International Journal of Innovation, Creativity and Change. www.ijicc.net
Volume 14, Issue 1, 2020

The Development of Ethnoscience Based Acid-Base Modules to Improve Students' Scientific Literacy Ability

CA Dewi[a*], Martini[b], Z Gazali[c], N Rahman[d], M Zulhariadi[e], AT Wicaksono[f], TP Astutik[g], [a]Chemistry Education Department, Universitas Pendidikan Mandalika, Mataram, Indonesia, [b]Chemistry Education Department, Universitas Negeri Surabaya, Surabaya, Indonesia, [c]Biology Education Department, Universitas Nahdlatul Wathan, Mataram, Indonesia, [d]Elementary School Education Department, University of Muhammadiyah Mataram, Mataram, Indonesia, [e]Biology Education Department, Universitas Islam Negeri Mataram, Mataram, Indonesia, [f,g]Chemistry Education Department, Universitas Islam Negeri Antasari Banjarmasin, Kalimantan Selatan, Indonesia, Email: [a*]ayudewi_citra@ikipmataram.ac.id, [b]martini@unesa.ac.id, [c]zulkarnain.gazali@gmail.com, [d]nangrhm87@gmail.com, [e]zulhariadi@uinmataram.ac.id, [f]ardiantriowicaksono@gmail.com, [g]ningtut@gmail.com

The purpose of this study is to develop ethnoscience based acid-base modules to improve student's scientific literacy ability. This study is developmental research using the ADDIE design model limited to the evaluation stage. The draft module was validated by two material experts and one media expert using a validated questionnaire. The module effectiveness test uses a pre-experimental model with one pretest-posttest group. The research design for the number of research subjects factored for as many as 30 students. Module effectiveness is analysed from graduation, n-gain scores, and t-test results of the pre-test and post-test. The results of content and design validations was 80% and 87% with valid criteria without revision, an n-gain score of 0.4 with medium category, and the t-test showed that there were significant differences between pre-test and post-test. Thus, it can be concluded that the ethnoscience based acid-base module can effectively improve students' scientific literacy ability in basic chemistry learning.

Key words: *Acid-Base Modules, Ethnoscience, Scientific Literacy Ability.*

Introduction

In the 21st century, the development of science, technology, and information takes place very quickly and is full of competition. To anticipate and win this competition, Indonesians must prepare themselves by growing and developing many competencies (Suardana et al., 2018). Thus, it brings the impact of a tight race in all areas of life. National education graduates must have competitive and comparative advantages according to national quality standards to win job opportunities in this global era. In line with the rapid development of IT and dynamic social change, it is necessary to prepare Indonesian science teachers who can compete freely and have the toughness in thinking and act scientifically to solve problems (Setiawan et al., 2017). Science education has a useful role in the knowledge of the world around it. For a better understanding of the importance of science, it needs to be familiar with scientific environment through systematic knowledge. One of the most important goals of science education is the development of scientific literacy (Drago & Mih, 2015). Scientific literacy is the ability to understand scientific processes and integrate meaningful scientific information in daily life (Fives et al., 2014).

The results of a PISA study indicated that the average scientific literacy score for Indonesian students was far below the international average, which shows that scientific literacy in Indonesian students is still very low. Indonesia has always obtained a score below the average rating. Based on data from PISA 2012, Indonesia ranked 64 out of the 65 participating with the average acquisition of the scientific literacy component about 382 (OECD, 2014). The findings of this study (Sumarni, 2018) showed that the daily life of Indonesians does not reflect scientific literacy. Many people are still incapable of applying their knowledge of chemistry to their life. The research conducted by Sujana et al. (2014), Sulistiawati (2015), Sumarni et al. (2017), Hastuti (2019), Dewi (2019), and Dewi & Mashami (2019) find that most students have difficulty in applying chemistry education in the real world. The finding supports Celik (2014) and Bacanak & Gőkdere (2009) who showed that 56% of prospective chemistry teachers are unable to deliver proper and correct information regarding nominal and functional literacy of chemistry. The findings of this study (Kemendikbud, 2013) showed that low levels of scientific literacy is caused by some of the PISA's testing materials which were not included in the Indonesian science curriculum, but also by the unavailability of ethnoscience modules that meet the demands of the curriculum and the competency standards for graduates. Not every change in the Indonesian curriculum has been accompanied by ethnoscience modules that are appropriate for the new demands.

