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AN ETHNOSCIENCE STUDY IN CHEMISTRY LEARNING TO DEVELOP SCIENTIFIC LITERACY

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ABSTRACT

The low scientific literacy index of Indonesian students is due to lack of attention to socio-cultural environment. Also, there are still many contents, the context, and processes in chemistry learning that have not been achieved as learning resources for developing the domain of scientific literacy into four main areas. They are science content, competence, or science process, the context of the application of science and attitude. This study intended to develop scientific literacy through ethnoscience pedagogic in chemistry learning. The method of this study was qualitative descriptive with the retrieval of data through direct observation, questionnaires, and interviews. The results of the study showed that the needs of: (1) the curriculum emphasis on the development of chemistry literacy for students; 2) the skills of chemistry lecturers in designing learning programs by using local potential in their respective regions; (3) the early discussion on the material coverage the basic concepts of chemistry; and (4) the emphasis not only on chemistry content but also on context, processes, and attitudes. Thus it can be concluded 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.

Keywords: chemistry learning, ethnoscience, scientific literacy

INTRODUCTION

Education has a tight relation with the culture of a nation. Through education, moral values, and national excellence in the past could be reintroduced, developed, and examined into an acceptable current culture (Daryanto, 2014). Nowadays, culture can be integrated into students learning at school, particularly science lessons (Sudarmin, 2014). Science is a set of knowledge as a result of the research designed comprehensively into a knowledge grouped following the study fields, such as physics, biology, and chemistry. Also, science is an inquiry method which means that science supplies illustrations or descriptions of the approaches used in the preparation of knowledge (Kun, 2013).

The implementation of 2013 Curriculum 2013 is for the advancement of education in Indonesia. Curriculum 2013 leads students to think critically and learn actively in seeking information, explaining a phenomenon, and giving solutions to a problem. Such learning will be more effective if students have the provision of literacy skill (Anjarsari, 2014). The scientific literacy of Indonesian students was still at level 2 or remains below average.

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In 2006, PISA-OECD (Program for International Student Assessment-Organization for Economic Cooperation and Development) had measured students' scientific literacy. The result strengths the fact that Indonesian students are low in the scientific literacy in which there were 29% for the content, 34% for the process, 32% for context (Kelly et al., 2013). The low scientific literacy level of Indonesian students was closely related to the students' incomplete understanding of science learning. In the case of content, it was caused by the science learning process, which only focused on memorizing than understanding (Jufri et al., 2016). As a consequence, the teacher needs to give great attention to this case (Jurecki & Wander, 2012).

During this time, the students acted as a good listener. They tend to listen to the teacher explanation. The important one was the product instead of the learning process, attitude, and application. The next one is the contextual aspect; teachers are not entirely integrating the materials with the students' environment (Treacy & Kosinski-Collins, 2011). The low level of student chemistry literacy shows that there are still many contexts, content, and processes in basic chemistry concepts that have not been achieved (Sujana et al., 2014). Furthermore, phases of teaching and learning in scientific literacy according to Holbrook (2011) comprise contact phase, curiosity, collaboration, decision making, and re-contextual.

One way that can be used to improve students' scientific literacy skill is by integrating ethnoscience or local wisdom into learning materials. Ethnoscience derives from the word "ethnos," which means nation and "scientia," which denotes knowledge. The function of ethnoscience would ease students to explore the facts and phenomenon existing in society and be integrated with scientific knowledge (Melyasari et al., 2018). Ethnoscience can captivate students interested in learning because it is related to their own regional identity. Also, ethnoscience could promote a sense of awe with regional culture and preserve it. The chemistry learning model based ethnoscience can improve students' critical thinking (Arfianawati et al., 2016).

Learning the integrated science applied, at this time, intends to introduce numerous benefits around certain regions. Scientific explanations about cultural phenomenon around students can assist them in understanding the surrounding environment and what they learn in school. Ethnoscience, which is rooted in the lives of students, is a form of contextual experience (Sudarmin, 2014). The concept that is contextual in science learning can be related to ethnoscience. In general, ethnoscience-based learning to increase scientific literacy skill is so far rarely found in Indonesia. Therefore, the researchers are willing to develop science literacy through ethnoscience pedagogic in chemistry learning. Chemistry learning can be integrated into ethnoscience because chemistry learning involves contextual experience in everyday life about local wisdom into learning materials and a phenomenon that exists in society.

Learning chemistry is theoretically teaching students to have the ability to identify chemical problems and making a conclusion based on evidence for the sake of recognizing natural changes and the effect of human's interaction to nature (Gorokhov, 2010). This complex world changes quickly, which requires the understanding of chemistry to handle it (Gilbert & Treagust, 2009). Due to the understanding, literacy of chemistry from formal education is highly demanded (Rahayu, 2017). It means that the students should not only know and memorize things related to the concepts of chemistry but also understand and implement it in their daily life (Marks & Eilks, 2009).

