

THE VALIDITY OF STUDENT WORK SHEETS BASED ON CONTEXTUAL TEACHING AND LEARNING (CTL) IN ENVIRONMENTAL CHANGE MATERIAL TO TRAIN SCIENTIFIC LITERACY SKILLS

Paramastri Zaindara Dewi

Biology Department, Faculty of Mathematics and Natural Science, Universitas Negeri Surabaya
e-mail: paramastridewi@mhs.unesa.ac.id

Sifak Indana

Biology Department, Faculty of Mathematics and Natural Science, Universitas Negeri Surabaya
e-mail: sifakindana@unesa.ac.id

Abstract

Scientific literacy is the ability to use scientific knowledge in increasing understanding and applying knowledge to daily life. Contextual Teaching and Learning is an approach that connects learning materials to real conditions, hence student can apply their knowledge. This study aimed to describe the validity of student worksheets based on Contextual Teaching and Learning on Environmental Change material to train the scientific literacy skills. Development of Student Worksheets based on Contextual Teaching And Learning was conducted in the Biology Department of the Mathematics and Science Faculty, State University of Surabaya. This study was a developmental research that used 4-D model consisted four stages namely define, design, develop, and disseminate. The result of the validity was obtained based on the assessment scores of an education expert, a material expert and a Biology teacher. Validation criteria of student worksheets included the appropriateness of the content, presentation, language, suitability of the principles of the CTL stage, and scientific literacy skills. The result was analyzed descriptively quantitatively. The research result showed that the student worksheet obtained an average score of 3.91 including very valid categories.

Keywords: Student Worksheets, Contextual Teaching and Learning, Scientific Literacy Skills, Environmental Change material.

INTRODUCTION

Scientific literacy derived from the word *literate* meaning literacy and *scientia* means having knowledge. Scientific literacy skills are abilities to use of science knowledge, starting from the identification of a problem to form conclusions based on data or facts about the environment and its changes through human activities (Yuliati, 2017). Scientific literacy skills can be trained by applying the Contextual Teaching and Learning approach where an approach that is able to connect the content of the material being taught with the conditions in the real life of students (Depdiknas, 2003).

The principles of Contextual Teaching and Learning are constructivism, questioning, group learning, inquiry, and reflection. The Contextual Teaching and Learning approach can be a link between knowledge material and its application (Hudson, 2007).

Practicing scientific literacy skills can be done using learning media, namely Student Worksheets. Student Worksheet is one of the learning media that has little material and steps to carry out the task of learning activities based on predetermined Basic Competencies. (Prastowo, 2013). Student worksheets based on Contextual Teaching and Learning are sheets of student activities oriented to environmental problems that can be linked to real life so students are expected to be able to practice scientific literacy in improving aspects of awareness, caring for the

environment, formulating solutions to environmental problems and applying them in daily life.

The contextual teaching model emphasizes the process of student involvement in finding the relationship between knowledge and its application in daily life so can train scientific literacy (Rahayuni, 2016). Suryawati (2017) said that in the process of inquiry and problem solving, scientific and thinking skills are used in solving problems that occurred in the surroundings, students can discuss, help each other and share experiences with learning community thus giving rise to curiosity.

Muhajir (2015) stated that the Contextual Teaching and Learning approach can improve the scientific literacy of students because Contextual Teaching and Learning is an approach that causes students to be active in developing real-world contexts. Erta and Poedjiastoeti (2016) showed that Student Worksheets based on Contextual Teaching and Learning can train science process skills with an average skill percentage of 75.42%, the average score of students is 3.02 with the predicate B, getting a positive response amounting to 94.44%.

Basic competencies must be achieved by students are analyzing data on environmental changes, causes, and impacts on life and formulating ideas for solving environmental change problems that occur in the surrounding environment. Basic competency requires students not only to understand the theory of environmental problems, but also to be skilled in dealing with problems that occur related to

environmental pollution. Science literacy skills are needed because environmental problems such as pollution can cause adverse effects on human life and the environment itself, so that real understanding and handling are needed not just theories.

