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Implementation of Integrated Problem-Based Learning Model With Ethno Cemistry Sasambo to Improve Chemistry Literation

Mutiah*, Yayuk Andayani, Jackson Siahaan, Supriadi, Mukhtar Haris

Chemistry Education Study Program, University of Mataram, Mataram, Indonesia
*E-mail: mutiah_fkip@unram.ac.id

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Abstract: This research aims to increase the chemistry literation of students through the Integrated Problem Based Learning Model with Ethno Chemistry Sasambo in Analytical Chemistry lecture. The subject of this research is all 86 students who are taking the Chemistry Analytical lecture. Meanwhile, the object is chemistry literation in several aspects such as content, context, competition, and attitude and the response of students toward conducting an Integrated Problem-Based Learning model with local culture in the salt production process. The research methodology used in this research is action class research in three cycles. Each cycle consists of planning, observation, and evaluation-reflection. Results of this work gained are: (1) Increase in students' chemistry literation from mid to high category that can be seen as cycle 1 is 62.8 as enough category, cycle 2 is 70.7 as enough category, and cycle three is 76.7 as high category. (2) Students' response shows that 95% of them stated that they are very interested and wanted more and vary integrated of local culture.

Keywords: Chemistry Literation; Ethno Chemistry; Problem-Based Learning.

Introduction

One of the educational policies in the 21st century emphasizes the importance of scientific literacy as a transferable outcome [1], including chemical literacy [2], which is needed to answer current global challenges [3]. This is in line with the 2013 curriculum, which requires conformity between the material taught and experiences or examples in everyday life [4]. Therefore, prospective chemistry teacher students need to gain experience in a culturally integrated learning process because science learning will be easier for students to understand if teachers pay attention to their culture [5]. This shows the importance of educating students with chemical literacy so that they are able to prepare themselves to answer global challenges [3]. To achieve this, chemical literacy really needs to be taught to students so that they can live in the midst of modern society in the 21st century. Learning chemical literacy by teaching chemical concepts that are integrated with local culture can start with observations from real-world contexts and relate them to molecular and symbolic representations of these chemical phenomena [6]-[7].

The problem currently being faced in the Chemistry Education Study Program at FKIP Unram is that students' chemistry literacy is still low due to their inability to analyze the relationships between concepts. [8] This fact is a challenge in itself for the Chemistry Education Study Program as an institution providing prospective chemistry teachers to prepare and plan so that students' chemical literacy meets standards. Academic qualifications and professional teacher competencies. According to [9], the low level of chemical literacy makes students less responsive to developments and problems that occur in the surrounding environment. One of the elements that make Indonesian students' chemical literacy low is the choice of strategies and teaching models [2]. By involving students in learning activities, teachers can help students improve their scientific (chemistry) literacy skills so that teachers can create a positive learning environment and prepare students to learn to understand science [10]. For this reason, it is necessary to improve the learning process, which is student-centered and not only emphasizes mastery of concepts but also pays attention to students' chemical literacy because future chemistry teachers will increase the chemical literacy of future generations.

The PBL learning model is student-centered learning and is driven by real problems, not by abstract concepts [11]. Problems can be found in real life and can be overcome by integrating local cultural elements so that they can form intelligent people in the future who remain determined to preserve local culture [12]. [13] explained that students who were given chemical ethnoscience-based chemistry learning experienced an increase in their chemical literacy abilities, both in terms of content, context, competency, and attitudes toward chemistry. Students' scientific literacy can also be improved through the PBL model [14]. Considering the important role of teachers as learning agents, prospective teacher students must also have high chemical literacy because the low

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chemical literacy of prospective teachers will, of course, greatly influence the learning they will do in the future.

To facilitate prospective chemistry teachers regarding their needs in the future, the learning model that has been implemented needs to be innovated into a PBL learning model that is integrated with concepts reflected in cultural traditions, cultural symbols, value systems, social systems, or cultural products in tribal communities. Sasak, Samawa and Mbojo (Ethno Kimia Sasambo). Integration of local culture is very necessary because it is rich in values contained in the form of physical, artistic, culinary, and life norms that can be used as a learning resource. This also aims to ensure that students become ethno-chemically literate teacher candidates who preserve their culture.

