The Development of Free Inquiry Lab-Based Students’ Worksheet to Increase the Dimension in Science Literacy Process

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Abstract
This research aimed at 1) developing and producing feasible free inquiry lab-based students’ worksheet to increase the dimension in students’ science literacy process and 2) examining the effectivity of free inquiry lab-based students’ worksheet in increasing the dimension in students’ science literacy process. This research was conducted using research and development method. The students of XI MIPA SMA Kristen 1 Salatiga were the subject of this research. This research was conducted in the first semester of 2018-2019 academic year. The validation questionnaire and students’ response, the observation sheet of dimension process and learning model implementation, and science literacy question sheet were the research instrument covered in this research. The hypothesis test was conducted using paired-sample t-test. The result of this research revealed that 1) the developed free inquiry lab-based students’ worksheet was feasible based on the assessment result from the professional validator with the average 80.19% and the students’ response was very good towards the worksheet with the assessment average 82.49%. 2) The free-inquiry lab students’ worksheet was effective in increasing students’ dimension in science literacy process in plant tissue topic, which was supported with the average of students’ dimension of science literacy process 87.71% (very good) and the students’ N-Gain was 0.7 (very good). It was proved by the paired samples t-test statistic test with the result 0.00 < 0.05, therefore H0 was rejected, or in the other words, the free inquiry lab-based students’ worksheet was effective in increasing the dimension in science literacy process.

Keywords: Students’ Worksheet, Free Inquiry Lab, Dimension Process, Science Literacy, Plant Tissue Topic

1. Introduction
The twenty first century is characterized with the development of science and sophisticated technology. Along with the development of science and technology, there are various challenges should be faced. One of the challenges in education is to create qualified educational system and be able to produce qualified human resources for giving the contribution to the development (Mukminan, 2014). Therefore, it is important to shape the competences needed for the human resources in order to be able to compete in this globalization era (Hermita, Suciati, & Rinanto, 2016).

The important role of education in facing the developing science and technology becomes the target in growing and developing process of every human resources’ potential (Tirtarahardja & Sulo, 2012). Therefore, every teacher, who takes the important, part also must be able to follow educational innovations thoroughly in order to realize the educational quality.

The development of science and technology is also supported with the development of science, especially in natural science. According to Arikunto (2006) the natural science education and technology has a close relationship where natural science education is the base of technology development, while technology supports the development of science.

The quality forming process is very important to do through science learning process. For that reason, the learning quality in science learning is important in order to motivate students’ so that they can develop their skills and thinking towards scientific process (Ardhana, 2002). Science learning also trains the thinking ability in high order, such as logical, critical, creative, and innovative thinking, problem solving, the ability in making an appropriate
decision, and the ability in science technology which will lead to the shaping of the students’ science literacy (Liliasari, 2011).

Science literacy is an ability owned by a person in understanding, at this point is to understand the scientific concepts and their processes, communicating, and the ability to apply the science to solve the problem (Yuliati, 2017).

Science literacy are categorized to four dimension: science application context, competencies, knowledge, and attitudes (OECD, 2007). The science process has a vital role in science literacy because in this process a person can involve directly in the scientific method, it is to prove the scientific concepts, construct the scientific knowledge, and train the communication skills based on the obtained data and fact from science process.

Referring to the fact happened in Indonesia, according to Programme for International Student Assessment (PISA), Indonesia is in the sixty ninth rank from seventy six participating countries (OECD, 2016). It is known generally that the average of Indonesian students’ science skills has not been able to relate between knowledge and its application which affects students’ competencies. In line with that (Utami, 2018) reveals that the science literation profile of junior high school students in Purwokerto is still low, where the test result shows that the students’ science content ability is 53.80%, the science process ability is 44.03%, and the students’ science context ability is 35.088%. In accordance with the result released by PISA, the average result of science literacy skills is also categorized as low. This is revealed towards the research conducted by Wardhani, Situmorang, & Sastrodihardjo (2018) that the science literacy competency is categorized as fair with the average 66.67%, while the research conducted by Pratiwi, Situmorang, & Krave (2018) in SMA Kristen 1 Salatiga revealed that it is needed to design a suitable learning model to increase students’ science literacy competency.