The large number of students who do not possess the basic skills in science is an important indicator of the quality of education. According to OECD (2013), students who reach level one have limited scientific knowledge, which they apply only in certain familiar situations; they are also able to clearly and explicitly provide scientific explanations only according to the proof given. High-quality science education is important not only for preparing students to pursue a career in the science fields, but also to contribute to preparing a population of citizens who are literate in science and who can "face current global challenges" (Wieman, 2007). In this regard, science education helps realise the students' potentials and contributes to the development of a nation's human resources (Reddy, 2006).

Ethnoscience modules have great impact on science education on campus. One of the goals of science education in the college is to prepare individuals for lifelong science education in the real world; therefore, it is important to study to what extent ethnoscience modules are designed to meet that goal. Modules are an important resource in the teaching and learning process; therefore, efforts should be made to ensure that high-quality ethnoscience modules will be selected and recommended to campuses. A high-quality module is regarded as the primary tool in promoting the education of a nation and its national development. Science teachers depend to a great extent on existing modules. Ethnoscience modules help teachers to provide the organisational structure of the subject or lesson. Modules also offer various resources to the collection of additional information and the formation of more precise concepts. Also, they help train students and develop the necessary science skills. Another benefit of modules is that they help reduce the problems associated with the students' lack of background information. Ethnoscience modules are the key to developing scientific ideas and clarifying scientific concepts in the early stages of teaching and learning. They are the main source used by science educators around the world to guide them in their teaching about content and skills dictated by the curriculum. When teachers use modules as their guide for the curriculum and as resources for the preparation of their class syllabus, the quality of these modules has a great impact on the quality of their teaching (Lemmer et al., 2008; Newton & Newton, 2006; Ogan-Bekiroglu, 2007; Reys & Reys, 2006; and Brandt, 2005; Holbrook & Rannikmae, 2009; Rusilowati et al., 2016).

The preparation of ethnoscience modules is one way to improve students' scientific literacy ability. Dewi et al. (2019) stated that the development of scientific literacy needs to be done by focusing on the preparation of future generations of scientific literacy with curriculum content that pays attention to culture and daily life to make it more contextual. Sinaga et al. (2017) showed that the design of better science textbooks could improve secondary school students' scientific literacy ability. Alim et al. (2019) stated that ethnoscience-based guided inquiry learning has a significant influence on the mastery of scientific literacy and the student's character. Fitria & Wisudawati (2018) stated that ethnoscience-based chemical enrichment books deserve to be a source of science literacy by students. Atmojo et al. (2018) showed that science learning integrated with ethnoscience can increase scientific literacy and scientific character. Based on those statements, it is necessary to develop ethnoscience based acid-base modules to improve students' scientific literacy ability. Through the development of ethnoscience based acid-base modules students can master scientific literacy in relation to how they perceive the environment, health, economy, and the problems of modern society, technology, progress, and the development of science.

The purpose of this study is to develop ethnoscience based acid-base modules to improve student's scientific literacy ability. This ethnoscience based acid-base module was developed on the grounds that: (1) there is a need for a learning resource in the form of ethnoscience based acid-base modules that elevates the local culture as a form of a love of the nation's culture, which is then studied from the side of science as a source of students' scientific literacy, so it can improve students scientific literacy ability; (2) the unavailability of a chemitry book based on ethnoscience that is common in the community. With the ethnoscience based acid-base modules students can know the application of chemistry in daily life primarily in the culture of a society in Indonesia.

Research Method

This study comprises of development research with the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) design model. The development model used is limited to the fifth stage, i.e., the evaluation, which includes the following stages:

1. The analysis study stage includes research and data collection (research and information collecting), consisting of: need assessment and curriculum which is useful to know the product needed and will be developed, literature study related to product development, especially in the form of a book, and ethnoscience concept, which will become the characteristics of the book to be developed, as well as the analysis of materials related to local cultures (Sasak) that can be translated scientifically.
2. The design study stage includes planning, gathering references for ethnoscience-based chemistry in culture.
3. The development study stage includes initial development of product draft (develop a preliminary form of product), the preparation of systematics and components contained in the ethnoscience based acid-base modules, preparation of the contents of the ethnoscience based acid-base modules and the design lay-out or book cover, and consulting on the initial product results with supervisors, product validation, as well as product revisions. Through the preliminary field test (preliminary field test), the draft module was validated by two material experts and one media expert using a validation questionnaire, which was responded to by ten students from the chemistry education study program FSTT UNDIKMA Mataram. Revision of the trial results (first product revision): at this stage, the product improvement is based on an assessment by reviewers and the responses from the chemistry education study program students.
4. The implementation study stage includes the module effectiveness test to measure students' scientific literacy ability.

