JPPIPA, Vol.4 No. 2 2019

Jurnal Penelitian Pendidikan IPA

http://journal.unesa.ac.id/index.php/jppipa

DEVELOPMENT OF SCIENCE LEARNING MATERIAL WITH SOCIO-SCIENTIFIC ISSUES (SSI) ON CLIMATE CHANGE MATERIALS TO IMPROVE SCIENCE LITERACY OF JUNIOR HIGH SCHOOL STUDENTS

Oleh:
Yaumi [1], Madlazim [2], Titik Taufikurohmah[3]

[1] Student of S2 Science Education, FMIPA, State University of Surabaya, Indonesia
[2] Lecturer of Physics Department, FMIPA, State University of Surabaya, Indonesia
[3] Lecturer of Chemical Department, FMIPA, State University of Surabaya, Indonesia

Abstract

This research aims to produce IPA learning devices with the approach of Socio-Scientific Issues (SSI) on climate change materials to improve the science literacy of Junior high school students. The learning devices developed are syllabus, learning Implementation Plan, Student teaching materials, Student Worksheets, and Science literacy test. This type of research is development research with the model Dick and Carey. Test learning devices in the classroom using one group pre-Test post-Test design. The research instruments in this study are validation sheets, learning implementation observation sheets, activity observation sheets, test sheets, and student response polls. Data collection using validation methods, observations, tests, and polls. Data analysis techniques use quantitative descriptions. The results of the study show that learning devices are declared worthy of validity, practicality, and effectiveness. The validity aspect indicates that the learning device is very valid and reliable. The practicality aspect of the practice of learning has an average 3.66 with excellent criteria and an student activity is very active. The average achievement of science literacy from 32 students in class VII A when pre-test was at level 2 experienced an increase when post-test was at level 4. Based on N-Gain test the value of 0.50 is on medium criteria. Students ' response to the application of a Socio-Scientific Issues (SSI) approach to climate change material is very good. Learners give a positive response of 87.60%.

Keywords: *Socio-Scientific Issues, scientific literacy, respons*

[1]Correspondence address:
Scienece Department
Universitas Negeri Surabaya
Surabaya 60231, Indonesia
Email: yaumi.sains15@gmail.com

p-ISSN: 2527-7537
e-ISSN: 2549-2209

INTRODUCTION

National education serves to develop the ability, form the character and civilization of the nation dignified in order to educate the life of the nation, aims to develop the potential of learners to become human beings who believe and fear To God Almighty, noble, healthy, knowledgeable, capable, creative, independent, and be a democratic citizen and a responsibility (Kemendikbud, 2016A). The Indonesian education system is focused on the success of learners. Learners are expected to have skills geared towards life skills. The benefits of life skills for learners in the future can sustain the welfare of life for himself, his family and its futures with a decent life in society (Shoimin, 2014).

Entering the XXI century, the development of the world is getting faster and sophisticated. Various changes occur in the field of knowledge, technology and information to improve the quality of life of society. Along with the perceived benefits, it will cause negative impacts, such as the occurrence of global warming, energy crisis or environmental damage. These negative impacts can be addressed by the Community having science literacy. People who are knowledgeable and able to apply their knowledge to solve the problems in real life are referred to by the Community's iterations of science. The achievement of society that has been passed through science has become the demands of the Times (Rahayu, 2017).

Indonesian nation is a great nation. Indonesia should be able to develop a culture of literacy as a prerequisite to the life of the XXI century through an integrated education, ranging from family, school, to society. Science literacy is one of the skills required in the XXI century identified by the World Economic Forum. The mastery of the six basic literations agreed upon by the Word Economic Forum 2015 is crucial not only as learners, but also for parents and all citizens. The six basic literations include read-write literacy, numeracy literacy, science literacy, digital literacy, financial literacy, and cultural literacy (Kemendikbud, 2017a).