The facts presented above give a picture that the science understanding of students in Indonesia is still categorized as low. This also shows the learning process which is not optimal. The low scientific understanding from the students is often related with the restricted motivation, horizon, and the creativity from the educators. Besides that, the learning process which is lacked of direction to the students’ participation activity and focused to the material delivering target so that it does not give a meaningful learning experience to the students (Priyambo & Situmorang, 2017). The data released by The Ministry of Education in Indonesia shows that the students’ concept mastery based on the 2016/2017 Academic Year Biology National Examination Result is still categorized as low, it is 40% in national level and 47.13% in Central Java and 56.42% in plant tissue material.

Based on that fact, the educators need to apply a precise strategy and innovations in the learning process to optimize the students competence achievement. The development of students’ worksheet is considered as one of the efforts to motivate students to do scientific observation so that it can build students’ knowledge on the concept learned in Biology subject. The students’ worksheet includes the activity which is must be done by students to maximize their understanding along with the learning indicator achievement (Trianto, 2009). The development conducted on students’ worksheet needs to be supported with scientific approach-based learning model.

Inquiry is one of the scientific based learning models. It is characterized with a process done to find and understand an information towards systematical, critical, logical, and analytical finding so that the students’ are able to formulate their own finding (Trianto, 2009). The application of the inquiry learning model encourages students’ direct involvement to scientific process so that they are able to increase the science understanding. Wenning (2011) classifies inquiry based learning to some levels and one of the levels is inquiry laboratory. In this level, students are able to establish the concept based on conducted scientific examination towards team work to build their knowledge.

There are three types of inquiry lab: guided inquiry lab, bounded inquiry lab, and free inquiry lab (Wenning, 2011). Guided inquiry lab is characterized with teacher’s direct involvement in a whole part in guiding the students building their own knowledge, while bounded inquiry lab is typified with the pre-lab activity which still needs teacher’s involvement. The teacher’s involvement itself is limited in identifying the main problem. The free inquiry lab
is indicated with the direct identification of the research problem done by the students so that the students is able to build their own knowledge.

The inquiry lab model application encourages students’ active involvement in the learning process. It is relevant with the research result by Suryanto, Susanti, & Saputro (2015) which shows that the free inquiry model gives a positive result towards higher students’ learning achievement in the experimental class along 80.22 and it is compared with control class 72.53. This is supported by the free inquiry model which gives a whole freedom to students to dig and find the answers through an experiment for solving the problem so that it is able to form and build students’ scientific concept finding process, though the other learning media or tool is needed to help students in finding the concepts. Besides that, the similar research conducted by Sulistiawan, Sumardi, & Berman (2017) states that the application of levels inquiry model is able to increase students’ achievements in all aspects such as cognitive, affective, and psychomotoric. This model encourages students to find their own concepts related to a material through a set of scientific process.

If it is correlated with the science dimension process, therefore it is assumed that free inquiry lab has the real connection as one of the learning models which can increase students’ dimension in science literacy process. The plant tissue topic contains the concept of constitutive, structure, and the purpose from each plant’s constitutive tissue. The basic competency that the student should achieve is that the students should be able to apply the concept of the correlation between the plant’s cell tissue structure and the purpose of plant’s organ based on the observation result.

Consequently, teachers need to design an activity that can facilitate students to achieve that competency. The development of free inquiry lab-based students’ worksheet is one of the appropriate solutions to be applied for the presence of students’ worksheet can direct students in conducting experiment related to the identification of plant’s constitutive tissue while free inquiry lab encourages students to involve directly and actively in scientific experiment to build their knowledge on that topic. It will lead to the shaping of students’ science literacy. This research is conducted to develop and verify the effectivity of free inquiry lab-based students’ worksheet in enhancing the dimension in science literacy process for the students’ of SMA Kristen 1 Salatiga.

