USEJ 7 (1) (2018)

Unnes Science Education Journal

http://journal.unnes.ac.id/sju/index.php/usej

# THE DEVELOPMENT OF STUDENT WORKSHEET BY USING GUIDED INQUIRY LEARNING MODEL TO TRAIN STUDENT'S SCIENTIFIC ATTITUDE

**Misbah[1], Dewi Dewantara, Sayid Muhammad Hasan, Syubhan Annur**

Physics Education, Faculty of Teacher Training and Education,
Universitas Lambung Mangkurat

## Article Info

Received July 2017
Accepted December 2017
Published February 2018

*Keywords:*
*Guided inquiry learning, student's worksheet, scientific attitude*

## Abstract

This research is aimed to develop student's worksheet using guided inquiry learning model to train senior high school students' scientific attitude on the dynamic electricity subject. The specific purposes of this research are to: (1) describe the validity of student worksheet, (2) describe the practicality of student worksheet based on questionnaire responses, (3) describe the effectiveness of student worksheet based on students' cognitive result, and (4) describe the achievement of students' scientific attitude ability. This research uses research and development methods with ADDIE design. The research shows that: (1) the student worksheet validity is categorized as very valid, (2) the practicallity of the student worksheet based on questionnaire responses is categorized as practical, (3) the effectiveness of student worksheet is categorized as effective, and (4) the achievement of students' scientific attitude ability is moderate. In conclusion, student worksheet using guided inquiry learning model to train students' scientific attitude for senior high school on the dynamic electricity subject is eligible to be used in learning process.


p-ISSN 2252-6617
e-ISSN 252-6232

✉Corresponding author:
**Misbah**
Brigjend H. Hasan Basry Street, Kayutangi, Faculty of Teacher Training and Education Building,
Universitas Lambung Mangkurat, Banjarmasin, South Kalimantan, 70123
E-mail: misbah_pfis@unlam.ac.id

## INTRODUCTION

Physics is one of science branch which underlies the development of advanced technology and the concept of living in harmony with nature. On senior high school level, physics learning is conducted by using scientific inquiry to develope the ability to think, work, have scientific attitude, and communicate which are the life skills aspect. People who are honest, independent, able to work as a group, able to follow rules, trustworthy, strong and have a high work ethic, will produce a well organized life community system (Yulianti, Khanafiyah, & Sulistyorini, 2016).

Inquiry skills that are given to students can be: formulating problems, formulating hypotheses, designing and conducting experiments, and formulating conclusions or generalizations (Setiawan, Sunarti, & D. Astriani, 2016). Therefore, students are able to understand the nature around them scientifically and acquire inquiry skills (Hairida, 2016). When involved in an investigation, the students describe objects and events, ask questions, build explanations, describe explanations of current scientific knowledge, and share their ideas with others (Şimşek & Kabapinar, 2010).

The learning process in Indonesia focuses more on the students' cognitive development, and it is less on students' affective and psychomotoric development. Preliminary observation had been conducted in SMA Muhammadiyah 1 Banjarmasin. The result of the observation indicates that the learning activities only focus on the students' cognitive development. The available practicum tools are not used by the teacher in the learning activities in the classroom. The impact of this problem can be seen from the low learning outcomes of the students at the school with an average of 65.32.

Observing that facts, the researcher wishes to develop a teaching material that is able to cover the cognitive, affective and psychomotoric aspect of the students in the learning activities, and can improve students' learning outcomes and also able to train the students' scientific attitude. Teaching materials developed should be easy to use by the students. One of the functions of student worksheet is as a practicum instruction because from many teaching materials used, student worksheet is the easiest material to be used by teachers or students in learning activities (Prastowo, 2015). To support activities in the student worksheet, guided inquiry learning model is used because this learning model is part of practicum activities such as orientating, formulating problems, formulating hypothesis, identifying and defining operational variables, conducting experiments, analyzing data, summarizing and making abstraction, so it is suitable for the practicum activities in the student worksheet.