Table 1: Criteria for Product Feasibility and Revision

Achievement Level (%)	Qualification	Information
81-100	Very good	No need to revision / valid
61-80	Good	No need to revision / valid
41-60	Enough	Revised / invalid
21-40	Less	Revised / invalid
0-20	Very less	Revised / invalid

(Fives et al., 2014)

The module effectiveness test uses a pre-experimental model with one group pretest-posttest only research design for the number of research subjects, which factored for as many as 30 students. The instrument used was a reasonable multiple-choice question used to measure students' scientific literacy ability. The increase in students' scientific literacy in this study was determined based on the average score gain normalised by Hake's criteria and t-test results of the pre-test and post-test.

$$\%g = \frac{\%Sf - \%Si}{100 - \%Si} \times 100\%$$

With:

g = normalised gain
Sf = post-test score
Si = pre-test score

The calculation results obtained <g> value are then divided into three categories Hake (Ardianto & Rubini, 2016) namely:

Table 2: Gain value classification

Average Gain	Criteria
$0,00 < g \leq 0,30$	Low
$0,30 < g \leq 0,70$	Medium
$0,70 < g \leq 1,00$	High

The Result and Discussion

To obtain a learning module that meets the criteria of being valid and can measure the ability of students' scientific literacy, the researcher follows the development procedure using the ADDIE model, analysis, design, development, implementation, and is limited to the evaluation stage.

a. Analysis Stage

During the analysis phase, activities include analysis of student needs and problems, curriculum analysis, learning resources analysis, and evaluation.

Analysis of Student Needs and Problems

Researchers examine the basic problems faced by students in learning, so they need to develop teaching materials in the form of modules. The results of researchers' research on problems that arise in chemistry learning include: a) The many, varied and integrated material causes students to be less interested in learning chemistry especially in acid-base material, b) The lecture still uses conventional methods and the material presented by the lecturer is one-way, so students are unable to understand the material well, c) The use of teaching materials such as textbooks owned by lecturers is still in the form of improvised textbooks, and not many students have a handbook such as worksheets or other relevant chemistry books causing less student interest and less satisfaction in undergoing the learning process so that students' scientific literacy abilities are low. The research of Sumarni et al. (2017) and Bacanak & Gőkdere (2009) show that many students of chemistry education are incapable of showing the application of chemical concepts as well as relating that to the surrounding phenomena. This condition shows that students' learning outcomes in their senior high or university are not enough to make them literate in chemistry. This literacy reflects the readiness of citizens to encounter global challenges (ArcherBradshaw, 2017; Holbrook & Rannikmae, 2009).

Curriculum Analysis

Curriculum analysis is carried out to map the core competencies and basic competencies relating to acid-base material in the curriculum as a basis for making indicators and learning the objectives of modules. The findings of this study (Dewi et al., 2019) showed that focusing on the preparation of future generations of scientific literacy through the cultural-based curriculum produces more contextual learning. Learning resources used in the classroom learning process can elevate local culture as related to basic chemistry.

Learning Resources Analysis and Evaluation

Analysis of learning resources is done to determine the situation and conditions of chemistry learning in the UNDIKMA Mataram of chemistry education study program. Learning resources like the textbooks that are used by lecturers only contain material and questions that must be resolved by students, do not train students in solving problems encountered, and are less contextual or lack examples that can be applied in daily life. Based on the results of the analysis, the appropriate teaching material is by designing modules that are varied with ethnoscience models on acid-base material to improve students' scientific literacy abilities. The findings of recent studies (Sumarni, 2016; Fitria & Wisudawati, 2018; Atmojo et al., 2018) showed that ethnoscience-based chemical books could increase students' scientific literacy ability.

b. Design Stage

During the design phase, activities include: Determine and design appropriate learning models, and designing learning modules.