The application of chemistry concepts in social life is directly related to local wisdom. Local wisdom is a stimulus of motivation for students to construct their knowledge. The integration of cultural competence in the different profession will become the determining key for professional service, including in education. Thus, the lecturer should be able to utilize local culture to accommodate the demand in the learning process (Nieto & Zoller Booth, 2010). The importance of cultural integration in science as an ethnoscience is explained by Nieto & Zoller Booth (2010) as by the social constructivism of Vygotsky (Sumarni, 2018).

The importance of cultural integration in science as an ethnoscience is explained by (Nieto & Zoller Booth, 2010) as by the social constructivism of Vygotsky (Sumarni, 2018). The concept discusses the urgency of cultural competence in education. Vygotsky has more emphasis on the sociocultural concept, which is the social and interactional context of students in learning. Vygotsky is also sure that the learning process is not only at school, but it can also occur when the students do tasks they never did in school, which they can do it well in the society. Therefore, a future teacher should obtain the experiences of integrating culture to their learning process.

Based on the facts, considering teachers are essential in the learning process, there should be an innovation in the learning process of the teaching institution. Following the suggestions of (Bacanak & Gökdere, 2009), teaching institution should be able to improve the literacy rate of a future chemistry teacher. Thus, the writer proposes ethnoscience learning process for chemistry to achieve the objective. This research has a specific purpose to develop scientific literacy of the chemistry students through ethnoscience based chemistry learning. According to Ariningtyas et al. (2017), scientific literacy can be increased through learning chemistry charge ethnoscience. Perwitasari et al. (2017) the result showed that learning application the concept of energy and its amendments charge ethnoscience fish curing used to improve the scientific literacy of students.

Practically, the advantages of this research are: (1) To become the guidance of consideration in educational policy, especially in developing teaching education; (2) To become a suggestion for lecturer to develop chemistry education that students will have the literacy of chemistry; (3) To motivate another researcher to conduct further researches regarding the development of chemistry based on local wisdom; (4) Ethnoscience based learning processes in chemistry learning can increase chemistry literacy; and (5) The students' interest in conducting ethnosciences based learning process is positively correlated to students' learning outcomes.

METHODS

This research has been conducted at the Chemistry Education Study Program FPMIPA IKIP Mataram from January to February 2019. The research subjects were Chemistry Education lecturers of basic chemistry or course. This type of research is descriptive qualitative research. There were two types of data used in this research; primary and secondary data. The primary data collection is done through direct observation and interviews. It aims to make a direct observation of the object under study in the form of syllabus, RPS, and chemical teaching materials used during the learning process in the classroom. The results of the interviews were carried out directly to the basic chemistry lecturer at the Chemistry Education Study Program FPMIPA IKIP Mataram. Secondary data collection is done through the study of literature to obtain theoretical foundations and support data relating to the learning of chemistry in the study of ethnoscience.

RESULTS AND DISCUSSION

Chemistry Literacy of FPMIPA IKIP Mataram Students

Table 1. The Average Value of FPMIPA IKIP Mataram Students' Chemistry Literacy

Students	Chemistry Literacy	Category
Students 1	56	Low
Students 2	25	Low
Students 3	43	Low
Students 4	41	Low
Students 5	21	Low
Students 6	40	Low
Students 7	55	Low
Students 8	10	Low
Students 9	47	Low
Students 10	26	Low
Students 11	21	Low
Students 12	56	Low
Students 13	57	Low
Students 14	50	Low
Students 15	31	Low
Students 16	30	Low
Students 17	35	Low
Students 18	31	Low
Students 19	20	Low
Students 20	32	Low
Average	36.35	Low

The pretest results showed that the students' chemistry literacy was relatively low. This state is mainly caused by classroom activity in which they only listen to and memorize a teacher's presentation. Moreover, the teacher does not completely connect materials with the students' environment. This fact is similar to Jurecki & Wander (2012) and Treacy & Kosinski-Collins (2011). As a result, there are many content, contexts, and processes in basic chemistry concepts that have not been achieved (Sujana et al., 2014). In other words, this rote science learning does not help students' understanding at all (Jufri et al., 2016).

The influenced scientific literacy the low by many things, including the curriculum and education system, selection of teaching methods and models, learning facilities and facilities, learning resources, teaching materials and others (Celik, 2014). So that need to be the skills of lecturers in developing students' scientific literacy.

Emphasising on a Curriculum Involving the Importance of the Development of Chemistry Literacy

The curriculum of Chemistry Education Study Program has not shown a curriculum integrating ethnoscience. The evidence is the curriculum structure of the Chemistry Education Program FPMIPA IKIP Mataram as seen in Figure 1.