According to Atasoy (Taslidere, 2013), student worksheet is a teaching material that allows students to build their own knowledge and can encourage students to participate in learning activities in the classroom (Taslidere, 2013). One of the functions of the student worksheet is as a guide in practicum activities. According to Johnstone and Shavaili (Majid, 2014) an approach in using student worksheet is student worksheet inquiry where the observation has not been determined by the teacher so that the students' observations can vary.

In improving the quality of physics learning, a distinctive change is needed in teaching and learning activities (Wirtha & Rapi, 2008). The use of guided inquiry learning model in practicum activities in the student worksheet can be seen from the theory underlying the learning model. The guided inquiry model is based on constructivism theory where students build their own knowledge through real-life experiences of an object or problem. The implimentation of inquiry learning positively affects students' cognitive and affective abilities (Koksal & Berberoglu, 2014). In addition, guided inquiry model is also able to train students 'scientific attitude and students' scientific process skills (Karim, Zainuddin, & Mastuang, 2016).

As for building students' scientific attitude, researcher develops an assessment of scientific attitudes based on the opinion of Gega (Bundu, 2006) who stated that there are four dimensions of scientific attitude; the attitude of knowing, the attitude of discovery, the attitude of critical thinking, and strong determination. The guided inquiry model can improve students' critical thinking skills (Damayanti, Ngazizah, & Setyadi, 2013). To train these attitudes, the appropriate indicators are developed so that can represent and train the four attitudes. Assessment sheet is made to assess the students' scientific attitude from the learning process and when the students do practicum activities that contained in the student worksheet.

Based on the description above, the researcher will develop student worksheet using guided inquiry model to train students' scientific attitude. From the results of the student worksheet development, the feasibility will be reviewed to determine whether the worksheet is feasible to be used for learning activities or not. The feasibility review can be determined based on validity, practicality, effectiveness, and achievement of student worksheet in training students' scientific attitude.

## METHODS

In this student worksheet development research by using guided inquiry model to train the high school students' scientific attitude on dynamic electric subject, the ADDIE design development research model is used. This development procedure consists of five steps; analysis, design, development, implementation, and evaluation (Al Mukarram, Hartini, & Wati, 2016).

This research was conducted between February-June 2016. The research took place on SMA Muhammadiyah 1 Banjarmasin which is located at Jl. Let.Jend. S. Parman No. 221 Banjarmasin. The subjects of the study were X-B students of SMA Muhammadiyah 1 Banjarmasin.

From the results of the study, the data of student worksheet development were obtained to analyze the validity, practicality, and effectiveness. The student's worksheet validation data was obtained from assessments by academicians and practitioners based on the overall average score from both of the interraters with assessment criteria that is adjusted to Table 1.

**Table 1.** Student Worksheet Validity Criteria

| No | Interval | Category |
|---|---|---|
| 1 | X > 3.4 | Very valid |
| 2 | 2.8 < X ≤ 3.4 | Valid |
| 3 | 2.2 < X ≤ 2.8 | Fairly valid |
| 4 | 1.6 < X ≤ 2.2 | Less valid |
| 5 | X ≤ 1.6 | Exceedingly less valid |

((Adaptation Widoyoko, 2013)

Coefficient of agreement is used to analyze the reliability from both of the interraters with the following formula:

$$KK = \frac{2S}{N_1 + N_2}$$

Note:

$KK$ = Coefficient of agreement (reliability)

$S$ = Number of the same code for the same object

$N_1$= Number of objects observed by the first interrater

$N_1$ = Number of objects observed by the second interrater

Criteria of reliability are showed in Table 2.