Determine and Design Appropriate Learning Models

In the module developed, teaching and learning activities use learning models, namely ethnoscience, which aims to improve students' scientific literacy ability. The steps of the learning process modify the Chemie im Kontext (Nentwig et al., 2007) based on the following sequences: 1) Contact phase: In the learning process, the lecturer invites students to discuss the application of the material in everyday life; 2) Curiosity phase: The teacher involves social problems to the decision-making component for specific problems related to chemistry and engages students in the problem-solving phase (Holbrook et al., 2008); 3) Elaboration phase: there is an exploration, experiment, and chemical concept given to students. These activities are in detail and are explained in the exploration of the local context. The experiment involves the proximate element, and the reconstruction of social understanding during field observation. From these events, it is expected that students will understand the importance of chemistry in their community; 4) Decision-making phase: students make a decision under the guidance of the lecturer as their facilitator. During field observation, students can find phenomena that are strongly related to chemistry in acid-bases. The lecturer supports them to think about "why," "how," etc. During the observation, students are also training themselves to explore their knowledge. The students can come with the knowledge which they previously have and relate their understanding to the concepts in chemistry; 5) Nexus phase: the students make a decision based on the materials and apply that to another context; 6) Evaluation phase: there is an evaluation to the learning process to value students' success, including in the aspects of content, context, and competence.

Designing Learning Modules

This stage carried out the specifications of the results of the development that has been produced, namely a module with ethnoscience learning models on acid-base material to improve students' scientific literacy ability. From this stage, a module design review is obtained as follows: (1) module cover; (2) foreword; (3) table of contents; (4) learning objectives; (5) introduction, which encompasses background, module description, prerequisites, core competencies, basic competencies, indicators, module usage instructions, concept maps; (6) learning activities include activity 1 (contact), activity 2 (curiosity), activity 3 (elaboration), activity 4 (decision-making phase), activity 5 (nexus), activity 6 (evaluation); (8) concluding consists of feedback and follow-up, expectations, glossary, answer key, bibliography and about the author.

c. Development Stage

At the development stage, teaching materials in the form of modules that have been prepared are validated by three experts and trial. The following is the product validation data presented on the results of the response/feasibility of teaching materials developed.

Table 3: The Validation Value of Expert Content/Material

Module Learning Aspects	**Earnings score (%)**
Cover and Content	80
Average score	80%
Qualification/Information	Good/Valid

Based on Table 3 from the content/material expert field, there is an assessment of the cover and content aspects of the material with an acquisition score of 80% with good and valid qualifications used as teaching material in basic chemistry learning.

Table 4: The Validation Value of Design Experts

Module Learning Aspects	**Earnings score (%)**
Cover Feasibility	90
Appearance and Presentation	84
Average score	87%
Qualification/Information	Very Good/Valid

Based on Table 4 from the results of the assessment of the feasibility of the cover, the appearance and presentation aspects of the design experts obtained an average score of 87% with very good and valid qualifications used in basic chemistry learning.

Table 5: The Validation Value of Practitioner Experts

Module Learning Aspects	**Earnings score (%)**
Cover and Content	91
Average score	91%
Qualification/Information	Very Good/Valid

Based on Table 5 of the validation of practitioners, there is an assessment of the cover and content aspects with a score of 91% with excellent qualifications and valid for use in basic chemistry learning.

Table 6: The Trial Value of Students

Indicator	**Earnings score (%)**	**Category**
Like learning to use the ethnoscience module	81	Positive
Easily understand the material on the ethnoscience module	86	Positive
Motivated to learn to use the ethnoscience module	84	Positive
Motivated to solve the problems contained in the ethnoscience module	91	Positive
Self-study using ethnoscience modules	85	Positive
Average	85%	Positive

Table 6 shows that overall, students responded positively to the use of ethnoscience-based acid-base modules in basic chemistry learning.