CURRICULUM STRUCTURE
CHEMISTRY EDUCATION STUDY PROGRAM SI

No	CODE	COURSES	SKS	COMPETENCE ELEMENT					SEMESTER							
				PK	KK	KB	PB	BB	1	2	3	4	5	6	7	8
	MAIN COMPETENCE															
		MKU Core														
1	90120201	Islamic education	2	√	√		√	√		2						
	90120202	Catholic Religious Education														
	90120203	Protestant Religious Education														
	90120205	Buddhist Education														
	90120204	Hinduism Education														
2	90120206	Pancasila Education	2	√	√		√	√	2							
3	90120207	Civic education	2	√	√		√	√		2						
		MKU Institusional														
4	90220205	Physical Education & Sports	2	√	√			√	2							
5	90220204	Indonesian	2	√	√		√	√			2					
6	90210201	Basic Social Sciences	2	√	√		√	√			2					
		MKDK														
7	93320305	Basic Chemistry I	3/1	√	√			√	3/1							
8	93320303	Basic Physics I	3/1	√	√			√	3/1							
9	93320307	General biology	3/1	√	√			√	3/1							
10	93320312	Basic mathematic	3	√	√			√	3							
11	93320306	Basic Chemistry II	3/1	√	√			√		3/1						
12	93320304	Basic Physics II	3/1	√	√			√		3/1						
13	19324301	Chemistry Mathematics	3	√	√	√		√		3						
14	90320202	English I	2	√	√	√		√	2							
15	90320203	English II	2	√	√	√		√		2						
16	19324302	Basic Statistics	3/1		√							3/1				
		MKK														
17	93420301	Student Development	3	√	√			√	3							
18	93420305	Learning Theory	3	√	√			√		3						
19	19324215	Modern Physics	2	√	√			√				2				
20	93420409	Assessment	4	√	√						4					
21	19424202	Study Chemistry Curriculum	2/1	√	√			√		2/1						
22	93420401	MKPBM I	4	√	√			√			4					
23	19324407	Analytical Chemistry I: Basic-2 Kim. Analytic	4/1	√	√	√		√			4/1					
24	19314322	Chemistry Physics I: Structures & Bonds	3/1	√	√	√		√			3/1					
25	19324210	Basic Theory & Organic Chemistry I & Cluster Monofunction (1)	2	√	√	√						2				
26	19324309	Inorganic Chemistry I: Basic Theory	3	√	√	√						3				
27	19324408	Analytical Chemistry II: Basic-2 Chemical Separation Analytical Chemistry I: Basic-2 Kim. Analytic	4/1	√	√	√		√				4/1				
28	93420402	MKPBM II	4/1	√	√			√				4/1				
29	19324323	Physical Chemistry II: Energetics	3/1	√	√	√		√				3/1				
30	19324322	Inorganic Chemistry II: Main 2-Elements	3/1	√	√	√		√					3/1			
31	19324317	K. Organic II: Monofunctional Cluster (2) & & Polifungsi	3/1	√	√	√							3/1			
32	19324311	Biochemistry I: Structure & Function	3/1	√	√	√		√					3/1			
33	19324312	Research methodology	3	√	√	√		√					3			
34	93420403	MKPBM III	4/1	√	√			√					4/1			
35	19324318	Chemistry Physics III: Reaction Kinetics	3/1	√	√	√		√						3/1		
36	19324323	Inorganic Chemistry III: The 2nd Element of Transition	3/1	√	√	√		√						3/1		
37	19324319	Organic Chemistry III: Macro Molecules	3/1	√	√	√		√						3/1		
38	19324320	Biochemistry II: Metabolism & Information Genetics	3	√	√			√						3		
39	90320201	Computer application	2	√	√	√		√					2			
40	90520201	Field Experience Program (PPL) 1	2	√	√			√						2		
41	19324214	Chemistry Coordination	2	√	√	√		√							2	
42	19314314	Analytical Chemistry III: Met. Spect. Analytic	3/1	√	√	√		√					3/1			
		Total SKS of Main Competencies	**120**						**21**	**20**	**21**	**21**	**21**	**14**	**2**	**0**

Figure 1. Chemistry Education Curriculum Structure

Chemistry literacy is one of the vital elements that must be developed in education. It is defined as the capacity to use chemical knowledge to identify questions and draw up conclusions based on the evidence to understand and assist them in making decisions about the natural world and human interaction with nature (Sujana et al., 2014). Chemistry literacy is related to people at all ages and levels of both science and non-science education. According to Gilbert & Treagust (2009), many aspects of chemistry have closely related to everyday life, such as:

1. Understanding chemical properties, norms, and methods. That is, how chemists work and how the products manufactured are accepted as scientific knowledge; for example, food, beverages, medicines, bleach, cleaners, room deodorizers, vehicle, land, air, and household appliances.
2. Understanding theories, concepts, and chemical models. The subject lies in a theory that has wide application; for instance, the decrease of air, water, and soil quality, ozone layer depletion, acid rain, corrosion, and global warming.
3. Understanding how chemistry and chemical-based technology relate to each other. Chemistry explains about nature, while chemical

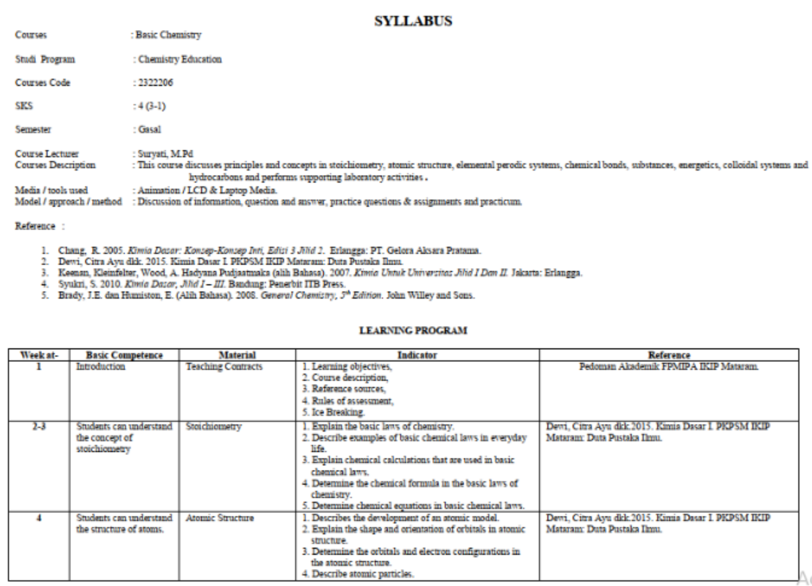
technology changes the world into a useful thing. The concepts and models produced by the two fields are strongly related so that each other influences each other.

4. Appreciating the effect of chemistry and chemical technology in relation to society. Understanding the nature of applicable chemical phenomena. Produce changes or modifications to better phenomena by changing the world we see.

Chemistry literacy in science learning is increasingly needed today so that we can live amid modern society (Priestley & Sinnema, 2014). For all of these reasons, scientific literacy is considered the key to competence (Putra et al., 2016). The science literacy assessment framework comprises aspects of context, competence, knowledge, and attitude (DeLuca & Klinger, 2010). Science literacy includes three competencies, namely explaining scientific phenomena, evaluating and designing scientific inquiry, interpreting the data, and scientific evidence (Roberts & Bybee, 2014). The result of the PISA assessment (2013), Science literacy of Indonesian students are ranked 64th out of 65 participating countries. To achieve the goals of someone's chemistry education literacy, the chemical curriculum has recently undergone increasing changes in many countries, in maintaining and improving the subject of the science curriculum (Celik, 2014). The government of Indonesian considers it is necessary to enact a 2013 curriculum to create a society of scientific literacy, but nowadays 2013 curriculum was dismissed in some of the schools because many teachers and the students were not ready for the implementation of this curriculum. Various breakthroughs were carried out by the government to achieve the objectives of the 2013 curriculum. Government also tried to distribute the 2013 curriculum to the entire schools in Indonesia in 2019. The students that prepared to be a science teachers also need to be prepared since in the college. It is expected that this research can prompt the increase of human resources that capable of literacy and be able to transfer their capability through learning science to accelerate government targets.

Chemistry lectures, in particular, can design learning programs using local potentials in their respective regions

Based on the results of the interviews conducted at the basic chemistry lecturer in January 2019, most lecturers did not understand the meaning of science in local cultures so that they had difficulty in connecting learning material with local cultural values. As a result, the students lack knowledge of local culture and understanding a natural phenomenon. The teacher used the following learning tools during the basic chemistry learning process in the class. It is presented in Figure 2.



SYLLABUS

Courses : Basic Chemistry

Studi Program : Chemistry Education

Courses Code : 2322206

SKS : 4 (3-1)

Semester : Gasal

Course Lecturer : Suryati, M.Pd

Courses Description : This course discusses principles and concepts in stoichiometry, atomic structure, elemental perodic systems, chemical bonds, substances, energetics, colloidal systems and hydrocarbons and performs supporting laboratory activities.

Media / tools used : Animation / LCD & Laptop Media.

Model / approach / method : Discussion of information, question and answer, practice questions & assignments and practicum.