The 2013 curriculum was developed on the 21st Century Skills framework. The XXI century competency framework shows that knowledge (through core subject) alone is not enough, must be equipped with one of them with a crystalline creative thinking ability (Partnership for 21st Century Skill, 2002). Science Learning in the 2013 curriculum is Integrative Science. Science learning implemented in an integrated manner has the meaning of combining various aspects of the domain of attitude, knowledge, and Skills (Purwanti, 2013). It should be an applicative science-oriented study, developing Thinking Skills in science, learning skills, curiosity, and the development of caring and responsible attitudes towards the natural and social environment developed in Learning science. science learning should be designed and implemented through strategies that can meet the needs of the kontekstualitas so that learners can deal with real problems in the environment to support the formation of knowledge, value, Attitudes, and thinking skills.

Education at the Junior High School level or equivalent of many subjects, one of which is natural sciences. Natural science is a science of objects and natural phenomena done with the skill of experimenting using scientific methods (Kemendikbud, 2017c). Science education is aimed at inquisations and doing so can help learners to gain a deeper understanding of the environment. Science education In fact consists of three components namely attitudes, processes, and scientific products (Ibrahim, 2010). Science education as attitude makes a person has a positive attitude including developing curiosity, able to cooperate with others, tolerant and so on. Science education as a process is interpreted to develop, find knowledge, and apply science. Science education as a product interpreted information, ideas, facts, theories, concepts, and the law on Science that has been recorded and recorded as scientific knowledge.

Curriculum 2013 has provided a new atmosphere in education in Indonesia. The 2013 curriculum expects the realization of the society that is iterating into the science by establishing the competencies that the learners must have in the future include the ability to communicate, critical thinking, consider the problems Moral and living ability in the global community (Kemendikbud, 2016c). The 2013 curriculum improvement in 2017 is integrating character education strengthening (PPK) in learning. The strengthened characters are religious, nationalist, independent, mutual assistance, and integrity. The other character is to integrate literacy, 21st century skills or called 4C (Creative, Critical Thinking, Communicative, and Collaborative), and integrate HOTS (Higher Order Thinking Skill). The PPK movement needs to integrate, deepen, expand, and complete various programs and character education activities that have been done now. School Literacy Movement) at all levels of education in Indonesia. Application at school is done by habituation of reading 15 minutes before learning by billing a summary on the Linkbook. This activity is very positive for the training of students ' literacy. It is not apart from global

education with the rapidly growing technological and information role in society (Kirana, 2018).

Hope the future curriculum shows the importance of incorporating scientific social issues (Socio-Scientific Issues) in teaching and learning activities in the classroom. Socio-Scientific Issues becomes very important in science education because it can be used as a tool to make science learning more relevant for students ' lives, rides directing learning outcomes such as student appreciation To the nature of science, improving student arguments in dialogue, enhancing the ability of learners to evaluate scientific data and information, is an important component in Science Literacy (Sadler & Zeidler, 2004).

Science literacy is the ability to use science, identify questions, and draw conclusions based on evidence to make decisions about nature and make changes through human activity (OECD, 2016). Literacy is not only an understanding of knowledge, but it is about understanding the various aspects of the science process and the ability to apply knowledge and science processes in real situations faced by learners in a personal, Social and global in order to solve problems in their lives.

The study results of the PISA (Programme for International Student Assessment) showed that the literacy rate of Indonesian learners is low and below the OECD (Organization for Economic Cooperation and Development). The final measurement of science literacy conducted in 2015 shows that the average value of Indonesian learners ' science literacy is 403. The measurement of science literacy has increased but is still low compared to the OECD average (OECD, 2016). The results showed that Indonesian learners are still struggling to make connections between concepts of science and phenomena in everyday life. The lack of science literacy of Indonesian students is due to various factors such as the curriculum, learning, and assessment of science education that emphasize the dimensions of content and forget the dimension of context and process (Firman, 2007). Science education in Junior High School Practice in Indonesia is generally only emphasized on memorization and less emphasis on the process by which learners formulate scientific questions for investigation, using knowledge to explain natural phenomena, and draw conclusions from the observable facts. This condition indicates that there is a need for improvement efforts to study in school, especially in science materials.