**Table 2.** Reliability Criteria

| No | Criteria | Interpretation |
|---|---|---|
| 1 | 0.80 ≤ KK ≤ 1.00 | Exceedingly high |
| 2 | 0.60 ≤ KK < 0.80 | High |
| 3 | 0.40 ≤ KK < 0.60 | Moderate |
| 4 | 0.20 ≤ KK < 0.40 | Low |
| 5 | 0.00 ≤ KK < 0.20 | Exceedingly Low |

(Adaptation Arikunto, 2010)

The student worksheet practicality is obtained from the analysis of students' responses using questionnaire to the developed worksheet. The worksheet practicality criteria is as shown in Table 3.

**Table 3.** Practicallity Criteria of Student Worksheet

| No | Mean Score | Criteria |
|---|---|---|
| 1 | X > 4.2 | Very Practical |
| 2 | 3.4 < X ≤ 4.2 | Practical |
| 3 | 2.6 < X ≤ 3.4 | Moderately Practical |
| 4 | 1.8 < X ≤ 2.6 | Less Practical |
| 5 | X ≤ 1.8 | Exceedingly Less Practical |

(Widoyoko, 2013)

The effectiveness of the student worksheet is reviewed through student learning outcomes (Sasanti, Hartini, & Mahardika, 2017). The test is a pretest and posttest which is then analyzed using t test pretest one group design. The test formula t pretest one group design (Arikunto, 2010) is as follows:

$$t_{hitung} = \frac{Md}{\sqrt{\frac{\Sigma x_d^2}{N(N-1)}}}$$

Description:

Md = mean from deviation between (d) *posttest* dan *pretest*

$X_d$ = deviation difference with mean deviation

N = number of subject

df = degree of freedom; N – 1

The last is the analysis of the achievement of the student worksheet in training students' scientific attitude. Passing grade (X) is used to calculate the average score of each aspect which is the average assessment result by each interrater. The scores that have been obtained are adjusted to the affective scoring criteria as in Table 4.

**Table 4.** Scientific Attitude Criteria

| No | Mean Score | Criteria |
|---|---|---|
| 1 | $2.25 \leq \overline{M} \leq 3$ | Very Good |
| 2 | $1.5 \leq \overline{M} < 2.25$ | Good |
| 3 | $0.75 \leq \overline{M} < 1.5$ | Adequate |
| 4 | $0 \leq \overline{M} < 0.75$ | Less |

(Sungkowo, 2010)

Note:

$Mi$ = Ideal Mean = 1/2 (max score + min score)

$SDi$ = Ideal Standard Deviation = 1/6 (max score + min score)

## RESULTS AND DISCUSSION

### Student Worksheet Validity

The validity is obtained from the assessment by academicians and practitioners to the worksheet by using validity sheet. The results of student worksheet validation can be seen in Table 5.

**Table 5**. Result of Validity

| Assessment Aspects | Mean | | Mean | Criteria |
|---|---|---|---|---|
| | 1 | 2 | | |
| Format | 3.63 | 3.50 | 3.56 | Highly Valid |
| Language | 3.00 | 3.25 | 3.13 | Valid |
| Content | 3.63 | 3.63 | 3.63 | Highly Valid |
| X | | | 3.44 | Highly Valid |
| Reliabilitas | | | 0.8 | Very High |

From Table 5, it can be seen that the worksheet developed can be used as a learning activity material and categorized as very valid. The average assessment by both of interraters is 3.44 with a very valid category with a very high reliability of 0.8.

This student worksheet is constructed with scientific attitude training orientation, so that in the worksheet will be added with some tasks to measure students' scientific attitude. Student worksheet in this subject learning is very important because through it the students seek information and conclusions in groups and learn to find the problems and then seek the truth. The student worksheet contains performance tasks that must be performed by the students containing the objectives, the formulation of the problem, the observation of the attitude of discovery (formulating hypothesis, variable identification, variable operational definition, and data presentation), tools and materials, data, conclusions, and abstractions).