The problem that often occurs is pollution of river water by plastic waste. Pollution of river water due to garbage that occurs in the Gedangan river, pollution of waste has caused an unpleasant odor and disrupts activities around the river area (Antaraneews, 2017). This problem is in accordance with the learning material namely environmental change.

Based on the description, a study was carried out "Development of worksheets based on Teaching and Contextual Learning (CTL) on Environmental Change Materials to Train Science Literacy" which aims to describe the validity of student worksheets based on Contextual and Learning Teaching on Environmental Change material to practice skills scientific literacy.

METHOD

This research was developmental research that used 4-D Model. The stages of the 4-D model were define, design, develop, and disseminate. Define stage was conducted several analyzes including: curriculum, formulation of learning indicators, assignments, and concepts. Design stage was the preparation of student worksheets. Student worksheets and learning devices are consulted with the supervisor and produce Draft I. Develop stage was carried out by review and validation of student worksheets. The research was conducted by a supervisor and two examiners. Validity assessment is carried out by two Biology lecturers 2 namely an education lecturer and a biology lecturer, and one Biology teacher of Senior High School 1 Gedangan. Disseminate stage was revised the draft and student worksheets.

The validity of student worksheets based on Contextual Teaching and Learning on Environmental Change material to train science literacy was obtained from assessment with criteria including: the appropriateness of content, presentation, language, and suitability of the principles of CTL stages and scientific literacy skills. The scores obtained are based on the following Likert scale calculation (Riduwan, 2013):

Table 1. Value Criteria Analysis of Validity

Category	Value
Very good	4
Good	3
Average	2
Poor	1

The research data were analyzed using the formula:

$$Score = \frac{\sum \text{score of all criterias}}{\sum \text{validator}}$$

Each criterion can be declared feasible if the score is 2.01-4.00 with the interpretation of the data in table 2.

Table 2. Interpretation Criteria Analysis of Student Worksheets

Average score	Category
1.00 – 1.75	Poor
1.76 – 2.50	Average
2.51 – 3.25	Valid
3.26 – 4.00	Very valid

RESULT AND DISCUSSION

Based on the research that has been carried out it produces Student Worksheets based on Contextual Teaching and Learning on Environmental Change material to train scientific literacy skills. The first page of student worksheets had Basic Competencies, listed indicators of learning and learning objectives. The second page includes a little material about changes in the environment and principles of CTL, namely constructivism with aspects of science literacy skills, knowledge and competency. In the principle of constructivism, an article is presented regarding environmental pollution (water and soil pollution) so that students can train aspects of scientific literacy skills by analyzing the phenomenon of environmental changes, causes, impacts, and solutions to environmental changes that occur. The principle of questioning with aspects of competency scientific literacy skills asks students to formulate 3 questions related to environmental changes that occur around the school environment. The principle of working in groups trains aspects of attitude literacy skills. The principle of inquiry with aspects of competence, context, and attitude scientific literacy skills requires students to formulate problems, form hypotheses, conduct experiments, analyze data, form conclusions and formulate problem solving ideas. The principle of reflection trains aspects of attitude scientific literacy skills by writing new information obtained during learning. The following is a student worksheet based on Contextual Teaching and Learning which consists of 2 student worksheets.

Depdiknas (2004) stated that good student worksheet is compiled by the following conditions a) The material listed is in accordance with Basic Competence. b) There is Basic Competence and aims of learning. c) There are instructions for using student worksheets. d) Presentations of writing, pictures, assignments and their assessment are interesting. e) Using learning resources according to development and easily obtained by students. f) The surrounding environment can be utilized. g) The concept of material can develop student's knowledge. h) The sentence presented is clear. i) There are pictures and writings to attract interest. j) The accuracy of the time allocation of student activities. k) Guiding students to be active in learning.