2. Method

The research is conducted using research and development method which is adapted from the steps in Borg and Gall’s theory of Research and Development (R&D) (Borg, W. R & Gall, 2003). It is directed for generating a product, that is free inquiry lab-based students’ worksheet for senior high school students. The steps conducted in this research covers the preliminary studies and collecting information, planning and designing, making free inquiry lab-based students’ worksheet, product validation I (internal review) by the lecturer expertised in the topic and learning media, product validation II (external review) by the teacher teaching the Biology subject for Senior High School Students, limited trial which covers legibility test by six students of XI MIPA and limited trial in small group participated by ten students. The next step is to conduct product effectivity test towards the application of free inquiry lab-based students’ worksheet to the students of XI MIPA 1 SMA Kristen 1 Salatiga.

The product trial is conducted with applying the draft of free inquiry lab-based students’ worksheet in learning process. After that, the observation is conducted. The product trial is conducted with using the One Group Pre-test & Post-test (Sugiyono, 2010).

The subjects of the trial is the students’ of XI MIPA from SMA Kristen 1 Salatiga in the first semester of 2018-2019 academic year. The subjects of the trial in the research and development are 6 students participating in the legibility test, 10 students participating in limited trial (small group) and 24 students from XI MIPA 1 participating in product effectivity test.

The data collection process uses questionnaire, observation, and written test. The questionnaire is used in validating the developed students’ worksheet so that a feasible free inquiry lab-based students’ worksheet can be obtained to be implemented in the learning process. The observation is conducted for assessing the achievement in the dimension in
science literacy process and assessing the learning implementation. The written test is conducted to assess the achievement in students' knowledge which covers pre-test and post-test.

The research instruments used cover the students' worksheet validation questionnaire for expertised validator, students' worksheet validation questionnaire for students, the observation sheet for observing the achievement in the dimension in science literacy process, learning achievement observation sheet, and the science literacy questions as the test for seeing students' learning result.

The technique in analyzing the data covers the analysis of product validation developed using the descriptive quantitative analysis based on the validation result, response, and the validators commentary through the students' worksheet. The analysis of learning implementation is done based on the observation result by the observer through the whole percentage from the learning syntax in the lesson plan. The analysis of the achievement in the dimension in students' science literacy is conducted based on the final score obtained by each student. This accumulative score is the amount of the total score from each component/science process assessment aspect used in the assessment. The effectivity analysis of free inquiry lab-based students worksheet towards the enhancement in the dimension in students' science literacy process is done using paired samples t-test with the assistance of SPSS 18.0 version. This effectivity test is the analysis prerequisite test which covers normality test and homogenity test. For the next step, the hypothesis with paired samples T-Test is conducted.

3. Result and Discussion

A. The Feasibility of Free Inquiry Lab-Based Students' Worksheet

The feasibility result of the free inquiry lab-based students' worksheet is obtained based on the assessment result from the expertised validator and the assessment from the students toward the students' worksheet which has been developed and applied in the learning process of plant tissue topic for XI MIPA 1 students. The free inquiry lab based student worksheet was developed using the development steps adapted from the development model proposed by Borg, W. R & Gall (2003), though the steps was not applied in whole regarding to the time limitation and the research expense. This is relevant with what is proposed by Ardhana (2002) which states that in the developing process, we are able to choose the most suitable steps based on the condition which we face. A learning tool is considered as feasible if they fulfill the validity standards based on the assessment from the experienced validator (Prihantya, Mitarlis, & Maulida, 2016). Here is the feasibility test result of the free inquiry lab based students worksheet in detail:

Table 1: The Assessment Result of The Feasibility in Free Inquiry Lab-Based Students

| No. | Assessment Aspects                  | P (%) | Category      |
|-----|------------------------------------|-------|---------------|
| 1.  | Preface                            | 72.92 | Feasible      |
| 2.  | Content                            | 79.17 | Very Feasible |
| 3.  | Utilization                        | 72.92 | Feasible      |
| 4.  | Assignment/Evaluation/Assessment   | 85.71 | Very Feasible |
|     | **Average**                        | **77.68**| **Very Feasible** |