Based on the research that has been done, the results of expert validators in the field of content/material with an average score of 80 with good qualifications and criteria do not need revision. The qualitative data or responses or suggestions for improvement provided by the validator are good enough. From the results of the research that has been done, the results of the expert validator in the field of product design with an average score of 87 with very good qualifications and criteria do not need revision. The qualitative data or suggestions for improvement provided by the validator are the modules that can be used or applied in a learning activity, but there is a revision made in advance about the cover that needs to be repaired and completed with the author's biodata. The acid-base module cover suggestions and corrective responses initially mentions acid-base material, salt hydrolysis, and buffer solutions. However, to make it better, it would be nice to remove the title by writing salt hydrolysis, and the buffer solution is the only used acid-base because it represents a buffer solution and salt hydrolysis because it is included in the acid-base material.

Based on the research that has been done, the results of the practitioner validator with an average score of 91 with very good qualifications and the criteria do not need to be revised. As for the qualitative data or responses or suggestions for improvement provided by the validator, it should cover the full cover to make it more interesting, the writing should be improved like a general chemistry book and use a font type in general, and it should be filled in every sheet of paper to save paper and keep it from being too thick so that there is a lot of interest in reading. With a small amount of interesting chemicals, add chemical formulas. The results of trials that have been conducted on students with an average score are 85 with a positive student response category to the ethnographic-based acid-base module. The findings of recent studies (Rusilowati et al., 2016; Sudarmin et al., 2017; Setiawan et al., 2017; Dewi et al, 2019; Sudarmin et al, 2019) showed that the ethnoscience pedagogic in chemistry learning could develop student scientific literacy in terms of content, competence, context, and attitude.

d. Implementation Stage

To find out the increase, students' scientific literacy abilities were analysed using t-test and n-gain, as presented in Table 7.

Table 7: T-test Value of Student Scientific Literacy Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Scientific Literacy	Equal variances assumed	.971	.328	3.170	62	.002	4.34375	1.37040	1.60436	7.08314
	Equal variances not assumed			3.170	61.886	.002	4.34375	1.37040	1.60426	7.08324

Based on table 6, the Sig. (0.002) <0.05, which indicates that there is a significant difference between students' scientific literacy before and after using ethnoscience-based acid-base modules.

Table 8: Value of Scientific Literacy Aspect

Scientific Literacy Aspect	**% Pre-test**	**% Post-test**	**% N-Gain**
Content	55	69	31
Process	65	79	40
Attitude	54	77	50
Average	58	75	40

Based on table 8, the N-Gain average scientific literacy aspects of content, process, and attitude is 40%. This shows that the scientific literacy ability of students is included in the medium category.

Based on the results, the t-test showed that there is a significant difference between students' scientific literacy ability before and after using ethnoscience-based acid-base modules. An N-Gain average of about 40% from scientific literacy aspects (content, process, and attitude) showed that students scientific literacy ability is increased. Research by Sumarni (2018) showed that the implementation of ethnoscience-based learning in chemistry could improve students' literacy in chemistry. According to Dewi, et al. (2019), ethnoscience in chemistry learning can develop scientific literacy. Fitria & Wisudawati (2018) showed that the development of ethnoscience-based chemical enrichment books deserves to be a source of science literacy by students. The results of the study by Atmojo et al. (2018) showed that science learning integrated with ethnoscience could improve students' scientific literacy with a gain score of 0.81, which is in the high category. Alim et al. (2019) showed that ethnoscience-based guided inquiry learning has a significant influence on the mastery of scientific literacy and the student's character. Melyasari et al. (2018) indicate that the student's scientific attitude could increase as well as learning activities get a positive response. Setiawan et al. (2017) showed that the developed local wisdom-based natural science module is suitable to improve the ability of students' science literacy either theoretically or empirically. The findings of this study (Sumarni, 2018; Sumarni & Kadarwati, 2020; Fasasi, 2017; Parmin & Fibriana, 2019; Yuliana et al., 2018) showed that the implementation of ethnoscience-based learning in chemistry can improve students' literacy in chemistry.

Conclusion

This study concluded that ethnoscience-based acid-base modules could be considered for use in basic chemistry learning so students are more active in independent learning and can construct concepts and apply chemical concepts in daily life. The implementation of an ethnoscience based acid-base module can improve students' scientific literacy ability in the learning and teaching process. The percentage given in the pre-test, and post-test recapitulation report is evident for this conclusion. The pre-test score was 55% for content, 65% process, and 54% for attitude. Meanwhile, during the post-test, the scientific literacy ability increased for each indicator. Students' ability in the content increased to 69%, their process increased to 79%, and their ability of attitude increased to 77%. This research indicates that the development of ethnoscience based acid-base modules is one good option for improving students' scientific literacy ability. This learning model should be implemented in various fields of education. Research with the same topic should be conducted in the future with different subject matter and in different contexts.