Reference :

1. Chang, R. 2005. *Kimia Dasar: Konsep-Konsep Inti, Edisi 3 Jilid 2.* Erlangga: PT. Gelora Aksara Pratama.
2. Dewi, Citra Ayu dkk. 2015. Kimia Dasar I. PKPSM IKIP Mataram: Duta Pustaka Ilmu.
3. Keenan, Kleinfelter, Wood, A. Hadyana Pudjaatmaka (alih Bahasa). 2007. *Kimia Untuk Universitas Jilid I Dan II.* Jakarta: Erlangga.
4. Syukri, S. 2010. *Kimia Dasar, Jilid I – III.* Bandung: Penerbit ITB Press.
5. Brady, J.E. dan Humiston, E. (Alih Bahasa). 2008. *General Chemistry, 5th Edition.* John Willey and Sons.

LEARNING PROGRAM

Week at-	Basic Competence	Material	Indicator	Reference
1	Introduction	Teaching Contracts	1. Learning objectives, 2. Course description, 3. Reference sources, 4. Rules of assessment, 5. Ice Breaking.	Pedoman Akademik FPMIPA IKIP Mataram.
2-3	Students can understand the concept of stoichiometry	Stoichiometry	1. Explain the basic laws of chemistry. 2. Describe examples of basic chemical laws in everyday life. 3. Explain chemical calculations that are used in basic chemical laws. 4. Determine the chemical formula in the basic laws of chemistry. 5. Determine chemical equations in basic chemical laws.	Dewi, Citra Ayu dkk.2015. Kimia Dasar I. PKPSM IKIP Mataram: Duta Pustaka Ilmu.
4	Students can understand the structure of atoms.	Atomic Structure	1. Describes the development of an atomic model. 2. Explain the shape and orientation of orbitals in atomic structure. 3. Determine the orbitals and electron configurations in the atomic structure. 4. Describe atomic particles.	Dewi, Citra Ayu dkk.2015. Kimia Dasar I. PKPSM IKIP Mataram: Duta Pustaka Ilmu.

			5. Determine atomic number, mass number and isotope.	
5	Students can understand the periodic system of elements	Periodic System of Elements	1. Explain Grouping of Elements and Its development. 2. Explain the Short Periodic System. 3. Determining Electrons, Periods, and Electron Configurations in the Long Periodic System. 4. Describe the Periodic Characteristics of Elements.	Dewi, Citra Ayu dkk.2015. Kimia Dasar I. PKPSM IKIP Mataram: Duta Pustaka Ilmu.
6-7	Students can understand chemical bonds	Chemical Bonds	1. Explain Atomic Stability in Chemical Bonds. 2. Explaining the Ion Formation Process. 3. Explain the Process of the Occurrence of Covalent Bonds 4. Determine the Polar and Non-Polar Covalent Associations in the Chemical Association. 5. Determining the Nomenclature of Compounds in the Chemical Association. 6. Determining Molecular Forms in Chemical Bonds.	Dewi, Citra Ayu dkk.2015. Kimia Dasar I. PKPSM IKIP Mataram: Duta Pustaka Ilmu.
8	**MID SEMESTER**			
9	Students can understand the concept of matter	Substance	1. Describe the Form of Gas. 2. Describe Liquid Form. 3. Describe Solid Form. 4. Describe Mesophase Forms. 5. Describe Phase Equilibrium.	Dewi, Citra Ayu dkk.2015. Kimia Dasar I. PKPSM IKIP Mataram: Duta Pustaka Ilmu.
10-11	Students can understand energetic concepts.	Energetics	1. Explain Thermodynamic Theory. 2. Explaining the Thermodynamic System. 3. Explain the state of thermodynamics. 4. Explain the Basic Laws of Thermodynamics. 5. Explain Entropy and Free Energy Relationships in Thermodynamics.	Dewi, Citra Ayu dkk.2015. Kimia Dasar I. PKPSM IKIP Mataram: Duta Pustaka Ilmu.
12-13	Students can understand the colloidal system.	Colloid System	1. Describe the Differences in Solutions, Colloids, and Suspensions. 2. Describe the properties of colloids. 3. Describe the Colloid Purification Process. 4. Explain the Use of Colloids.	Dewi, Citra Ayu dkk.2015. Kimia Dasar I. PKPSM IKIP Mataram: Duta Pustaka Ilmu.
14-15	Students can understand hydrocarbon compounds	Hydrocarbons	1. Describe the Uniqueness / Uniqueness of Carbon Atoms. 2. Describe the Position of the Carbon Atom. 3. Explain the classification of hydrocarbon compounds. 4. Describe Alkanes, Alkenes, and Alkyns in hydrocarbons. 5. Explain Reactions of Hydrocarbon Compounds.	Dewi, Citra Ayu dkk.2015. Kimia Dasar I. PKPSM IKIP Mataram: Duta Pustaka Ilmu.
16	**FINAL EXAMS**			