Table 1 above shows the feasibility assessment result of the free inquiry lab-based students' worksheet by validators based on the percentage of each assessment indicators with the total average 77.68% which can be categorized as very feasible, or in other words the students' worksheet with the topic plant tissue has been very feasible to be applied in the learning process. Besides the assessment in the percentage number, the validator expertised in plant tissue topic also gives suggestions with the clarity of the material and the choice of the plant used as the practice material. The plant should be easy to get in the surrounding as much as possible. This is in line with the conducted research where the teacher needs to design a learning activity which is related with the reality through a contextual phenomenon or
related with surroundings (Chamany, Allen, & Tanner, 2006). Besides that, validators expertised in the material suggests related with the needs of illustration or description on plant tissue by the students’. It can help students along the identification process. A learning device, including the students’ worksheet, will be better and effective if it is completed with the illustration as the real picture of the discussed concept (Toharudin, Hendrawati, & Rustaman, 2011). This was also stated Shabiralyani, Hasan, Hamad, & Iqbal (2015), say that using visuals illustration as a teaching method stimulates thinking and improves learning environment in a classroom. Students develop and increase personal understanding of the areas of learning when they experience a successful and pleasant learning in the classroom.

Table 2: The Feasibility Assessment Result of Free Inquiry Lab-Based Students

| No. | Assessed Aspects       | P (%) | Category          |
|-----|------------------------|-------|-------------------|
| 1.  | Physical Appearance    | 90.63 | Very Feasible     |
| 2.  | Attractiveness         | 93.75 | Very Feasible     |
| 3.  | Utilization            | 75.00 | Very Feasible     |
| 4.  | Feedback               | 71.43 | Feasible          |
|     | **Average**            | **82.70** | **Very Feasible** |

Based on the result revealed on Table 2 above, it can be known that the feasibility assessment result of the students’ worksheet by the validators expertised in learning media is very feasible with the total average 82.70%. In other words, the students’ worksheet as the learning media assessed through the assessment aspects on the table above has been very feasible to be applied in the learning process.

Nevertheless, validators expertised in learning media also gives suggestions to clarify the character of the free inquiry lab from the students’ worksheet which will become the special characteristic from the developed students’ worksheet. Basically, this developed students’ worksheet is a learning device integrated with free inquiry lab model so that the implication will align with the learning phases in the free inquiry lab phases. All suggestions or inputs from various validators are used as evaluation for the revision of the students’ worksheet in maximizing the development of free inquiry lab-based students worksheet product.

After the students’ worksheet has been revised and has been stated as feasible, the legibility test is conducted. Six students from XI MIPA 2 participated in this test. Ten students from XI MIPA 1 participated in the restriction test. From the conducted trial, later the students will do the assessment based on the aspects stated on the questionnaire. The result of the students’ assessment towards the students’ worksheet is described as below:

Table 3: The Students’ Response Towards Free Inquiry Lab-Based Students Worksheet

| No. | Assessed Aspects | P (%) | Category   |
|-----|------------------|-------|------------|
| 1.  | Visual           | 83.33 | Very Good  |
| 2.  | Utilization      | 81.25 | Very Good  |
| 3.  | Construction     | 86.46 | Very Good  |
| 4.  | Content          | 78.91 | Very Good  |
|     | **Average**      | **82.49** | **Very Good** |

Based on the result obtained as described in Table 3, it can be known that students’ have a very good response, proved with the assessment average in every assessment aspects, 82.49%, or in other words, the students’ response has a positive response from the students as the students’ worksheet implementation subject which directly interacts with the students’ worksheet towards a series of activities in the worksheet.