Specifically the result of the validation of the student worksheet is viewed from the aspect of the format, language, and content. Student worksheet validation assessment is generally outlined in two categories; valid and very valid as in Table 5. Based on these aspects, the general result of the validity was obtained with very valid category with no revision. The table also describes the need for improvements in some aspects such as the aspect of the format concerning the clarity of the objective formulation presented in the student worksheet and the suitability of the answer space with the answer key, while the language aspect relating to the suffiency of the sentence with the students' level of thinking and ability, and sentences that have multiple interpretations, the last, aspect of content that lack of illustrations of images to clarify the concept. From the table, it can be seen that the assessment generally very valid of 3.44, with the validity reliability value is 0.8 with very high category of reliability. Therefore, based on the results of the validity assessment, the student worksheet which developed using guided inquiry model with scientific attitudes training is valid, so it is appropriate to be used to support the learning process.

The developed worksheet should contain questions that can stimulate students to investigate, discover, solve problems, and create (Majid, 2014). The next question can be open or guiding. According to Johnstone and Shavaili (Majid, 2014) inquiry worksheet, in which the results of observations have not been established before so that the observations by students may vary and the procedures in the student

worksheet are designed by students themselves. However, because the inquiry type used in this worksheet is guided inquiry, in each step of inquiry activities, the students are not left alone but guided by the teacher.

Based on the result of the development that was made, the students worksheet have been adjusted with the researcher's interest which is the usage of guided inquiry learning model with scientific attitude training. This student worksheet is developed as a practicum instruction which contains scientific attitude evaluation. The validator's validity results state that the student worksheet is compatible with the student worksheet making theory.

**Student Worksheet Practicallity**

From the results of the calculation of student response questionnaire to determine the practicality of the developed worksheet, the obtained data is as shown by Table 6.

**Table 6**. Analysis Result of Student Response Questionnaire

| Aspects | Mean Score | Category |
|---|---|---|
| Usage Convinience | 3.49 | Practical |
| Benefit | 3.68 | Practical |
| Time Efficiency | 3.72 | Practical |
| General | 3.63 | Practical |

From table 6, it can be seen that the practicality of the worksheet developed generally categorized as good with average 3.63. This is indicated by the average score of the convinience of 3.49 with good category, the benefit with average of 3.68 with good category, time efficiency when using the worksheet with average of 3.27 with good category.

Student response questionnaire is used to see the practicality of the developed worksheet viewed from students' perspective as the user of the worksheet. Student response questionnaire is developed based on three indicators or aspects, namely usage convinience, benefits, and time efficiency. Student response questionnaire was distributed to 27 high school students of class X-B SMA Muhammadiyah I Banjarmasin after learning using the worksheet developed.

Based on the results of the analysis on the questionnaire of student responses, it is found that on the aspect of usage convenience obtained average score of 3.49 with good category, the benefit aspect obtained the average score of 3.68 with good category, and the aspect of time efficiency obtained average score 3.72 with good category. Therefore, the overall students' response to student worksheet developed obtained a score of 3.63 with good category. These results indicate the practicality of the worksheet used by students. In line with the opinion of Nieveen (Akker, Brenda, Anthony, Nienke, & Tjeerd, 2007; Wulandari & Sholihin, 2016) who stated that the practicality of the product can be known through student responses as the user of the worksheet. Due to the fulfillment of the percentage of aspects of usage convenience, benefits, and efficiency of time is good, it can be concluded that the student worksheet using guided inquiry model is categorized as practical.

**Effectiveness of Student Worksheet**

The effectiveness of student worksheet can be reviewed using pretest and posttest sheets which then analyzed using paired t test to know the result of student learning achievement. The calculation result of student learning outcomes using pretest and posttest are analyzed using t test, and then tcount of 43.03 was obtained with ttable of 2.06. From the calculation result, it is known that $t_{count} > t_{table}$ then Ha is accepted so that the wroksheet developed is in effective category.

Based on the research objective which is to describe the effectiveness of the worksheet developed by using the learning outcomes achievement tests which are pretest and posttest that are tested using t test are used in this research. Obtained $t_{count} > t_{table}$ or 43,03 > 2,06 thus the $H_0$ is rejected and $H_a$ is accepted. The effectiveness of a worksheet can be determined through a student test score. Therefore, based on test results on the use of the student worksheet in learning activities the worksheet is categorized as effective.