Based on the description above, the objectives of this research are as follows: (1) Analyze chemical content in local Sasambo culture related to analytical chemistry lecture material. (2) Applying the Sasambo ethno-chemical integrated problem-based learning model in Analytical Chemistry lectures. And (3) Describe the increase in students' chemical literacy skills after being given learning using the Sasambo ethno-chemical integrated problem-based learning model

Research Methods

The subjects of this research were students from the Chemistry Education Study Program, PMIPA, FKIP Unram, who took Analytical Chemistry lectures as many as 86 participants (3 classes). The research objects are (1) Chemical literacy in the aspects of content, context, competence, and attitudes and (2) Student responses to the implementation of the Sasambo ethno-chemical integrated PBL learning model. The action research procedure is a cycle of (1) Action planning, (2) Implementation of actions and observations, and (3) Evaluation-Reflection [15]. The planning stage is carried out for the entire research cycle, which includes analyzing RPS, preparing teaching materials, and exploring problems in local culture, which will be raised as topics in PBL learning. There are three main topics for implementing the action, which are designated as cycle topics: Cycle I: Identification of cations and anions, Cycle II: Gravimetric analysis, and Cycle III: Volumetric analysis. The implementation of actions for each cycle is referred to as [16]. The selection of problems is determined by studying local cultural events as a result of observations and interviews as a basis for finding solutions based on the material studied in each cycle.

Results and Discussion

The results of the identification of local culture required by the analytical chemistry lecture material determined that the local culture of salt production was integrated into PBL learning because it is a local culture that exists among the Sasak, Samawa, and Mbojo tribes.

Analysis of Chemical Content in Local Cultures of Salt Production

As a result of observations, interviews, and documentation that have been carried out in Pijot village, Keruak District, East Lombok, data regarding the production process of krosok salt and fine salt were obtained. The results of the chemical content analysis in the local salt production process are shown in Table 1 below.

Table 1. Chemical Contents in the Salt Production Process

Salt Production Process	Chemistry concept
Making salt is done by flowing seawater evaporated with sunlight in the salt-making fields, and salt crystals are formed and harvested after five days. On crystallization, salt will occur if the salt water concentration is between 25–29°Be. **Problem:** What are the chemical elements in seawater? How can the crystallization process of salt formation occur?	identify major and minor elements in seawater Separation of cations and anions with precipitation reaction, Concentration unit Measurement of seawater salinity Solubility equilibrium (Ksp) The degree of saturation of the solution The process of forming salt crystals/crystallization
When harvesting salt, not all seawater becomes salt; seawater that cannot crystallize is mixed with soil so that the salt at the bottom will be black and have very low purity. **Problem:** What are the cation/anion contents of salt production in the wastewater? Why is there residual seawater that cannot crystallize?	Identification of Cl and Na anions in local salt Na cation flame test in local salt Determination of water content in salt Review of Ksp values for each chemical compound in seawater The process of forming salt crystals Coprecipitation and post-precipitation information crystal
Some of the salt produced is white, and some is black, which is mixed with soil, so it must be processed to remove soil impurities by dissolving it with seawater to obtain old water that is ready to be cooked.	Salt recrystallization Identify the Cl and Na anions, Na cation flame test Salt quality parameters

Problem: What is the quality of the salt produced?	Qualitative and quantitative tests of cations and anions in wastewater
After cooking for 2 hours, clean salt crystals are formed, the crystal texture is smoother, and the water does not form salt. Tofu entrepreneurs buy the remaining water for ingredientsComposition coagulation chemicals in wastewater from salt production (MgCl2, CaSO4, NaCl)	Separation or purification of dirty salt Determination of the quality of refined salt using gravimetric and volumetric methods Determination of Ca and Mg in water left over from salt cooking method complex formation titration
Problem: What is the quality of the salt after being cooked again?	Determination of Ca levels in residual salt water using acid-base titration, gravimetry, and complex formation titration

Based on the data in Table 1, the chemical content in the salt production process covers all the material content in the Analytical Chemistry course. The chemical content applied as a learning objective refers to the results of an analysis of the relevance of local salt production processes with analytical chemistry material that has been carried out by [17]. The learning objectives in cycle I are: (1) identify cations and anions in seawater, local salt, and wastewater from salt production. And (2) Design a separation and identification scheme for cations and anions to increase NaCl levels in local salt. The chemistry content applied to the second cycle learning objectives is as follows: (1)Explain basic concepts of crystallization salt, which goes through a gradual deposition process related to solubility and value degrees No. (2) Designing methods to analyze and determine major elements in seawater, local salt, and residual salt water using the gravimetric method. The learning objectives in cycle III are: (1) Designing methods to analyze volumetrics and apply them to determine the quality of salt and levels of Ca and Mg in wastewater from salt production.

Chemical Literacy

Students' chemical literacy is measured every cycle after implementing problem-*based learning*. Sasambo's integrated ethno-chemistry includes aspects of content, context, competence, and attitude. The content aspects measured include the application of original chemical knowledge in society with chemical concepts contained in the analytical chemistry course syllabus. The context aspect consists of issues in the real world related to chemistry in learning, and the competency aspect consists of the identification of variables in chemical investigations. In contrast, the attitude aspect is the attitude towards chemical experiments that can be carried out [18]. Increasing chemical literacy in each cycle is shown in Figure 1 below.