Figure 2. Syllabus & Learning Program of Basic Chemistry

The lecturer's role is very crucial to support the students' success. The lecturer's teaching skill determines student success in learning. Therefore, a lecturer must have a high proficiency in chemistry literacy, as well as other knowledge and the skills to guide and direct students so that they have high scientific literacy. It has been appropriately stated that a teacher should support the development of chemistry literacy to allow students to construct meaning in scientific literacy (Holbrook & Rannikmae, 2009). Because of its crucial role as agents of learning, the prospective teacher must have high chemical literacy skills as it positively will affect future learning: the lower chemical literacy, the lower the quality of teaching chemistry. Lectures with a low level of scientific literacy cannot be expected to develop scientifically-literate people nor implement the curriculum effectively so that the university curriculum should enhance the literacy level of future teachers (Bacanak & Gökdere, 2009).

Also, the learning process that combines community science and scientific science can increase students' understanding of scientific science concepts and experience more meaningful learning. Local culture in learning can improve student science literacy skills. Students learn more effectively if they utilize the environment or equipment around them. It can stimulate their curiosity to do the observations and trigger them to ask questions (Hindarto et al., 2017) so that they can conclude, and gain experience through scientific processes. The experience gained from the scientific process is more durable. Thus, it is necessary to introduce local culture to the young generation through education by developing scientific literacy through the study of ethnoscience in chemistry learning. The use of local culture in learning allows students to do direct observations and train students to be able to discover for themselves diverse concepts that are thoroughly studied (holistic), meaningful, authentic, and active. Integrated ethnoscience chemistry learning is also complemented by supporting factors, namely integrated syllabi, RPS of integrated ethnoscience, integrated teaching materials on ethnoscience, and the question of integrated ethnoscience. Preparation of syllabus and teaching materials adapted to the conditions of the region based on excellence and uniqueness that are characteristic of the region, in this study centered on regional characteristics in the preparation of syllabus and teaching materials carried out by analyzing traditional knowledge (ethnoscience) that can be adapted and integrated with science in learning chemistry.

Chemistry learning integrated with local wisdom is done by reconstructing original science. The intended reconstruction is the realignment or translation of original science into western science concepts or scientific science. This original science is obtained through observation of the cultures that exist in society. Therefore it can be said that this learning model is based on local wisdom, because it is derived from indigenous knowledge or local intelligence of a community derived from the noble values of cultural traditions to regulate the order of people's lives in order to achieve community progress both in creating peace and improvement in people's welfare. (Suastra, 2010) Stated that future science learning needs to be sought so that there is a balance between the knowledge of science and the cultivation of scientific attitudes, as well as the values that exist and develop in local wisdom and the community. Therefore, the socio-cultural environment of students needs to get serious attention in developing science education in higher education because it contains original science that can be useful for their lives. The statement above shows how important local wisdom is in chemistry learning to develop scientific literacy. It is an effect to increase student scientific literacy. The statement above strengthens the function of science education to improve the responsible individual.

The scope of the materials should be discussed; the emphasis should be not only on the content of chemistry but also on the context, process, and attitudes

Based on the discussion results, basic chemistry concepts that have the potential to emerge ethnoscience in chemistry learning include; (1) a tradition of "mamaq" Sasak tribe to strengthen teeth in acid-base topic; (2) "TerasiNisa" by Samawa tribe on buffer solution topic; (3) durable "Tamban" using original Sasak salt in salt hydrolysis topic; (4) turmeric, Water girlfriend Leaves, discolor rhoeo leaves, and Hibiscus as natural acid-base indicators on acid-base titration topic; (5) "ilo" by Mbojo tribe on hydrocarbon topic; and (6) "Celilong" jaje by Sasak tribe on colloid system topic. These topics could raise aspects of local culture in learning to become an object of learning chemistry so that chemistry literacy can be developed through the study of ethnoscience. The following ethnoscience study in basic chemistry learning is presented in Table 2.

Table 2. Ethnoscience Pedagogic in Learning Chemistry to Develop Scientific Literacy

Topics Related to Chemical Content	Context of Ethnoscience	Aspects of Scientific Literacy Developed	Indicator of Aspects Scientific Literacy
Acid-Base	Tradition "*mamaq*" *Sasak* tribe to strengthen teeth	1. Science content or knowledge	Recognizing chemical concepts; Defining some key concepts; Using knowledge in chemistry to get information.
Buffer Solution	Making *"TerasiNisa"* *Samawa* tribe	2. Science process or competence 3. Context of the application of science	Planning scientific research; Using scientific evidence; Identifying scientific question.
Acid-base titration	Natural acid-base indicators are Turmeric, Water girlfriend Leaves, discolor rhoeo leaves, and Shoe flowers	4. Attitude	Issuing identifying; Explaining a phenomena of chemistry concepts; Analyze the information given.
Hydrocarbons	Making "*ilo*" typical of the *Mbojo*tribe		Applying science ability to problem-solving; Applying science ability to communication; Being able to use science products well.