The use of the student worksheet using guided inquiry learning is effective because students become actively involved in concept acquisition activities (Maikristina, Dasna, & Sulistina, 2013). When the students are active in guided inquiry learning, their understanding of the concept becomes better (Bilgin, 2009; Koksal & Berberoglu, 2014). Therefore, student worksheet with guided inquiry model helps student master the concept (Asmawati, 2015). Thus, this affects students' learning outcomes.

This is in accordance with a research by Minawati, Haryani, & Pamelasari (2014) which stated that the use of guided inquiry based worksheet has a positive effect in improving students' learning outcomes.

**Achievement of Student's Scientific Attitude**

The achievement of the student worksheet in training students' scientific attitude is shown by Table 7 as follows.

**Table 7.** Analysis Result of Student's Scientific Attitude Achievement

| No | Scientific Attitude Dimension | Mean | Category |
|---|---|---|---|
| 1 | Curiousity | 1.24 | Moderate |
| 2 | Discovery | 1.60 | Good |
| 3 | Critical Thinking | 1.52 | Good |
| 4 | Strong Determination | 1.33 | Moderate |
| | Mean | 1.42 | Moderate |

From Table 7, it can be seen that the mean of overall assessment of the achievement of the worksheet in training students' scientific attitude is 1.42 that is categorized as moderate. The mean of each dimension of scientific attitude are the attitude of curiosity of 1.24 with moderate category, the attitude of the discovery of 1.60 with good category, the attitude of critical thinking of 1.52 with good category, and strong determination of 1.33 with moderate category.

The learning process using guided inquiry learning model was observed to find out the achievement of students' scientific attitude by 4 observers. Observations were made using the rubric of scientific attitude evaluation. Table 7 shows that the achievement of students' scientific attitude during learning process using the student worksheet with guided inquiry learning model is viewed through four dimensions: curiosity attitude, discovery attitude, critical thinking attitude, and strong determination attitude. The average achievement of students' scientific attitudes in four meetings for the four dimensions of attitudes observed is 1.42 with moderate category. The reliability of first and second observer is 0.44 with moderate category as well as the reliability of the third and fourth observer of 0.40 with moderate category.

From the results of calculations only on the dimensions of discovery and critical attitudes that obtain good category, while the dimensions of curiosity and strong dteremination only obtain moderate category. This is because the indicators developed by the researcher are still less specific in terms of determining the score so that the observers are difficult to determine the score on what they observe.

A developed worksheet is able to train the scientific attitude (Setiawati, 2013). This is because the developed worksheet used guided inquiry model that uses investigation activities in finding a physics concept, or can be said that phases in the guided inquiry model has fulfilled the process of science activities. The observed scientific attitude is an attitude that must exist when the process of science is done. To facilitate the observation of scientific attitudes in the worksheet, there is an entry on the scientific attitude of the scientific process, including the attitude of the discovery (formulating the hypothesis, the identification and definition of operational variables, the presentation of data), and the critical thinking (data analysis, summing up, and abstraction). The attitude of curiosity and strong determination were observed during the learning process and the use of the worksheet takes place.

Guided inquiry learning positively affects students' attitudes (Bilgin, 2009). By using a guided inquiry approach, students can develop honesty, responsibility, discipline, cooperative, and curiosity character (Jaya, Sadia, Arnyana, & Si, 2014). According to Johnstone and Shavaili (Majid, 2014) a worksheet containing inquiry activities can train scientific attitudes when the students conduct an investigation. This is in line with Abruscato (Dwianto & Prasetyo, 2015) who stated that science is knowledge that gathered through a series of systematic processes for the discovery of nature. This knowledge is characterized with values and attitudes in the process of the scientific discovery.