Science literacy can be trained by the media learning as an intermediate means in the learning process. Learning Media needs to have issues, ideas, and scientific phenomena that can increase the curiosity and motivation of learners in reading scientific readings (science literate). Learning devices can be used as appropriate learning media. This learning Media can be used as an innovation in educational development (Daryanto, 2015).

The climate change material is at basic competencies 3.9 analyzing climate change and its impact on ecosystems and basic competencies 4.9 makes writing about the idea of adaptation/countermeasures climate change issues (Kemendikbud, 2018). This material comprises sub chapters of climate change which are examined based on greenhouse effect, depletion of ozone layer, global warming, impacts as well as efforts to countermeasure climate change impacts. Learners are expected to identify, analyse, evaluate, criticize, and provide solutions to countermeasures climate change impacts in daily life. This material is chosen because it relates to the daily life of learners. Climate change contains a natural phenomenon that changes at any time. The changes that exist will pose a lot of social scientific issues in the community. These materials have authentic problems that can be used as learning materials that are associated with the context, knowledge, skills, attitudes, and literacy of science.

Results of pre-research in class VII by spreading the poll and interviewing SCIENCE teachers to learn learning at school. The distribution of polls was conducted on class VII A of the doctrinal year 2019-2020 as many as 32 learners. Class VII A was chosen randomly based on teacher of science recommendation because all VII classes had heterogeneous abilities. The fact gained from pre-research is a) 71% of learners say IPA is an interesting lesson to learn. Learners have difficulty in understanding SCIENCE subjects by 29%. b) Learners apply the IPA material in daily life by 30% and 70% of learners answer No. During this time, science studies in schools used the methods of lectures and experiments. c) Learners say teachers in the classroom are more often experimental than 43% of talks and discussions, with a study of 12% discussion methods and lecture methods of 45%. This indicates that the experiment method has been applied.

The level of literacy in school especially in science learning has not been applied, application of only limited habituation of reading books. A) Learners say the application of integrated Science Literacy in SCIENCE lesson as much as 82% answered no and 12% of learners answered already. The usefulness of SCIENCE learning has not been felt by learners in dealing with the problems in life by 23%. This suggests that science literacy has not been integrated in science

learning. Based on the results of interviews with science teachers, it was obtained that school already implemented the 2013 curriculum.

The model used by teacher is a cooperative model of various types, PBL (Problam Based Learning), and scientific approach. The third implementation of the model is also not maximized in class. During the learning process still found a passive learner. The Socio-Scientific Issues approach has not been applied by teachers because it has never known the approach. This approach is applied for students to learn science education with daily life. Teacher does not yet know the ranking of Science literacy that Indonesia participated in PISA. Teachers only know about literacy activities with habituation of reading books. The implementation of the Science Literacy Movement has lasted for two years with habituation of reading for 15 minutes after praying. Students are required to log the reading book page and write a summary on the book of Literacy. Once a week is collected on the class guardian as an activity control. The test for measuring literation is also not yet present. The semester assessment and end of Semester tests are only in the realm of C1, C2 and C3. The achievement of students on climate change material shows as much as 50% has not been completed. When teachers are asked to raise opinions about achieving students ' science literacy in the school by researchers, teachers lack understanding the meaning of science literacy so that the learning of science is not yet oriented towards achieving science literacy. Therefore, a learning approach is needed that can improve student science literacy skills, the Socio-Scientific Issues approach.