The development of chemistry literacy, especially the chemistry students at the Mataram IKIP can be done through the improvement of the lecture process carried out, and the scope of the materials on the basic concepts of chemistry given. Especially for the give basic concepts of chemistry, the emphasis should be not only on the content of chemistry, but also on the context, process, and attitude. This is very important as the assessment of chemistry literacy according to PISA is not only on content, but also the context, knowledge (knowledge of science and knowledge about science), and attitudes (DeLuca & Klinger, 2010). One effort to develop the literacy of students at IKIP Mataram is through the improvement of the learning process carried out by integrating ethnoscience in chemistry learning.

Ethnoscience is a knowledge acquired by the language and culture of a person who can be tested for truth, and this can be innovated in science-based learning in the classroom (Abonyi et al., 2014). Ethnoscience is a learning approach that elevates local culture or wisdom to become an object of science learning. Science learning developed from the perspective of local culture and organized local wisdom related to certain natural phenomena and events will increase students' interest in science and will be more easily understood by students. Ethnoscience, as a national identity, is something that needs to be considered in Indonesian curriculum development especially in the chemistry curriculum. One type of the ethnoscience study is related to indigenous science mapping. Genuine science knowledge consists of all knowledge that pertains to the facts of society. The development pattern of such knowledge is inherited continuously between generations, unstructured and systematic in a curriculum, informal, and generally a knowledge of people's perceptions of a particular natural phenomenon (Sudarmin et al., 2015).

CONCLUSION

This study concluded that the development of scientific literacy needs to be done focusing on the preparation of future generations of scientific literacy through cultural-based curriculum to produce a more contextual learnings, particularly learning resources used in the classroom learning process to elevate local culture related to basic chemistry learning. This type of learning source will ease students conceptual understanding as it connects to community culture and everyday life. Thus, the ethnoscience pedagogic in chemistry learning can develop student scientific literacy in terms of content, competence, context, and attitude.

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REFERENCES

Abonyi, O. S., Achimugu, L., & Njoku, M. (2014). Innovations in Science and Technology Education: A case for Ethnoscience Based Science Classrooms. *International Journal of Scientific and Engineering Research*, *5*(1), 52–56.

Anjarsari, P. (2014). Literasi Sains dalam Kurikulum dan Pembelajaran IPA SMP. *Prosiding Semnas Pensa VI" Peran Literasi Sains" Surabaya*, *20*.

Arfianawati, S., Sudarmin, M., & Sumarni, W. (2016). Model Pembelajaran Kimia Berbasis Etnosains untuk Meningkatkan Kemampuan Berpikir Kritis Siswa. *Jurnal Pengajaran MIPA*, *21*(1), 46–51.

Ariningtyas, A., Wardani, S., & Mahatmanti, W. (2017). Efektivitas Lembar Kerja Siswa Bermuatan Etnosains Materi Hidrolisis Garam untuk Meningkatkan Literasi Sains Siswa SMA. *Journal of Innovative Science Education*, *6*(2), 186-196.

Bacanak, A., & Gökdere, M., (2009). Investigating the Level of the Scientific Literacy of Primary School Teacher Candidates. In *Asia-Pacific Forum on Science Learning & Teaching* (Vol. 10).

Celik, S. (2014). Chemical Literacy Levels of Science and Mathematics Teacher Candidates. *Australian Journal of Teacher Education (Online)*, *39*(1), 1-15.

Daryanto. (2014). *Pendekatan Pembelajaran Saintifik Kurikulum 2013. Yogyakarta: Gava Media*.

DeLuca, C., & Klinger, D. A., (2010). Assessment Literacy Development: Identifying Gaps in Teacher Candidates' Learning. *Assessment in Education: Principles, Policy & Practice*, *17*(4), 419–438.

Gilbert, J. K., & Treagust, D. F. (2009). Introduction: Macro, Submicron and Symbolic Representations and the Relationship Between Them: Key Models in Chemical Education. *Multiple Representations In Chemical Education* (pp. 1–8). Springer.

Gorokhov, V. (2010). Vladimir I. Kurashov: History and Philosophy of Chemistry. *HYLE International Journal for Philosophy of Chemistry*, *16*(2), 121–125.

Hadi, W. P., Sari, F. P., Sugiharto, A., Mawaddah, W., & Arifin, S. (2018). Studi Etnosains Terasi Sebagai Sumber Belajar IPA Berbasis Kearifan Lokal. In *National Conference on Mathematics, Science and Education (NACOMSE)* (Vol. 1, pp. 343–348).