## CONCLUSION

Based on the results of development and testing, it can be concluded that the student worksheet using a guided inquiry learning model to train students' scientific attitude on dynamic electric subjects is appropriate to be used. This can be proved by:

1. The validity of the student worksheet developed based on the assessment by

academics and practitioners is categorized as very valid.
2. The practicality of the student worksheet developed based on the calculation of students response questionnaire is categorized as practical.
3. The effectiveness of the student worksheet developed based on students' learning outcomes that were analyzed using t test is categorized as effective.
4. Achievement of the student worksheet developed based on the sheet of scientific attitudes is categorized as moderate.

## ACKNOWLEDGEMENT

The Author thank to Faculty of Teacher Trainer and Education, Universitas Lambung Mangkurat due to the funding DIPA 2017. Also, thank to SMA Muhammadiyyah 1 Banjarmasin.

## REFERENCES

Akker, J. V. D., Brenda, B., Anthony, E. K., Nienke, N., & Tjeerd, P. (2007). *An Introduction to Educational Design Research*. Enschede: Netzodruk.

Al Mukarram, A., Hartini, S., & Wati, M. (2016). Pengembangan Lembar Kegiatan Siswa (LKS) DAN Media Pembelajaran IPA SMP Berbasis Keterampilan Berpikir Kritis. *Berkala Ilmiah Pendidikan Fisika*, *2*(3), 353–369.

Arikunto, S. (2010). *Prosedur Penelitian Suatu Pendekatan Praktik*. Jakarta: PT. Rineka Cipta.

Asmawati, E. Y. (2015). Lembar Kerja Siswa (LKS) Menggunakan Model Guided Inquiry untuk Meningkatkan Keterampilan Berpikir Kritis dan Penguasaan Konsep Siswa. *Jurnal Pendidikan Fisika*, *3*(1).

Bilgin, I. (2009). The Effects of Guided Inquiry Instruction Incorporating A Cooperative Learning Approach on University Students Achievement of Acid and Bases Concepts and Attitude Toward Guided Inquiry Instruction. *Scientific Research and Essays*, *4*(10), 1038–1046.

Bundu, P. (2006). *Penilaian Keterampilan Proses dan Sikap Ilmiah dalam Pembelajaran Sains-SD*. Jakarta: Departemen Pendidikan Nasional.

Damayanti, D. S., Ngazizah, N., & Setyadi, K. E. (2013). 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. *Jurnal BioEdu*, *2*(3), 203–208.

Dwianto, A., & Prasetyo, Z. K. (2015). Science Domain Based Learning Integrated Local Wisdom to Improve Student's Science Process Skills anda Scientific Attitudes. In *Proceeding of International Seminar on Science Education* (pp. 1–8). Yogyakarta: Yogyakarta State University.

Hairida. (2016). The Effectiveness Using Inquiry Based Natural Science Module With Authentic Assessment to Improve The Critical Thinking and Inquiry Skills of Junior High. *Jurnal Pendidikan IPA Indonesia*, *5*(2), 209–215.

Jaya, I. M., Sadia, I. W., Arnyana, I. B. P., & Si, M. (2014). Pengembangan Perangkat Pembelajaran Biologi Bermuatan Pendidikan Karakter Dengan Setting Guided Inquiry Untuk Meningkatkan Karakter dan Hasil Belajar Siswa SMP. *Jurnal Pendidikan IPA*, *4*(1).

Karim, M. A., Zainuddin, & Mastuang. (2016). Meningkatkan Keterampilan Proses Sains Fisika Siswa Kelas VIII SMP Negeri 2 Juai dengan Menggunakan Model Pembelajaran Inkuiri Terbimbing. *Berkala Ilmiah Pendidikan Fisika*, *4*(1), 35–42.

Koksal, E. A., & Berberoglu, G. (2014). The Effect of Guided-Inquiry Instruction on 6th Grade Turkish Students' Achievement, Science Process Skills, and Attitudes Toward Science. *International Journal of Science Education*, *36*(1), 66–78.