The dream to realize the society of science can be realized when the teacher as a vital component in the education system has adequate competence as a manifestation of its professionalism. One form of competency is able to design a study that is set in Socio-Scientific Issues with several aspects supporting science literacy and applying it in class. Socio-Scientific Issues is a learning approach that involves scientific social issues by orienting the learning in the context of science and its relationship to social life in the community. Examples include the issue of central Kalimantan CO_2 emissions that exceed the world threshold on learning. Learners will analyze with a solution map strategy to solve the problem. Socio-Scientific Issues aims to improve the ability to make the right decisions about the problems that will be discussed or evolving. The learning is used by increasing reading of scientific readings and following emerging scientific social issues (Lambert et al, 2017). The teacher's role in teaching the Socio-Scientific Issues approach should pay attention to the three-stranded framework of a sensible disagreement, good or important communication to engage in disagreements in the sense, and the idea and experience is narrative that can explain the difference of good opinion (Gutierez, 2015).

The Socio-Scientific Issues approach is crucial as the target of science learning. The use of Socio-Scientific Issues aims to provide a meaningful learning experience for learners. The Socio-Scientific Issues approach is combined with the Discovery Learning model. The learning process includes the process of information, transformation and evaluation. The information process is the learner encoding or encoding for the information received. The transformation stage is that learners identify, analyze, transform, and transform the information obtained into abstract or conceptual forms so that later in turn can be utilized for broader things. Evaluation stage is a learner self-assess the information that is transformed can be used to understand the symptoms or solve the problems faced (Suprijono, 2014). The Model of discovery Learning approaches Socio-Scientific Issues can be found in the global context of environmental issues is climate change. Based on the background, there is a study titled "Learning Tool Development approaches Socio-Scientific Issues on climate change material to improve the science literacy of Junior high school students."

METHOD

This type of research is the development of learning devices with the model Dick and Carey. The subject of this study was a student of the VIIA class amounting to 32. The design of the research used in the trial is One Group Pre-Test Post-Test Design.

The data collection techniques in this study include validation techniques for obtaining learning device validity data. Observation techniques consisting of observations of the implementation of learning that aims to obtain data on the interoperability of learning processes with the adoption of SSI devices and describe the performance of learning phases during The learning process and observe the student activities undertaken during the learning process. The test technique is used to obtain data on the level of increasing students science literacy using pre-test and post-test. Poll techniques are used to get students response data on learning using the Discovery Learning implementation applied in the classroom.

Analysis of research result data includes learning device validity analysis, learning

execution analysis, student activity analysis, Student Science literacy Analysis, and response poll analysis.

RESULTS AND DISCUSSION

A. Validity Aspects

1. Learning Devices

Learning devices are validated by 2 expert lecturers and 1 teacher of science subjects prior to research. The validation is done to obtain assessment and suggestion in the learning tools that are developed as Draft 1. Devices that are validated include syllabus, learning process Implementation Plan, learners teaching materials, Student Worksheets, and Science literacy test. The validated learning devices were later revised based on the advice given by the validator and re-consulted. Recapitulation of the Learning device validation results in the following table.

Tabel 1. Recapitulation Of Device Validation Results

Science Process Skills	Score	Criteria
Syllabus	3.89	Very good
Learning process Implementation Plan	3.80	Very good
Teaching Books	3.88	Very good
Student Worksheets	3.78	
Test	3.80	Very good

The validations results skills that get the highest score are syllabus, while the science process skills that get the lowest score are student worksheets. Making a syllabus obtains a sore of 3.89, while student worksheet obtains a percentage of 3.78.Based on the results of syllabus validation, Learning process Implementation Plan, Teaching Books, Student Worksheets, and science literacy test get the result of the assessment above 3.50 with a very valid category indicates that the learning device is well developed so that it can be used in learning
(Riduwan, 2012).

The Student Worksheet contains a set of basic activities that students must carry out to maximize understanding in the effort to form basic abilities according to indicators of learning achievement achieved (Toharudin, 2011). Good teaching materials must be designed according to analytical rules. Teaching materials can help students to gain new knowledge (Konjo, 2013)

B. Practicality Aspects

1. Reliability

The observation of the learning implementation is done to describe the implementation of the socio-scientific issues in the teaching and learning process. SSI is approach is a learning process that emphasizes decision making or opinion related to scientific or reading social issues. The learning process using SSI is approach has initial knowledge learning, informal reasoning, decision-making, character and reflective appraisal, moral argument, reasoning, and life experience.