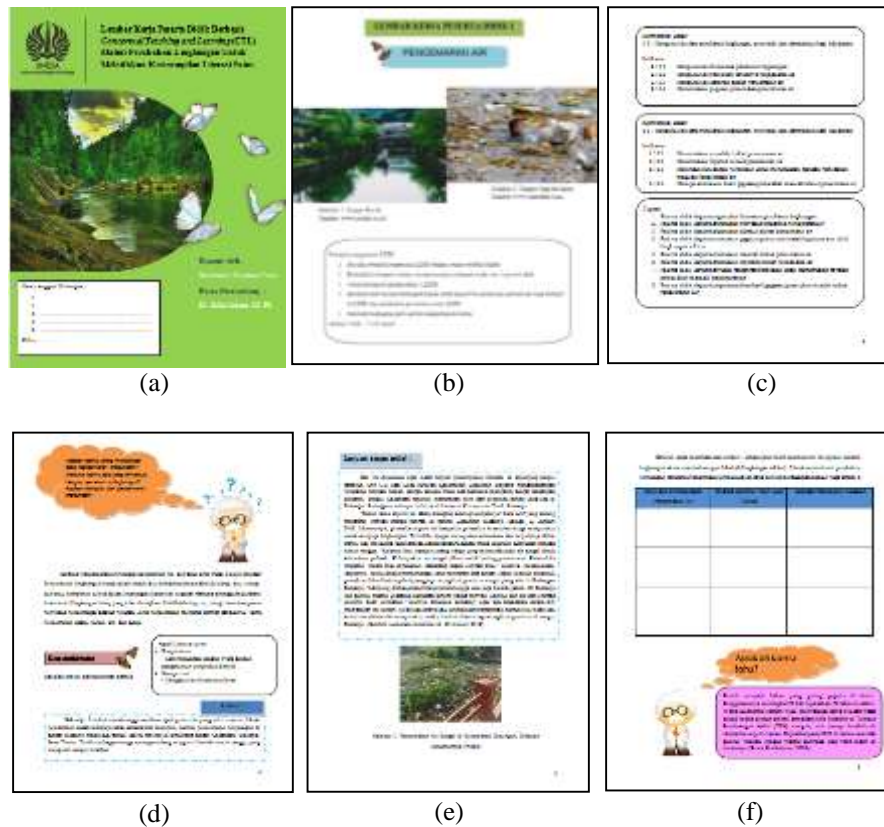


Figure 1. Example of display student worksheet based on CTL; (a) Cover, (b) Display of the introduction, (c)-(f) Display of content.

Table 3. Recapitulation Assessment of the advisability of student worksheets based on CTL on Materials for Environmental Change to Train Scientific Literacy Skills

No.	Criteria	Score			Average	Standard Deviation
		V1	V2	V3		
Advisability of content						
1.	Conformity with the Curriculum					
	a. In accordance with Basic Competencies and predetermined indicators	3	4	4	3.67	0.58
	b. Can support the achievement of core competency 3	4	4	4	4	0
	c. Can support the achievement of core competency 4	4	4	4	4	0
	Average of Conformity with the Curriculum				3.89	0.58
2.	Material					
	a. Student worksheets according to the concept	4	4	4	4	0
	b. Material in accordance with basic competencies and indicators	4	4	4	4	0
	c. Contains facts	4	4	4	4	0
	d. Pictures and captions according to the concept	4	4	4	4	0
	e. Biology terms used in accordance with the concept	4	4	4	4	0
	Average of Material				4.00	0
3.	Completion of the student worksheet					
	a. There is a front page	4	4	4	4	0
	b. Topics listed according to the material	4	4	4	4	0
	c. There are aims of learning	4	4	4	4	0
	d. List the indicators to be achieved	4	4	4	4	0
	e. List time allocation	4	4	4	4	0
	f. There are general instructions for use student worksheets in learning	4	4	4	4	0
	Average of Completion of the student worksheet				4.00	0

