is conducted in sub-topic of relation between work and energy. It took place on second semester of 2017/2018 academic year, exactly on April 30th, 2018. 24 students from X Science 2 Senior High School 1 Sampang became sample in this study.

To collect data in this study, the following study instruments are used. They are (1) observation sheet, (2) responses sheet, and (3) test sheet. Observation sheet aims to assess learning activities and students' activities in learning, responses sheet aims to find students' responses towards the developed students worksheet, and test sheet is used to find the gain of students' critical thinking skills. It is analyzed by paired t-test and calculating normalized gain.

## RESULT AND DISCUSSION

This study is a development study using ADDIE model. Before developing students worksheet, material analysis, necessity analysis, and students' characteristics analysis are done. After finishing analysis step, teaching instruments are all created and validated. It is called design step. Development step is done afterwards. In development step, students worksheet is developed through review process by two experts who are also physics lecturers. After finishing review process, students worksheet will go through validation process. Validation process is done by two physics lecturers and a physics teacher of senior high school. Figure 1 shows the result of validation process towards students worksheet.

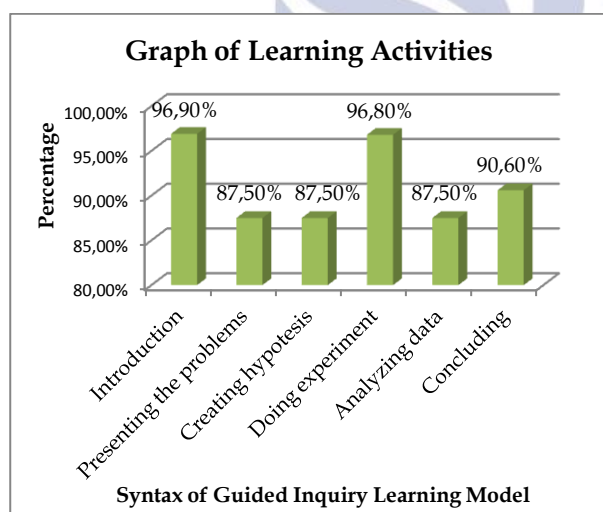


**Figure 1.** The graph of students worksheet validation result

Procedure aspect has the highest validity percentage, 91,7%. The result is obtained because the procedure in students worksheet and its language reability is good. Meanwhile, the lowest aspect is guide aspect with the percentage of 83,3%. This might be because it has less guide sentences and also questions which triggers the students to dig their initial knowledge.

Students worksheet's validity is supported by Siahaan (2017) who stated that guided inquiry-based students worksheet is in the category of very valid to be implemented in senior high school physics learning . From the result of recapitulaton of the developed students worksheet, the average percentage of students worksheet is 86,1%. It is in the category of very good based on Likert scale.

After getting through development step, it continues to implementation step. In this step, practicality and effectiveness of students worksheet is being assessed. Practicality is considered from learning activities and students' activities in learning. The following Figure 2 shows the graph of learning activities result using students worksheet that has been developed.



**Figure 2.** The Result of Learning Activities

Based on recapitulation of learning activities, it is found that the percentage of learning activities is 90,6% which belongs to category of very good. Besides being considered by learning activities, practicality is also considered by students' activity. Among five indicators of critical thinking skills, the indicator of constructing basic skills get the highest percentage, that is 90,1% which belongs to very active category. The result shows that students are able to do experiment, write significant data related to the experiment, and assess consistency among experiment data.

In general, the students can intercat in group to solve the questions at discussion part in the students worksheet, they are also able to communicate their work in front of other groups. But, difficulties can still be seen when they choose strategy or solution which should be used to answer questions at discussion part in students worksheet, expecially the question with evaluation cognitive level (C5), so teacher needs more effort to guide the students so they can think the best solution to solve the problem in that cognitive level.

The result is supported by previous study by Siahaan (2017) who stated that the increase of students' activities is significant when guided inquiry-based worksheet is implemented in the learning.

Based on the result obtained, the students worksheet is practical to be applied in the learning. The result has positive effect because it has increased students' activities and engagements when students worksheet that has been developed takes place in the learning.