Data on the implementation of learning outcomes using SSI's approach to climate change material learning observation sheet is filled by two observers. Recapitulation of the observation of the learning implementation is presented in the following table.

Table 2. Results of Completeness Analysis ofImplementation ofThe Socio-Scientific Issues

Science Process Skills	Score	Criteria
Preparation	3.87	Very good
Introduction	3.63	Very good
Core	3.43	Good
Cover	3.53	Very good
Time Management	3.30	Good
Classroom Atmosphere	3.33	Good

The overall implementation of learning has been in accordance with SSI is approach with a score between 3.87; 3.63; 3.43; 3.53; 3.30; and 3.33. This suggests that researchers have prepared good learning (Riduwan 2012).

SSI is learning at the stage of the implementation invites students to read scientific readings as initial knowledge, informal reasoning through observation activities, collecting data,

analyzing data and discussing results Observations, decision-making through making a conclusion and providing responses in response to readings and discussions, character and reflective assessment by inquiring and communicating opinions for argument, moral reasoning, and life experience i.e. associating learning with real life as a life experience (Zeidler et al, 2009).

Increased literacy and technology with conceptual learning approaches such as Socio-Scientific Issues can improve scientific conceptual understanding needed to understand the science of integration with application in society (Holbrook, 2011).

C. Effective Aspect

1. Student Science Literacy

Science Literacy assessment was obtained from pre-test before learning activities with the aim to know the early skills of Students ' science literacy. While the post-test was done by students after applied learning with SSI approach to know the skills of science literacy students.

The Science literacy test for pre-test and post-test consists of 15 questions of multiple choice with different levels in each problem. About adapted from PISA. Science Literacy Test Data is shown in the form of scores and levels based on PISA. Here the Science Literacy level table.

Table 3. Results of Science Literacy Level

Level	Pre-test	Post-test
1a	7	0
1b	10	0
2	14	0
3	1	11
4	0	11
5	0	8
6	0	2

The pretests results show that most learners are at level 2 which means that level 2 is the basis for science literacy skills. Students are able to demonstrate knowledge of basic estimiticity with the ability to identify assertions that can be investigated scientifically (OECD, 2016).

Science literacy results at the time of post-test showed an increase in the level of learners to levels 3, 4, and 5. Improved literacy at level 4 suggests that learners can use more complex or more abstract content knowledge, whether provided or remembered, to build a more complex or abstract explanation of events and processes. Learners can interpret data fetched from a fairly complex data set or less recognizable, compelling context.

In accordance with data, and provide proof for their choice (OECD, 2016). Level 2 increased to level 4 can demonstrate that there is aincreased ability of learners to understand, use, and evaluate communications (Al Rsa'i, 2013).

The increase in science literacy level is influenced by several things, the SSI approach is able to invite students to develop the concept through reading the issues or scientific phenomena that occur around, investigation to prove a Concepts, and the presence of reading materials or scientific articles on the teaching materials so that the ability of science literacy students can be trained (Toharudin,2011).

2. Student Responses

Student responses are an opinion of students on the application of learning discovery Learning. Student response results suggest that learning discovery learning on the global warming material applied by researchers has been effective and received positive responses from students. The percentage response results in the amount of 94.10% which indicates the criteria is very good. Response has not shown 100% of the learning presented, this is because the learning approach presented has not been followed by the students so that it is not optimal and consistent in implementing the SSI approach.

In general, the implementation of SSI's approach received a positive response from students on climate change materials. This is demonstrated by the magnitude of students ' positive response to learning.

CONCLUSION

IPA learning devices with the approach of Socio-Scientific Issues (SSI) on climate change materials are valid, practical, and effective so that it is worth using in learning to improve the science literacy of Junior high school students.