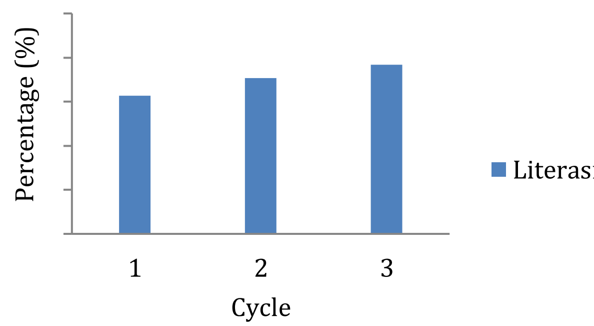

Figure 1. Diagram of student chemistry literacy in each cycle

Table 2. Chemical Literacy Values in every aspect

Aspect	Indicator	Cycle 1	Cycle 2	Cycle 3
Content	Understanding	67	73	75
	Draft	60	68	72
	Knowledge/ideas	68	70	75
	Rates	65	70.3	74
Context	Current/past issues	56	65	70
Competence	Explain	60	65	72
	Evaluation	64	70	72
	Planning	52	70	80
	Data interpretation	65	75	78
	Rates	60.3	70	75.6
Attitude	Interested/happy	70	83	88
	Scientific attitude	70	75	85
	Environmental care	70	75	88
	Rates	70	77.3	87
Average Chemical Literacy		62.8	70.7	76.7

Figure 1 shows that students' chemistry literacy from cycles I, II, and III has increased from 62.8 (medium) to 70.7 (medium) and in cycle III to 76.7 (High). This shows that learning by integrating natural phenomena related to the local culture of salt production allows students to see, experience, and be directly involved. As a result, learning can change perceptions that are considered abstract and difficult to become interesting because they can be associated with real life. With student-centered learning, chemical concepts become simpler and easier to understand and are used to solve problems together in groups. The application of the PBL learning model that is integrated into Sasambo ethno chemistry is more meaningful because students learn not only about chemical concepts but also things that exist in their lives. Chemical literacy value for each aspect from Cycle I, cycle II, and cycle III are shown in Table 2.

Table 1 explains that the content aspect includes indicators regarding understanding of facts, explanation of chemical concepts, and procedural ideas. The content includes the salt production process, such as knowing the formula for local salt, mentioning cations and anions in seawater and local salt, and explaining methods for separating chemical substances to improve the quality of salt. In cycle 1, the concept indicator has the lowest value, while the knowledge/idea indicator is higher. This shows that students are still weak in applying concepts but can provide better ideas. In cycle I, it can be concluded that integration of local culture can give rise to good ideas but cannot be linked to appropriate concepts. For cycles 2 to 3, the increase in understanding and concept indicators becomes higher. This explanation shows that giving more actions makes students more accustomed to it so that they understand the concepts related to the ideas proposed.

In the context aspect, it can be seen that at the beginning of the cycle, students were not able to identify issues or problems related to local culture, but the increase was high in the second cycle. The explanation is that students were directed to discuss and make direct observations about local issues found in the community to be identified and related to lecture material and completed in groups.

In the competency aspect, the design indicator was only 52 in cycle I and increased very sharply in cycle 2 to 70. The increase in the design competency aspect was probably due to the implementation of Sasambo's ethno-chemical integrated PBL learning, which can train students to use chemical concepts and knowledge to answer scientifically about events or events. Natural phenomena that exist in society. An increase in this indicator also shows that students do not experience difficulties in designing a method or idea to find or prove a solution related to a problem.

The achievement of attitude scores in the third cycle looks very good. This explains that students become very interested in carrying out practicums, have a highly scientific attitude, and have an attitude of caring for the environment after implementing the Sasambo ethno-chemical integrated PBL learning. Interest in chemistry shows how someone likes to study chemistry and explore information obtained from the benefits of practical results, stories of cultural activities, or issues that occur. This is in accordance with the opinion, which states that culture-based learning will increase interest in chemistry [19-20].

Student Response to Learning

Student responses regarding the application of integrated PBL learning in Sasambo ethno chemistry showed that 80% of students stated that by connecting with local culture, learning became more meaningful. 90% of students stated that they were very interested and felt they could solve the chosen problem. 95% of students stated that the practicum carried out was useful for finding the truth from unclear information. 95% of students suggested adding more local cultural aspects.

Conclusion

Application of the model learning Sasambo's ethno-chemical integrated PBL can increase students' chemical literacy in terms of content, context, competence, and attitudes. Increasing student chemistry literacy from low to high with details: cycle I was 62.8 (medium), cycle II was 70.7 (medium), and Cycle III was 76.7 with category height. Student responses showed that 95% said they were very interested and wanted more and more varied integration of local culture.

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