This also can be seen from students’ written response that, generally, students are assisted in understanding the concept of plant tissue towards the implementation of the free inquiry lab-based students’ worksheet in the learning process. This is in line in line with the essence of the designing process of students’ worksheet which is basically to assist students in finding a concept, correlating the concept has been learned and found through a series of
activity in it (Martiyono, 2012). Looking at the importance of the students’ worksheet to the students in the learning process, teachers need to design the students’ worksheet as good as possible so that the worksheet can facilitate the students, enhance the learning activity, encourage the students to be able to work individually, and guide the students to the concept development (Hamdani, 2011).

B. Learning Model Implication

The validated and revised free inquiry lab-based students’ worksheet later implied in a class. The result of the free inquiry lab learning implication is described in the graphic below:

![Figure 1](image)

**Figure 1**: Learning Model Implication Percentage

Based on the graphic in Figure 1, it can be known that almost all aspects planned in the lesson plan had been implemented based on the observation done by the observer. It is shown in the graphic based on the observation done by the observers. The observation done by the Observer 1 shows that there are 13 indicators implicated from 14 implication indicators (92.86%), while the observation done by the Observer 2 shows that there are 12 indicators implicated from 14 implication indicators in the learning model (85.71%).

C. The Achievement of The Dimension in Science Literacy Process

The achievement of the dimension in science literacy process is measured through the observation sheet that contains assessment indicators based on the implication trial of the free inquiry lab-based students’ worksheet in the learning process towards 20 students of XI MIPA 1. The achievement of the dimension in the science literacy process is described as below.

**Table 4**: The Result of The Achievement for The Dimension in The Science Literacy Process

| No. | Science Process Indicators      | P (%)  | Category |
|-----|---------------------------------|--------|----------|
| 1.  | Formulating Hypothesis         | 82.08  | Very Good|
| 2.  | Conducting Experiment          | 85.42  | Very Good|
| 3.  | Observing                      | 90.42  | Very Good|
| 4.  | Data Interpreting              | 88.33  | Very Good|
| 5.  | Applying the Concept           | 90.42  | Very Good|
| 6.  | Communicating                  | 89.58  | Very Good|
|     | **Average**                    | **87.71** | **Very Good** |

According to the results obtained in Table 4, it shows that this students’ worksheet is able to give a very good result in terms of the dimension in students’ science literacy process. It is proved with the students’ achievement average in every indicator, 87.71% with the category very good. The indicators of measured dimension in students’ science literacy process are based on the the indicators of science process in general as stated in the table above (Malik, Kurnia, & Siti, 2017). The indicators in the table above become the base of the
students’ science process assessment which is measured along the biology learning process by implementing free inquiry lab-based students’ worksheet to conduct an observation/experiment of plant tissue so that students can find their own concept. This is in line with the essence from the science dimension process as the form of development and enhancement of students’ science process ability through experiment. Besides that, (Chebii, Wachanga, & Kiboss, 2012) states that experiment or direct trial through practical activity encourages curiosity so that students are challenged to do trials for being more active in Biology learning activity.

The presence of students’ worksheet as a learning device integrated with the steps of free inquiry lab, if it is linked with the dimension in science literacy process, has a very strong correlation. It can be seen from the result obtained above. Students’ worksheet is useful to increase the activity of students in the learning process (Piawi, K.M, & Mawardi, 2018). As the inquiry which is designed to courage the students directly to the scientific process (Trianto, 2009), the free inquiry lab based students’ worksheet facilitates the students to be actively involved in the scientific experiment process to build their knowledge about the plant tissue which affects the students’ science literacy, especially in the science process dimension. This is supported by the steps in free inquiry lab Joyce & Weil (2000) which covers the problem exposition, data collection and verification, conducting an experiment, formulating an explanation/concept, and the inquiry process analysis. They direct students to do scientific investigation independently without direction before conducting the activity, yet the students will do based on the designed students’ worksheet and integrated with free inquiry lab model. This also becomes the special characteristic of free inquiry lab at once. This will lead to the enhancement of the dimension in students’ science literacy process.