No.	Criteria	Score			Average	Standard Deviation
		V1	V2	V3		
	Average of Advisability of content				3.96	0.58
Advisability of presentation						
4.	Display of student worksheets					
	a. The title is in accordance with the material to be delivered	4	3	4	3.67	0.58
	b. The colors used are appropriate	4	4	4	4	0
	c. The image used is interesting	4	4	4	4	0
	d. Pictures make clear the achievement of material	3	4	4	3.67	0.58
	e. Attractive design for learning	4	3	4	3.67	0.58
	Average of Display of student worksheets				3.80	1
5.	Text used in the student worksheets					
	a. The text is clear and easy to read	4	4	4	4	0
	b. Font size is appropriate	4	4	4	4	0
	c. Appropriate font	4	4	4	4	0
	Average of Text used in the student worksheets				4.00	0
	Average of Advisability of presentation				3.90	1
Advisability of language						
6.	Accuracy of sentence structure					
	a. The language used is operational and commonly used	4	4	4	4	0
	b. The language used is in accordance with PUEBI	4	4	4	4	0
	c. Writing punctuation accordingly	4	4	4	4	0
	d. Does not cause double meaning	4	4	4	4	0
	Average of Accuracy of sentence structure				4.00	0
7.	Communicative language					
	a. Easy to understand	4	4	4	4	0
	b. Use good Indonesian	4	4	4	4	0
	c. The sentence represents the delivery of content	4	4	4	4	0
	Average of Communicative language				4.00	0
	Average of Feasibility of language				4.00	0
Suitability of the principles of Contextual Teaching and Learning						
8.	Includes the characteristics of CTL					
	a. The problems listed are real problems found in the environment around the school	4	4	3	3.67	0.58
	b. Can construct knowledge that has been owned by students with new knowledge	4	4	4	4	0
	c. Guide students to make ideas for solving environmental problems	4	4	4	4	0
	Average of Includes the characteristics of CTL				3.89	0.58
9.	Includes CTL components / stages					
	a. Constructivism (constructive knowledge to be meaningful through real experience)	4	4	4	4	0
	b. Questioning	4	4	4	4	0
	c. Working in groups	4	4	4	4	0
	d. Inquiry (conducting investigations, data analysis, and conclusions)	2	4	4	3.33	1.12
	e. Reflection (informing new information that has been obtained)	4	3	4	3.67	0.58
	Average of Includes CTL components / stages				3.80	1
	Average of Suitability of the principles of Contextual Teaching and Learning				3.85	0.58
Suitability of the principles of Scientific Literacy Skills						
10.	Covers aspects of scientific literacy					
	a. Context about the environment (There are real problems that are in the environment of students)	3	4	4	3.67	0.58

No.	Criteria	Score			Average	Standard Deviation
		V1	V2	V3		
	b. Knowledge	4	4	4	4	0
	c. Competency	4	4	4	4	0
	d. Attitude	4	3	4	3.67	0.58
Average of Suitability of the principles of <i>Scientific Literacy Skills</i>					3.84	0.58
Average of all criteria					3.91	2.08
Category					Very valid	

The average results of validation get an average score of 3.91 including a very valid category with a standard deviation of 2.08. This shows that the student worksheets based on Contextual Teaching and Learning can be said to be very feasible because it has fulfilled the requirements in the aspects of advisability of content, presentation, language, conformity with the CTL approach and conformity of aspects of scientific literacy. Based on Table 4, showed that the results of the content advisability validation get an average score of 3.96 so that the advisability of the contents of the worksheet of students is included in a very valid category. Content aspects include the suitability of basic competencies and indicators that have been applied, the content of the material, and the completeness of the student worksheets.

Student worksheets that have been developed have a match between basic competencies and predetermined indicators. Basic Competency are analyzing data on environmental changes, causes, and impacts on life and formulating ideas for solving environmental change problems that occur in the surrounding environment. Indicators show the actions of students which are the elaboration of basic competencies (Mulyasa, 2007). Vianti (2011) stated that indicators are developed according to the characteristics of students, the material to be studied, school units, regional potential and formulated in measurable operational verbs.