Hereafter, effectiveness of students worksheet is considered by the result of critical thinking skills test and students' responses. Table 1 shows the result of students' critical thinking skills test.

**Table 1.** The Result of Students' Critical Thinking Skills

Data	Average Score	N-gain	Category
Pre-test	13	0,78	High
Post-test	82		

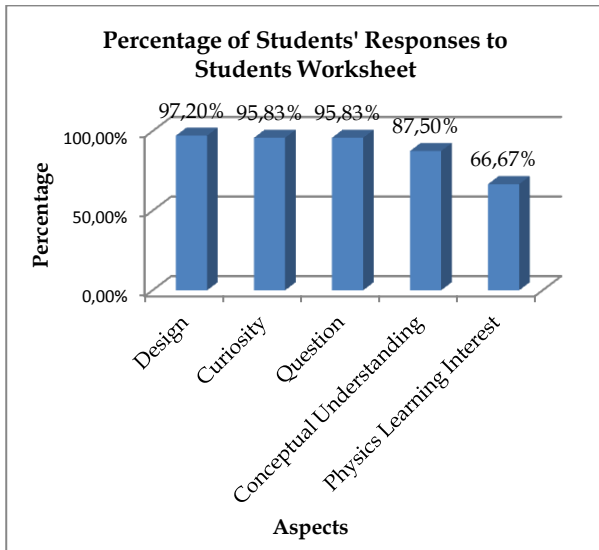
Based on Table 1, the average of students' normalized gain is 0,78. This result shows that the increase of students' critical thinking skills is high, because the n-gain  $\geq 0,7$  (Hake, 1999).

This result is supported by previous studies which state that the increase of students' critical thinking skills belongs to high category in every meeting when guided inquiry-based students worksheet is implemented (Siahaan, 2017). Damayanti (2013) also states that guided inquiry-based students worksheet can optimize students' critical thinking skills.

Considering the result of students' critical thinking skills test, students worksheet which has been developed is effective o be implemented in the learning. It has positive values which is making the students get used of thinking critically to resolve problems that need analysis and evaluation skills.

Effectiveness is also considered by students' responses towards students worksheet that has been developed. The following Figure 3 shows the result of students' responses.





**Figure 3.** The Result of Students' Responses

Considering students worksheet design, responses percentage is 97,2%. There are three aspects to be assessed in design, they are layout, font size, and colour match. Based on the average students' responses percentage, it indicates that students worksheet layout is appropriate, font size is proportional, and the colour blend is also good.

Not only aspect of design, aspect of curiosity, question and conceptual understanding also have positive responses, with percentage of 95,83%, 95,83%, and 87,5% respectively. It shows that students worksheet which has been developed can increase curiosity and conceptual understanding and the students also point out that the questions in students worksheet have been formulated clearly and can be understood without being misinterpreted.

Even so, the part of "Physics learning interest" get percentage of 66,7%. Eight of 24 students claimed that students worksheet was not able to increase their interest to learn physics yet. This critic shows that students worksheet which has been developed still needs to be improved so students' interest in learning physics can be better.

Students worksheet is claimed to be effective if students' responses percentage  $\geq 61\%$  (Riduwan, 2013). The result of response analysis of 24 students is 88,6%, it is classified in the category of very good. This result is supported by Rasulun (2017) and Siahaan (2017)'s study. Both of them indicates that guided inquiry-based students worksheet has got positive feedbacks from the students.

Considering from students' responses, students worksheet which has been developed is effective. This result has positive meaning, it means the students feel

like they can understand physics concepts better when students worksheet is being implemented in the learning.

## CONCLUSION

Based on results of the study that has been done, it can be concluded that guided inquiry-based students worksheet is valid to be applied in the learning. Based on validity aspect, the percentage of students worksheet validity is 86,1%. Practicality is considered by learning and students' activities with the percentage 90,6% and 84,5% respectively. It is also effective to be implemented in the learning. This statement can be proved by students' normalized gain with the value of 0,78, which is in the category of high and the average percentage of students' responses is 88,6% which belongs to very good category.