D. The Effectivity of Free Inquiry Lab-Based Students’ Worksheet towards The Enhancement in Science Literacy Process

The effectivity of free inquiry lab-based students’ worksheet towards the enhancement of dimension in science literacy process is measured based on the achievement in the dimension in students’ science literacy process supported with the Gain Standard Value, it is the deviation between the pre-test score and the post-test score gained by the students after implementing the free inquiry lab-based students’ worksheet in learning process. The result obtained is described as follows.

![Figure 2: Students' Enhanced Learning Result](image)

Based on the graphic in the second picture, it can be known that overall there is an enhancement from students’ learning result showed by the enhancement average from students’ pretest and post-test, 35,18, and the average of overall students’ N-Gain, 0,7. It can be interpreted as high category. Twenty students in XI MIPA 1 experiences the enhancement with the students’ N-Gain percentage value categorized as high 55% and the middle category is 45%. This means the implementation of free inquiry lab based students worksheet gives a positive impact towards students’ learning achievement because it facilitates students in a set of scientific process which encourages the students to be able to find the concept on a material. It is in line with what has been stated by Trianto (2009) that in general, the inquiry process is
able to develop all the students’ potential, not only restricted to the students’ skill development, but it also includes the process of formulating the problem, hypothesing, collecting and analyzing the data, and giving conclusion. Through the process, the students will realize about the investigation process which they have conducted so that the learning process will give a meaningful impression for students because the chance to be actively involved in finding the concepts has been given for them.

Table 5: The Result of the Free Inquiry Lab-Based Students Worksheet

| Paired-samples t-test | Paired Differences | 95% Confidence Interval of the Difference | T  | df | Sig. (2-tailed) |
|-----------------------|--------------------|------------------------------------------|----|----|-----------------|
| Learning Result – Dimension Process | Mean | Std. Deviation | Std. Error Mean | Lower | Upper |
| 7.50365E | 9.59388 | 2.14526 | 70.54643 | 79.52657 | 34.978 | 19 | .000 |

The effectivity test of free inquiry lab-based students’ worksheet in enhancing the dimension in students’ science literacy process is conducted through paired-sample t-test. A prerequisite test has been conducted before. This test covers normality test and homogeneity test. This test is done by analyzing the post-test result and the score achievement average from the dimension in students’ science literacy process. Because the analysis prerequisite test result has been fulfilled, then the hypothesis test can be conducted through the parametric statistic. The hypothesis test uses the paired-samples t-test and it is obtained the value sig. (2-tailed) 0.00 < 0.05, then Ho is rejected, in other words the free inquiry lab students’ worksheet is effective in enhancing the dimension in science literacy process. This is relevant with the research that the phases in free inquiry lab encourage the students to do the scientific investigation in solving the problem and give the students comfortability to dig and find the answers so that the students are able to shape and build the concept finding process independently (Suryanto et al., 2015).

In line with that, Khabibah & Suyatna (2018) also reveals that the use of inquiry-based student worksheet instill science generic skill of the students, (skills for the students in the scientific process, think, and act based scientific knowledge they have. This is possible to happen because the learning activities are conducted through the experiments, the students have to play important role to prove the hypotheses they have designed. The students are involved in an inquiry process that included all the inquiry skills namely: identifying problems, formulating hypotheses, designing an experiment, gathering and analyzing data, and drawing conclusions about scientific problems and phenomena. they were encouraged to discuss their ideas about the scientific phenomena based on their science experiment. While performing the inquiry activity, the students practiced their metacognitive abilities in various stages of the inquiry process (Kipnis & Hofstein, 2008).

Besides that, the learning process using the students’ worksheet integrated with free inquiry lab model is able to enhance the students’ ability in science literacy process because it can facilitate students in doing scientific investigation so that the students do not only learn the concept, but also train the students’ process in finding a concept which will lead to the forming of the dimension in students’ science literacy process (Wenning, 2010).