Assessment of the advisability aspect of the presentation in terms of the display criteria of the student worksheet and the text used. Advisability of presentation student worksheets got an average score of 3.90 with very valid categories. The presentation of images in student worksheets is in accordance with the material studied, namely, Environmental Change. The image used is a picture of water pollution and soil contamination with a description of the image to clarify the image and the source of the image. Student worksheets with drawings or illustrations can attract the attention of student, images must be clear and in accordance with the material so as not to cause confusion for students when learning (Annisya, 2014).

The advisability aspects of the language are reviewed from the suitability of the language that matches PUEBI (*Pedoman Umum Ejaan Bahasa Indonesia*). The aspect of language advisability got an average score of 4.00 very valid categories. The

language used is the standard language that is compatible with PUEBI and the level of language according to the level of thinking of high school level students, as well as brief and clear.

The aspect of conformity with the CTL approach got an average score of 3.89 very valid. Aspects of conformity to the CTL approach to the worksheet of students who have been developed have included the principles of CTL including: the principles of constructivism, asking questions, group learning, inquiry and reflection.

The constructivism principle is raised in student worksheets through the activity of reading articles about water and soil pollution problems in the school environment to then analyze the environmental changes that occur, the causes, impacts and pollution solutions that occur in the table. The principle of constructivism aims to enable students to understand new knowledge based on knowledge that is already possessed and understood (Karim, 2017).

The question principle is raised in student worksheets to raise questions related to problems in the school environment of students. The principle of asking plays a role in directing and guiding to obtain concepts and learning material (Suryawati, 2010). Questioning activities can be used to inform what aspects have not been known by students (Trianto, 2014).

Principles of study groups are raised in student worksheets to work on activities in groups. Trianto (2014) said that learning activities and groups can obtain learning outcomes from cooperation with other students so as to create a place to exchange information and make it easier for students to solve learning-related problems. Learners can develop knowledge and abilities to learn in groups to solve problems, and apply the knowledge acquired (Barron dan Darling-Hammond, 2008).

The principle of inquiry through the process of systematic thinking, it is found in the experiments of water quality (DO, pH of water and soil pH) which consists of formulating problems, formulating hypotheses, doing practicum to get conclusions from problems and formulate problem solving ideas. The learning theory of Bruner's discovery suggests that in discovery learning helps students to improve their activities, so they are motivated to try to solve problems to obtain certain knowledge (Nur, 2008). Widowati (2017) said that learning with inquiry is important to do so that scientific literacy develops.

The principle of reflection can find new things that are obtained for students when learning or new knowledge is received. CTL learning is learning to link a problem, analyze real problems using the knowledge that is already owned to solve problems, so that CTL learning can help to instill understanding of a material that requires initial concepts with concepts obtained and learned (Suprihartiningrum, 2013). The contextual learning activities not only benefit to student, but also help teacher to make reflections on their instructional design (Wolfensberger, 2010)

Aspects of conformity with scientific literacy skills get an average score of 3.84 very valid categories. The student worksheets developed include environmental problems that occur around the school, environmental problems that occur are pollution of water and soil by plastic waste. This is in accordance with the aspects of the context used, namely the environmental context which is an understanding of science on environmental issues.

Knowledge aspects in student worksheets developed refer to articles that have been included, namely on environmental issues and articles to test the quality of the environment so that students can connect real environmental conditions around the school with the knowledge they already have, so that students can determine the formula for solving ideas the right problems according to the demands of Basic Competency. Learning related to environmental problems through science activities to determine solutions to real life problems can make student interest so that learning is more meaningful (Sudarisman, 2013).