Acknowledgment

The author would like to thank the president of Universitas Pendidikan Mandalika Mataram for their support and encouragement and the Chairman of LPPM of Universitas Pendidikan Mandalika Mataram Mataram for writing and research guidance.

REFERENCES

Alim, A., Sarwi, S., & Subali, B. (2019). Implementation of ethnoscience-based guided inquiry learning on the scientific literacy and the character of elementary school students. *Journal of Primary Education*, *8*(5), 139-147.

Ardianto, D., & Rubini, B. (2016). Comparison of students' scientific literacy in integrated science learning through model of guided discovery and problem based learning. *Jurnal Pendidikan IPA Indonesia*, *5*(1), 31-37.

Atmojo, S. E., Kurniawati, W., & Muhtarom, T. (2019). Science learning integrated ethnoscience to increase scientific literacy and scientific character. In *Journal of Physics: Conference Series*, 1254, (1),012033). IOP Publishing.

Archer-Bradshaw, R. E. (2017). Teaching for scientific literacy? An examination of instructional practices in Secondary Schools in Barbados. *Research in Science Education*, *47*(1), 67-93.

Balitbang Depdikbud. (2011). Seminar PISA: analisis trend kemampuan siswa Indonesia hasil PISA 2000-2009 , Jakarta DepDik Bud.

Bacanak, A., & Gökdere, M. (2009). Investigating level of the scientific literacy of primary school teacher candidates. In *Asia-Pacific Forum on Science Learning & Teaching*, 10, (1). 111-113.

Bryant, R. (2006). Assessment results following inquiry and traditional physics laboratory activities. *Journal of College Science Teaching, 35*(7), 56-61.

Celik, S. (2014). Chemical literacy levels of science and mathematics teacher candidates. *Australian Journal of Teacher Education*, *39*(1), 1-12.

Dewi, C. A., Khery, Y., & Erna, M. (2019). An ethnoscience study in chemistry learning to develop scientific literacy. *Jurnal Pendidikan IPA Indonesia*, *8*(2), 279-287.

Dewi, C. A., & Mashami, R. A. (2019). The effect of chemo-entrepreneurship oriented inquiry module on improving students' creative thinking ability. *Journal of Turkish Science Education*, *16*(2), 253-263.

Dewi, C. A. (2019, January). Improving creativity of prospective chemistry teacher through chemoentrepreneurship oriented inquiry module on colloid topics. In *Journal of Physics: Conference Series*, 1156(1), 012017). IOP Publishing.

Dragos, Viorel & Mih, Viorel. 2015. Scientific literacy in school. *Procedia-Social and Behavioral Sciences*, 209:167–172.

Fasasi, R. A. (2017). Effects of ethnoscience instruction, school location, and parental educational status on learners' attitude towards science. *International Journal of Science Education*, *39*(5), 548-564.

Fitria, M., & Wisudawati, A. W. (2018). The development of ethnoscience-based chemical enrichment book as a science literacy. *International Journal of Chemistry Education Research*, *2*(1), 50-59.

Fives, H., Huebner, W., Birnbaum, A.S., Nicolich, M. (2014). Developing a measure of scientific literacy for middle school students. *Science Education*, 98:549–580.

Hastuti, P. W., Setianingsih, W., & Widodo, E. (2019). Integrating inquiry based learning and ethnoscience to enhance students' scientific skills and science literacy. In *Journal of Physics: Conference Series*, 1387(1), 012059). IOP Publishing.

Holbrook, J. & M. Rannikmae. (2009). The meaning of scientific literacy. *International Journal of Environmental & Science Education*. 4(3): 275-288.

Kemendikbud (2013). *Dokumen kurikulum 2013*. Jakarta: Kemendikbud (2012).

Lemmer, M., Edwards, J.A., & Rapule, S. (2008): Educators' selection and evaluation of natural sciences textbooks. *South African Journal of Education*, 28:175-187.

Melyasari, N. S., Sutoyo, S., & Widodo, W. (2018, September). Scientific literacy skill of junior high school student using ethnoscience based learning. In *Seminar Nasional Kimia-National Seminar on Chemistry (SNK 2018)*. Atlantis Press.