4. Conclusion and Suggestion

Based on the result and the discussion above, it can be concluded that the developed free inquiry lab-based students worksheet is feasible and effective to enhance the dimension in science literacy process for students of XI MIPA 1 based on the feasibility assessment from expertised validators. The students’ response through the students’ worksheet is very good so that it can be implemented in the class learning process. It is supported with the students’ average of the dimension in science literacy process 87.71 (very good) and the N-Gain average 0.7 (very good) and also proved with the statistic test paired sample t-test.

Teachers need to develop a learning device or model which can enhance students’ science literacy, especially the dimension in science literacy process. The similar research to enhance students’ ability in science literacy needs to be conducted in other learning topic.
References
Ardhana, W. (2002). Konsep Penelitian Pengembangan dalam Bidang Pendidikan dan Pembelajaran. Malang: Universitas Negeri Malang.
Arikunto, S. (2010). Prosedur Penelitian : Suatu Pendekatan Praktik (Edisi Revisi). Jakarta: Rineka Cipta.
Borg, W. R & Gall, M. D. G. (2003). Education Research. Education Research. New York: Allyn and Bacon.
Chamany, K., Allen, D., & Tanner, K. (2006). Making Biology Learning Relevant to Students: Integrating People, History, and Context into College Biology Teaching. CBE Life Sciences Education, 7(7), 267 – 278.
Chebii, R., Wachanga, S., & Kiboss, J. (2012). Effects of Science Process Skills Mastery Learning Approach on Students’ Acquisition of Selected Chemistry Practical Skills in School. Scientific Research. Scientific Research, 3(8), 1291 – 1296.
Hamdani. (2011). Strategi Belajar Mengajar. Bandung: Pustaka Setia.
Hermita, R., Suciati, & Rinanto, Y. (2016). Pengembangan Modul Berbasis Bounded Inquiry Lab untuk Meningkatkan Literasi Sains Dimensi Konten pada Materi Sistem Pencernaan Kelas XI. Jurnal Inkuiri, 5(2), 94–107.
Joyce, B., & Weil, M. (2000). Models of Teaching. Journal of Chemical Information and Modeling. Amerika: A Person Education Company.
Khabibah, N., & Suyatna, A. (2018). The Use of Inquiry-Based Student Worksheet To Instills Science Generic Skill of The Students. International Journal of Research, 6(6), 131–138. https://doi.org/10.5281/zenodo.1301176
Kipnis, M., & Hofstein, A. (2008). The Inquiry Laboratory as a Source for Development of Metacognitive Skills. International Journal of Science and Mathematics Education, 6(3), 601–627. https://doi.org/10.1007/s10763-007-9066-y
Liliasari. (2011). Membangun Masyarakat Melek Sains Berkarakter Bangsa Melalui Pembelajaran. In Prosiding Seminar Nasional FMIPA UNNES (pp. 1–9). Semarang: FMIPA Unnes.
Malik, A., Kurnia, E., & Siti, R. (2017). Peningkatan Keterampilan Proses Sains Siswa melalui Context Based Learning. Jurnal Penelitian & Pengembangan Pendidikan Fisika, 2(1), 23–30. https://doi.org/10.21009/1.02104
Martiyono. (2012). Perencanaan Pembelajaran Suatu Pendekatan Praktis Berdasarkan KTSP Termasuk Model Tematik. Yogyakarta: Asjawa Pressindo.
Mukminan. (2014). Peningkatan Kualitas Pembelajaran Pendayagunaan Teknologi Pendidikan. In Tantangan Pendidikan di Abad 21 (pp. 1–11). Surabaya: Prodi Teknologi Pendidikan Program Pascasarjana Universitas Negeri Surabaya.
OECD. (2007). First Result From PISA 2003. Paris: OECD publishing.
OECD. (2016). PISA 2015 Assessment and Analytical Framework – Science, Reading, Mathematical and Financial Literacy. Paris: OECD publishing.
Piawi, K., K.M, U., & Mawardi. (2018). Development of Student Worksheet Based on Guided Inquiry with Class Activity and Laboratory in Thermochemistry Material. Proceedings of International Converention on Education. In International Conference of Social Science and Technology (pp. 669–673). Padang: Universitas Negeri Padang.
Pratiwi, F. L., Situmorang, R. P., & Krave, A. S. (2018). Hubungan Kemampuan Literasi Sains dengan Sikap Ilmiah Siswa Kelas XI MIPA SMA Kristen 1 Salatiga Pada Materi Sistem Gerak yang Diuji Menggunakan Problem Based Learning. In Seminar Nasional Biologi Dan Pendidikan Biologi Uksw 2018 (pp. 301–307). Salatiga: Fakultas Biologi Universitas Kristen Satya Wacana.
Prihantya, T. Istighfarin, Mitarlis, & Maulida, A. N. (2016). Kelayakan Perangkat Pembelajaran Berdasarkan Masalah untuk Meningkatkan Kemampuan Literasi Sains Siswa SMP. Jurnal Ilmiah, 7(1), 1–7.
Priyambodo, P., & Situmorang, R. P. (2017). Antigen Antibodi Pembelajaran. Yogyakarta: Pustaka Pelajar.
Shabiralyani, G., Hasan, K. S., Hamad, N., & Iqbal, N. (2015). Impact of Visual Aids in Enhancing the Learning Process Case Research: District Dera Ghazi Khan. *Journal of Education and Practice, 6*(19), 226–233.