Aspects of competence in worksheets of students require students to carry out analyzing activities, identify changes in the environment around the school environment (water and soil pollution), conduct scientific investigations, analyze experimental data, formulate ideas for problem solving, and communicate conclusions based on data analysis. The results of data analysis through interpretation lead to answering research questions or overcoming problems (Dharma, 2008). Rustaman (2008) said that scientific process is not just limited to data gathering, but also sharpens the mental processes. Science is not only conceptualized as a product, but a process of knowledge about nature phenomena.

Attitude aspects in student worksheets developed include the attitude of working together in group learning to solve environmental problems around the school, applying scientific skills for solving environmental problems through inquiry activities, drawing conclusions or decisions based on the results of data analysis, and fostering an environmentally caring attitude with formulate ideas for solving environmental problems. In this way, the self-confidence and personal development of student will be supported and increased (Murat, 2015).

This student worksheet based on Contextual Teaching and Learning in the aspect of the appearance and components of the CTL also has several deficiencies, it is seen from the low validation value. Display criteria Student worksheets and CTL components get an average score of 3.80 because in the display of the images contained in the worksheet the students have not listed the description of the image to explain the further image and on the principle of inquiry in CTL there is no link between environmental problems and the topic of inquiry activities. Therefore, after the validation of the worksheets of students from several biologists, improvements were made to student worksheets based on CTL.

Improvement of student worksheets in the display aspect provide captions to clarify the condition of the images used in the student worksheets and in the inquiry principle the contact articles are given regarding the factors that determine water quality and soil quality as a link between environmental issues that are topics in the Sheet student work, namely, water pollution and soil pollution.

CLOSING

Conclusion

Based on the results of the research, it can be seen that the Student Worksheet based on Contextual Teaching and Learning (CTL) on Environmental Change material to practice scientific literacy skills can be declared valid with a score of 3.91 which is categorized as very valid based on the aspects of eligibility, presentation, language, suitability with the CTL approach and conformity with aspects of scientific literacy.

ACKNOWLEDGEMENTS

The researchers would like to thank to Dr. Fida Rachmadiarti, M. Kes. and Dr. Yuliani, M. Si, as validators who has provided input for the completion of this research.

REFERENCES

- Annisa, F., Stepanus, S., Syukran, M. 2014. Secondary Analysis Lembar Kerja Siswa dalam Skripsi Mahasiswa tentang Remediasi Miskonsepsi. *Jurnal Pendidikan dan Pembelajaran* Vol.3(7): 1-12.
- AntaraneWS. 2017. Warga Sidoarjo Keluhkan Sampah Sungai Gedangan. (Online) (<https://jatim.antaraneWS.com/> diakses tanggal 20 Oktober 2018)
- Barron, B., Darling-Hammond, L. 2008. *Teaching for Meaningful Learning: A Review of Research on Inquiry-Based and Cooperative Learning*. Stanford University
- Depdiknas. 2003. *Kurikulum 2004, Standar Kompetensi Mata Pelajaran Matematika*