Nentwig, P. M., Demuth, R., Parchmann, I., Ralle, B., & Gräsel, C. (2007). Chemie im Kontext: Situating learning in relevant contexts while systematically developing basic chemical concepts. *Journal of Chemical Education*, *84*(9), 14-39.

Newton, D. P., & Newton, L. D. (2006). Could elementary Mathematics text- books help give attention to reasons in the classroom?, *Educational Studies in Mathematics* 64, 69-84.

Ogan-Bekiroglu, F. (2007). To what degree do the currently used Physics textbooks meet the expectations?, *Journal of Science Teacher Education* 18, 599–628.

OECD. (2013).*PISA 2015) draft science framework*. Paris: OECD Publications.

OECD. (2014). *PISA 2012 Results: What students know and can do (student performance in mathematics, reading and sciences).* Paris: OECD Publications.

Parmin, P., & Fibriana, F. (2019). Prospective teachers' scientific literacy through ethnoscience learning integrated with the indigenous knowledge of people in the frontier, outermost, and least developed regions. *Jurnal Penelitian dan Pembelajaran IPA*, *5*(2), 142-154.

Reys, B. J., & Reys, R. E.: (2006). The development and publication of elementary Mathematics textbooks: Let the buyer beware!, *Phi Delta Kappan,* 87(5), 377-383.

Reddy, V.(2006). Challenges to meet international *Maths and Science standards*. HSRC Review, 4(1). 147-156.

Rusilowati, A., Kurniawati, L., Nugroho, S. E., & Widiyatmoko, A. (2016). Developing an instrument of scientific literacy assessment on the cycle theme. *International Journal of Environmental and Science Education*, *11*(12), 5718-5727.

Setiawan, B., Innatesari, D. K., Sabtiawan, W. B., & Sudarmin, S. (2017). the development of local wisdom-based natural science module to improve science literation of students. *Jurnal Pendidikan IPA Indonesia*, *6*(1), 49-54.

Suardana, I. N., Redhana, I. W., Sudiatmika, A. A., & Selamat, I. N. (2018). Students' critical thinking skills in chemistry learning using local culture-based 7E learning cycle model. *International Journal of Instruction*, *11*(2), 399-412.

Sudarmin, R. F. K., Nuswowat, M., & Sumarni, W. (2017). Development of ethnoscience approach in the module theme substance additives to improve the cognitive learning outcome and student's entrepreneurship. In *Journal of Physics: Conf. Series*, 824, 012024.

Sumarni, W. (2016). Preliminary analysis of assessment instrument design to reveal science generic skill and chemistry literacy. *International Journal of Evaluation and Research in Education*, *5*(4), 331-340.

Sumarni, W. (2018). The influence of ethnoscience-based learning on chemistry to the chemistry's literacy rate of the prospective teachers. *Unnes Science Education Journal*, *7*(2). 144-156.

Sumarni, W., Rusilowati, A., & Susilaningsih, E. (2017). Chemical literacy of teaching candidates studying the integrated food chemistry ethnosciences course. *Journal of Turkish Science Education*, *14*(3), 40-72.

Sumarni, W., & Kadarwati, S. (2020). Ethno-stem project-based learning: Its impact to critical and creative thinking skills. *Jurnal Pendidikan IPA Indonesia*, *9*(1). 102-108.

Sujana, A., Permanasari, A., Sopandi, W., & Mudzakir, A. (2014). Literasi kimia mahasiswa PGSD dan guru IPA sekolah dasar. *Jurnal Pendidikan IPA Indonesia*, *3*(1). 114-124.

Sulistiawati, S. (2015). Analisa Pemahaman Literasi Sains Mahasiswa yang Mengambil Mata Kuliah IPA Terpadu menggunakan Contoh Soal PISA 2009. *Sainteks*, *12*(1). 125-136.

Wieman, C. (2007). Why not try a scientific approach to Science Education?, Change (September-October 2007), 9-15.

Yuliana, I., Tjandrakirana, T., & Widodo, W. (2018). Improving students scientific literacy: a development of thematic ethnoscience-based teaching material. In *International Conference on Mathematics and Science Education of Universitas Pendidikan Indonesia*, 3, 470-474.