Suggestion

1. Scientific readings on scientific social issues are added to the ability of learners ' science literacy more trained.

2. Allocation is noted and arranged appropriately to achieve maximum results.
3. Habituation of learners in reading and analyzing the phenomenon of existing scientific social issues.
4. Mastery of class is further improved to make the class condition more conducive and controlled.

REFERENCES

Anangun, S. S. (2010). Teachers Candidates. *Journal Procedia Social and Behavioral Science* , 981-985.

Borich, G. (1994). *Observation Skills for Effective Teaching.* USA: Macmilan Publishing Company.

Cahyo, A. N. (2013). *Panduan Aplikasi Teori-Teori Belajar Mengajar Teraktual dan Terpopuler.* Yogyakarta: Diva Press.

Daryanto. (2015). *Media Pembelajaran Edisi Revisi.* Yogyakarta: Gava Media.

Dick, W., Carey, L., & Carey, J. (2009). *The Systematic Design of Instruction (Seventh Edition).* New York : Person.

Hake, R. (1999). Analyzing Change Gain Score. *Journals of Physics Education Research* , 66.

Hoolbrook, J. R. (2009). The Meaning of Scientific Literacy. *International Journal of Environmental & Science Education* , 275-288.

Ibrahim, M. (2010). *Dasar-Dasar Proses Belajar Mengajar.* Surabaya: Unesa University Press.

Kardi, S. (2012). *Pengantar Pengembangan Kurikulum dan RPP.* Surabaya: PPS Unesa.

Inzanah. (2014). *Literasi Sains Mahasiswa Program Studi Pendidikan IPA Universitas Negeri Surabaya*. *Tesis* tidak dipublikasikan. Surabaya : UNESA.

Kemendikbud. (2016a). *Salinan Lampiran Peraturan Menteri Pendidikan dan Kebudayaan Nomor 22 Tahun 2016 tentang Standar Proses Pendidikan Dasar dan Menengah.* Jakarta: Kementrian Pendidikan dan Kebudayaan.

Kemendikbud. (2016b).*Panduan Gerakan Literasi Sekolah di Sekolah Menengah Pertama*. Jakarta: Kementrian Pendidikan dan Kebudayaan.

Kemendikbud. (2016c). *Panduan Pembelajaran untuk Sekolah Menengah Pertama*. Jakarta: Kementrian Pendidikan dan Kebudayaan.

Kemendikbud. (2017a). *Model Silabus Mata Pelajaran Sekolah Menengah Pertama/Madrasah Tsanawiyah Mata Pelajaran Ilmu Pengetahuan Alam*. Jakarta: Kementrian Pendidikan dan Kebudayaan.

Kemendikbud. (2017b).*Panduan Penyusunan RPP Revisi 2017.* Jakarta: Kementrian Pendidikan dan Kebudayaan.

Kemendikbud. (2017c).*Buku Guru Kelas VII Kurikulum 2013 Edisi Reviasi*. Jakarta: Kementrian Pendidikan dan Kebudayaan.

Kemendikbud. (2018). *Salinan Lampiran Peraturan Menteri Pendidikan dan Kebudayaan Nomor 37 Tahun 2018 tentang Perubahan Atas Peraturan Menteri Pendidikan dan Kebudayaan nomor 24 tahun 2016 tentang Kompetensi Inti dan Kompetensi Dasar Pelajaran pada Kurikulum 2013 pada Pendidikan Dasar dan Menengah*. Jakarta: Kementrian Pendidikan dan Kebudayaan.

Lambert, J. B. (2017). Argumentation as a strategy for increasing preservice teachers' understanding of climate change, a key global socioscientific issue. *International Journal of Education in Mathematic, Science, and Technology* , 101-112.