## SUGGESTIONS

Teacher needs to train students with experiment with different topic in advance before doing the study, it is to avoid difficulties that might happen to the students. Teacher needs more patience and effort to help the students so they can get used of solve the problems by themselves. Students worksheet should be improved in order to gain students' interest in learning physics.

## ACKNOWLEDGEMENTS

Enormous gratitude to Titin Sunarti and Suliyanah who provided expertise that greatly assisted the study and for comments that greatly improved the article. We would also thank Syamsul Arifin, physics teacher in Senior High School 1 Sampang for sharing his pearls of wisdom during the course of this study.

## REFERENCES

- Arafah, F.S, Priyono, B dan Ridlo, S. 2012. *Pengembangan Lembar Kerja Siswa (LKS) Berbasis Inkuiri Pada Materi Animalia Untuk SMA 12 Semarang*, (Online), Vol. 9, Nomor 2, (<http://ejournal.upp.ac.id/index.php/fkipbiologi/article/view/1175/895>, diakses pada 3 November 2017) .
- Astuti, Linda Dwi. 2016. *Pengembangan Perangkat Pembelajaran Fisika Aktif Tipe Information Search Berbasis Kearifan Lokal DIY untuk Meningkatkan Kemampuan Berpikir Kritis dan Nilai Karakter Siswa SMA*. Tesis. Yogyakarta: Universitas Negeri Yogyakarta.
- Belawati, Tian. 2003. *Pengembangan Bahan Ajar*.

Jakarta: Pusat Penerbitan Universitas Terbuka.

Damayanti, Dyah Shinta, Nur Ngazizah, Eko Setyadi K. 2012. *Pengembangan Lembar Kerja Siswa (LKS) Dengan Pendekatan Inkuiri Terbimbing Untuk Mengoptimalkan Kemampuan Berpikir Kritis Peserta Didik Pada Materi Listrik Dinamis SMA Negeri 3 Purworejo Kelas X Tahun Pelajaran 2012/2013*, (Online), Vol. 3, Nomor 1, ([http://ejournal.umpwr.ac.id/index.php/radiasi/article/view/658](http://ejournal umpwr.ac.id/index.php/radiasi/article/view/658), diakses pada 2 Oktober 2017).

Hake, R. R. 1999. *Interactive-Engagement Versus Traditional Methods: A Six-Thousand Student Survey of Mechanics Test Data for Introductory Physics Courses*, (Online), Vol. 66, Nomor 1, ([http://www.montana.edu.msse/Data\\_analysis/Hake\\_1999\\_Normalized\\_gain.pdf](http://www.montana.edu.msse/Data_analysis/Hake_1999_Normalized_gain.pdf) diakses pada 4 November 2017).

Haladyna, Thomas M. 2005. *Construct-Irrelevant Variance in High-Stakes Testing*, (Online), Vol. 23, Nomor 1, (<http://onlinelibrary.wiley.com/doi/abs/10.1111/j.1745-3992.2004.tb00149.x> diakses pada 8 November 2017).

Joyce, Bruce R. dan Marsha Weil. 2000. *Model-Model Mengajar dan Belajar; Dari Mana Mereka Datang dan Bagaimana Mereka Digunakan? Edisi Keenam (Models of Teaching and Learning; Where Do They Come From and How Are They Used? 6th Edition)*. Amerika: Allyn and Bacon.

Majid, Abdul. 2008. *Perencanaan Pembelajaran: Mengembangkan Standar Kompetensi Guru*. Bandung: Remaja Rosdakarya.

Nieveen, Nienke dan Tjeend Plomp. 2010 *An Introduction to Educational Design Research Edisi Ketiga*. Enschede: Netzdruk.

Rasulun, I. I. 2017. *Meningkatkan Kemampuan Berpikir Siswa dengan Model Inkuiri pada Materi Pesawat Sederhana*, (Online), Vol. 5 Nomor 1, (<http://www.jurnal.unsyiah.ac.id/JPSI/article/download/8407/6800> diakses pada 7 November 2017).