- Sekolah Menengah Pertama dan Madrasah Tsanawiyah*. Jakarta : Pusat Kurikulum Balitbang Depdiknas
- Dharma, S. 2008. Pendekatan, Jenis, dan Metode Penelitian Pendidikan. Direktorat Tenaga Pendidikan. Departemen Pendidikan Nasional
- Erta, N. A dan Poedjiastoeti, S. 2016. Pengembangan Lembar Kegiatan Siswa (LKS) Berorientasi *Contextual Teaching and Learning* untuk Melatihkan Keterampilan Proses Sains pada Materi Larutan Elektrolit dan Nonelektrolit Kelas X SMA. *Journal of Chemical Education* Vol. 5(1): 134-142.
- Hayat, Bahrul, dan Suhendra. 2010. *Benchmark International Mutu Pendidikan*. Jakarta : Bumi Aksara.
- Hudson, C., Whisler, C. 2007. Contextual Teaching and Learning for Practitioners. *Systemics, Cybernetics and Informatics* Vol 6(4): 54-58.
- Karim, A. 2017. Analisis Pendekatan Pembelajaran CTL (Contextual Teaching and Learning) di SMPN 2 Teluk Jambe Timur, Karawang. *Jurnal Formatif* Vol 7(2): 144-152.
- Muhajir, S., Rohaeti, E. 2015. Perbedaan Penerapan Model Pembelajaran Science Technology Society (STS) Dan Kontekstual Teaching And Learning (CTL) Terhadap Literasi Sains Dan Prestasi Belajar IPA. *Jurnal Pendidikan Matematika dan Sains* Vol.3(2): 143-155
- Mulyasa, E. 2007. *Kurikulum Tingkat Satuan Pendidikan: Suatu Panduan Praktis*. Bandung: Remaja Rosdakarya.
- Murat, G. 2015. The Effect of Scientific Studies on Students' Scientific Literacy and Attitude. *Ondokuz Mayıs University Journal of Faculty Education* Vol 34(1): 141-152
- Nur, M. 2008. *Pengajaran Berpusat pada Siswa dan Pendekatan Konstruktivis dalam Pengajaran*. Edisi kelima. PSMS. Universitas Negeri Surabaya
- Prastowo, Andi. 2013. *Panduan Kreatif Bahan Ajar Inovatif*. Yogyakarta: Diva Press.
- Rahayuni, G. 2016. Hubungan Keterampilan Berpikir Kritis dan Literasi Sains pada Pembelajaran IPA Terpadu dengan model PBM dan STM. *Jurnal Penelitian dan Pembelajaran IPA* Vol 2(2): 131-146
- Riduwan. 2013. *Skala Pengukuran Variabel-Variabel Penelitian*. Bandung: Alfa Beta.
- Rustaman, N, Y. 2008. Teaching Science to Develop Scientific Abilities in Science Education. *Proceeding of the 2nd International Seminar of Science Education*, 94-99
- Sudarisman, S. 2013. Implementasi Pendekatan Kontekstual dengan Variasi Metode Berbasis Masalah untuk Meningkatkan Kualitas Pembelajaran Biologi. *Jurnal Pendidikan IPA Indonesia*, (1): 23-30.
- Suprihatiningrum, J. 2013. *Strategi Pembelajaran: Teori dan Aplikasi*. Jogjakarta : Ar-Ruzz Media
- Suryawati, E., Osman, K., T. Subahan, M. M. 2010. The Effectiveness of RANGKA Contextual Teaching and Learning on Students Problem Solving Skills and Scientific Attitude. *Procedia Social and Behavioral Science* 9: 1717-1721.
- Suryawati, E., Osman, K. 2017. Contextual Learning: Innovative Approach towards the Development of Students' Scientific Attitude and Natural Science Performance. *EURASIA Journal of Mathematics, Science and Technology Education* Vol 14(1): 61-76
- Trianto. 2014. *Medesain Model Pembelajaran Inovatif-Progresif: Konsep Landasan, dan Implementasinya Pada Kurikulum Tingkat Satuan Pendidikan (KTSP)*. Jakarta : Kencana
- Vianti, L. S. 2011. Kesesuaian antara Pengembangan Indikator dan Kompetensi Dasar Dalam Silabus KTSP Aspek Membaca. SKRIPSI. Universitas Negeri Semarang
- Yuliati, Y. 2017. Literasi Sains dalam Pembelajaran IPA. *Jurnal Cakrawala Pendas* Vol. 3(2): 21-28
- Widowati, A. 2017. The Development of Science Literacy through Nature of Science (NoS) within Inquiry Based Learning Approach. *Journal of Physics: Conference Series* Vol. 909(1): 1-7
- Wolfenberger, B., Piniel, J., Canella, C., and Kyburz-Graber, R., 2010. The Challenge of Involvement in Reflective Teaching : Three Case Studies from a Teacher Education Project on Conducting Classroom Discussions on Scientific Issues. *Teaching and Teacher Education* Vol 26(3): 714-721