Kirana, Widya, H. (2018). *Pengembangan Perangkat Pembelajaran Berpendekatan Socio-Scientific Issues Pada Materi Getaran, Gelombang, Dan Bunyi Untuk Meningkatkan Kemampuan Literasi Sains Peserta Didik SMP*.*Thesis* tidak dipublikasikan. Surabaya: Pascasarjana Unesa.

Memis, Esra Kabatas; Cevik; Ebru Ezberci. (2017). Examination of Student's Small Groups Discussion in Argumentation Proces:Scientific and Socio-Scientific. Online: (https:/files.eric.ed.gov/fulltext/EJ1148912.pdf).

Nuangchalerm, Pasart. (2010). Engaging Students to Perceive Nature of Science Through Socioscientific Issues-Based Instruction. *European Journal of Social Science.*Vol(13). 1

OECD. (2016). *Programme for International Student Assessment (PISA) Result from PISA 2015- Indonesia*. Diunduh dari (HYPERLINK "https://www.oecd.org/pisa/PISA-2015-Indonesia.pdf" https://www.oecd.org/pisa/PISA-2015-Indonesia.pdf) pada 20 Maret 2019.

Purwanti, Widhy, H. (2013). Model Integrated Science Berbasis Socio Scientific Issues Untuk Mengembangkan Thinking Skills Dalam Mewujudkan 21St Century

Skills.*Jurnal Pendidikan Matematika dan Sains UNY*. Vol (1). 2 .

Putri, Pungky Dilaka. (2018). *Pengembangan Perangkat Pembelajaran IPA dengan Model Problem Based Learning (PBL) Berbasis Socio-Scientific Issues(SSI)untuk Meningkatkan Kemampuan Literasi Sains pada Materi Perubahan Iklim*.*Thesis* tidak dipublikasikan. Surabaya: Pascasarjana Unesa.

Rahayu, Sri. (2017). *Mengoptimalkan Aspek Literasi dalam Pembelajaran Kimia Abad 21*.Online:(http://seminar.uny.ac.id.pdf) diakses 18 Agustus 2018.

Ridwan. (2012). *Skala Pengukuran Variabel-Variabel Penelitian Cetakan ke VII*. Bandung: Alfabeta.

Sadler, T.D. (2004). Informal Reasoning Regarding Socioscientific Issues: A Critical Review of Research. *Journal of Research in Science Teaching*, Vol 41(5), 513–536.

Salim, N. (2007). *Psikologi Pendidikan.* Surabaya: Unesa University Press.

Shoimin, A. (2014). *Model Pembelajaran Inovatif dalam Kurikulum 2013.* Yogyakarta: Ar-Ruzz Media.

Slavin, R. E. (2011). *Psikologi Pendidikan.* Jakarta : PT Indeks.

Sugiyono. (2012). *Metode Penelitian Kuantitatif Kualitatif dan R & D.* Bandung: Alfabeta.

Suprijono, A. (2014). *Cooperativ Learning Teori & Aplikasi PAIKEM.* Surabaya: Pustaka Pelajar.

Thoharudin, U. (2011). *Membangun Literasi Sains Peserta Didik.* Bandung: Humaniora.

Van Joolingen, W. (1999). Cognitive Tools for Discovery Learning. *International Journal of Artificial Intellegence in Education* .Vol (10).385.

Zeidler, D. (2009). Advancing Reflective Judgment Through Socioscientific Issues. *Journal of Research in Science Teaching* .Vol (22).74.

Zeidler, D. (2005). Beyond STS: A. Research-Based Framework for Socioscientific Issues Edition. *Journal Of Science Education* .Vol (89).3.

Zeidler, D. L., & Bryan. (2009). Socioscientific Issues: Theory and Practice. *Journal of Elementary Science Education*. Vol (21). 2.

Zo'bi, Abdallah Salim. (2014). The Effect of Using Socio-Scientific Issues Approach in Teaching Environmental Issues on Improving the Students' Ability of Making Appropriate Decisions Towards These Issues. *International Education Studies*. Vol (7). 8.