Hindarto, N. Wiyanto, & Iswari, RS. (2017). Strengthening the Basic Competence of Sciences for Master Students of Science Education Program. *International Journal of Environmental & Sciencen Education*, *12*(10), 2261-2273.

Holbrook, J. (2011). Enhancing Scientific and Technological Literacy (STL): A Major Focus for Science Teaching at School. *Journal of the Science Teachers Association of Nigeria*, *46*(1), 9–34.

Holbrook, J., & Rannikmae, M. (2009). The Meaning of Scientific Literacy. *International Journal of Environmental and Science Education*, *4*(3), 275–288.

Jufri, A. W., Setiadi, S., & Sripatmi, D. (2016). Scientific Reasoning Ability of Prospective Student Teacher in the Excellence Program of Mathematics and Science Teacher Education at the University of Mataram. *Jurnal Pendidikan IPA Indonesia*, *5*(1), 69–74.

Jurecki, K., & Wander, M. C. F. (2012). Science Literacy, Critical Thinking, and Scientific Literature: Guidelines for Evaluating Scientific Literature in the Classroom. *Journal of Geoscience Education*, *60*(2), 100–105.

Kelly, D., Nord, C. W., Jenkins, F., Chan, J. Y., & Kastberg, D. (2013). Performance of US 15-Year-Old Students in Mathematics, Science, and Reading Literacy in an International Context. First Look at PISA 2012. NCES 2014-024. *National Bureau of Economic Research*.

Kun, P. Z. (2013). Pembelajaran Sains Berbasis Kearifan Lokal. In *PROSIDING: Seminar Nasional Fisika Dan Pendidikan Fisika* (Vol. 4).

Marks, R., & Eilks, I. (2009). Promoting Scientific Literacy Using a Sociocritical and Problem-Oriented Approach to Chemistry Teaching: Concept, Examples, Experiences. *International Journal of Environmental and Science Education*, *4*(3), 231–245.

Melyasari, N. S., Sutoyo, S., & Widodo, W. (2018). Scientific Literacy Skill of Junior High School Student Using Ethnoscience Based Learning, *171*(Snk), 125–128.

Nieto, C., & Zoller Booth, M. (2010). Cultural competence: Its Influence on the Teaching and Learning of International Students. *Journal of Studies in International Education*, *14*(4), 406–425.

Perwitasari, T., Sudarmin, S., & Linuwih, S. (2017). Peningkatan Literasi Sains Melalui Pembelajaran Energi dan Perubahannya Bermuatan Etnosains pada Pengasapan Ikan. *Jurnal Penelitian Pendidikan IPA*, *1*(2), 62-70.

Priestley, M., & Sinnema, C. (2014). Downgraded Curriculum? An Analysis of Knowledge in New Curricula in Scotland and New Zealand. *Curriculum Journal*, *25*(1), 50–75.

Putra, M. I. S., Widodo, W., & Jatmiko, B. (2016). The Development of Guided Inquiry Science Learning Materials to Improve Science Literacy Skill of Prospective MI Teachers, *5*(1), 83–93.

Rahayu, S. (2017). Promoting 21st Century Scientific Literacy Skills through Innovative Chemistry Instruction. In *AIP Conference Proceedings* (Vol. 1911, p. 20025). AIP Publishing.

Roberts, D. A., & Bybee, R. W. (2014). Scientific Literacy, Science Literacy, and Science Education.

Suastra, I. W. (2010). Model Pembelajaran Sains Berbasis Budaya Lokal untuk Mengembangkan Potensi Dasar Sains dan Nilai Kearifan Lokal di SMP. *Jurnal Pendidikan Dan Pengajaran*, *43*(1), 8-16.

Sudarmin. (2014). *Pendidikan Karakter Etnosains dan Kearifan Lokal (Konsep dan Penerapannya dalam Penelitian dan Pembelajaran Sains).* Semarang: CV Swadaya Manunggal.

Sudarmin, E., & Pujiastuti, Rr Sri Endang, M. (2015). Scientific Knowledge-Based Culture and Local Wisdom in Karimunjawa for Growing Soft Skills Conservation. *International Journal of Science and Research (IJSR)*, *4*(9), 598–604.

Sujana, A., Permanasari, A., Sopandi, W., & Mudzakir, A. (2014). Literasi Kimia Mahasiswa PGSD dan Guru IPA Sekolah Dasar. *Jurnal Pendidikan IPA Indonesia*, *3*(1), 99–107.

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), 198-205.

Treacy, D. J., & Kosinski-Collins, M. S. (2011). Using the Writing and Revising of Journal Articles to Increase Science Literacy and Understanding in a Large Introductory Biology Laboratory Course. *Atlas Journal of Science Education*, *1*(2), 29–37.

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