Sugiyono. (2010). *Metode Penelitian Pendidikan Pendekatan Kuantitatif, kualitatif, dan R&D*. Slistiawan, F., Sumardi, K., & Berman, E. T. (2017). Penerapan Model Pembelajaran Levels of Inquiry untuk Meningkatkan Hasil Belajar Siswa SMK. *Journal of Mechanical Engineering Education, 4*(1), 41–47. https://doi.org/10.17509/jmee.v4i1.7439

Suryanto, E., Susanti, E., & Saputro, S. (2015). Efektivitas Model Pembelajaran Modified Free Inquiry (Mfi) Disertai Peer Tutoring Terhadap Prestasi Belajar Siswa Pada Materi Hidrolisis Garam Siswa Kelas Xi Semester Genap Sma N 1 Kartasura Tahun Pelajaran 2013/2014. *Jurnal Pendidikan Kimia, 4*(2), 89–97.

Tirtarahardja, U., & Sulo, S. L. La. (2012). *Pengantar Pendidikan*. Jakarta: Rineka Cipta.

Toharudin, U., Hendrawati, S., & Rustaman, A. (2011). *Membangun Literasi Sains Peserta Didik*. Bandung: Humaniora.

Trianto. (2009). *Mendesain Model Pembelajaran Inovatif-Progresif*. Jakarta: Kencana Prenada Media Group.

Utami, D. D. (2018). Upaya Peningkatan Literasi Sains Siswa dalam Pembelajaran IPA. In *Prosiding Seminar Nasional MIPA V Banda Aceh* (pp. 133–137). Aceh: FMIPA Unsyiah.

Wardhani, K. B., Situmorang, R. P., & Sastrodihardjo, S. (2018). Profil Literasi SAINS Siswa Kelas X MIPA 2 SMA Kristen 1 Salatiga Pada Materi Virus. In *Seminar Nasional Biologi Dan Pendidikan Biologi Uksw 2018* (pp. 273–278). Salatiga: Fakultas Biologi Universitas Kristen Satya Wacana.

Wenning, C. J. (2010). Levels of inquiry: Using Inquiry Spectrum Learning Sequences to Teach Science. *Journal of Physics Teacher Education, 5*(4), 11–19.

Wenning, C. J. (2011). The Levels of Inquiry Model of Science Teaching. *J. Phys. Tchr. Educ. Online*, 6(2), 9–16.

Yuliati, Y. (2017). Literasi Sains dalam Pembelajaran IPA. *Jurnal Cakrawala Pendas, 3*(2), 21–28.