Maikristina, N., Dasna, I. W., & Sulistina, O. (2013). Pengaruh Penggunaan Model Pembelajaran Inkuiri Terbimbing Terhadap Hasil Belajar dan Keterampilan Proses Sains Siswa Kelas XI IPA SMAN 3 Malang Pada Materi Hidrolisis Garam. *Jurnal Pembelajaran Kimia*, *6*(1), 98–108.

Majid, A. (2014). *Strategi Pembelajaran*. Bandung: Remaja Rosdakarya.

Minawati, Z., Haryani, S., & Pamelasari, S. . (2014). Pengembangan Lembar Kerja

Siswa IPA Terpadu Berbasis Inkuiri Terbimbing Pada Tema Sistem Kahidupan Dalam Tumbuhan Untuk Smp Kelas VIII. *Unnes Science Education Journal*, *3*(3).

Prastowo, A. (2015). *Panduan Kreatif Membuat Bahan Ajar Inovatif*. Yogyakarta: Diva Press.

Sasanti, M., Hartini, S., & Mahardika, A. I. (2017). Pengembangan LKS Dengan Model Inquiry Discovery Learning (IDL) Untuk Melatihkan Keterampilan Proses Sains Pada Pokok Bahasan Listrik Dinamis Di SMAN 5 Banjarmasin. *Berkala Ilmiah Pendidikan Fisika*, *5*(1), 49–62.

Setiawan, B., Sunarti, T., & D. Astriani. (2016). The Application Of Inquiry Learning Model To Improve "Satu Atap" Students' Learning Results at SMPN 4 Singosari Malang. *Jurnal Pendidikan IPA Indonesia*, *5*(1), 45–50. https://doi.org/10.15294/jpii.v5i1.5788

Setiawati, R. (2013). Pengembangan Modul Berbasis Inkuiri Terbimbing untuk Mengoptimalkan Sikap Ilmiah Peserta Didik pada Pokok Bahasan Listrik Dinamis di SMA N 8 Purworejo Kelas X Tahun Pelajaran 2012/2013. *Radiasi: Jurnal Berkala Pendidikan Fisika*, *3*(1), 24–27.

Şimşek, P., & Kabapinar, F. (2010). The Effects of Inquiry-Based Learning on Elementary Students' Conceptual Understanding of Matter, Scientific Process Skills and Science Attitudes. *Procedia - Social and Behavioral Sciences*, *2*(2), 1190–1194. Retrieved from https://doi.org/10.1016/j.sbspro.2010.03.170

Sungkowo. (2010). *Seri Petunjuk Teknis Pelaksanaan Penilaian dalam Implementasi KTSP di SMA*. Jakarta: Kementerian Pendidikan Nasional.

Taslidere. (2013). The Effect of Concept Cartoon Worksheets on Student's Conceptual Understandings of Geometrical Optics. *Jurnal Education and Science 2013*, *38*(167), 144–161.

Widoyoko, E. P. (2013). *Evaluasi Program Pembelajaran*. Yogyakarta: Pustaka Pelajar.

Wirtha, I., & Rapi, N. (2008). Pengaruh Model Pembelajaran Dan Penalaran Formal Terhadap Penguasaan Konsep Fisika DAN Sikap Ilmiah Siswa SMA Negeri 4 Singaraja. *Jurnal Penelitian Dan Pengembangan Pendidikan*, *1*(April), 15–29.

Wulandari, N., & Sholihin, H. (2016). Analisis Kemampuan Literasi Sains Pada Aspek Pengetahuan Dan Kompetensi Sains Siswa SMP Pada Materi Kalor. *Edusains*, *8*(1), 66–73.

Yulianti, D., Khanafiyah, S., & Sulistyorini, S. (2016). Inquiry-Based Science Comic Physics Series Integrated. *Jurnal Pendidikan IPA Indonesia*, *5*(1), 38–44. https://doi.org/10.15294/jpii.v5i1.5787