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Ethnochemistry: Exploring the Potential of Samawa Local Wisdom as a Source for Learning Chemistry

Yeni Cahyani* **& Dwi Wahyudiati**
Department of Chemistry Education, Universitas Islam Negeri Mataram
* Corresponding Author e-mail: dwiwahyudiati@uinmataram.ac.id

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Abstract
One problem in chemistry learning at the secondary and tertiary levels is the availability of appropriate learning resources. To address this problem, it needs contextual teaching materials to implement an ethnochemistry learning approach. This research aims to explore and develop the traditional potential of Samawa local wisdom as chemistry learning material. In addition, this study also explored resources that can be used in teaching chemistry. This qualitative research utilized literature studies, interviews, and documentation to collect the data and was analyzed using Miles & Huberman's qualitative analysis. As for the sample used in this study were 10th grade students of SMAN 2 Taliwang. I use 2 classes, 1 class as the control class and 1 class as the experimental class.The community leaders, chemistry content experts, and relevant chemistry literature were selected as the study subject. Based on the findings, it can be concluded that Samawa's local wisdom can be used as a source of chemistry learning through integration with Samawa culture on chemical bonding material. Therefore, this research is expected to be a reference in developing contextual chemistry teaching to create more significant and exciting learning since it is relevant to real-life experience.

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INTRODUCTION

Chemistry learning is characterized by three main aspects: macroscopic, sub-microscopic, and symbolic. Each of these is interrelated and influences each other. The macroscopic level includes physical properties that can be observed or measured. Meanwhile, the sub-microscopic level is more abstract and requires theory to explain phenomena at the molecular level using theoretical model representations that cannot be observed directly. On the other hand, the symbolic level uses symbolic representations through pictures and formulas (Johnstone, 2006). Therefore, the task of the lecturer or chemistry teacher must be able to make students understand the characteristics of chemistry through the application of a constructivism-based learning approach. One of the implementations of a constructivism-based learning approach is developing chemistry teaching materials related to everyday life which can create meaningful chemistry learning (Wahyudiati et al., 2020; Wiwit, Ginting, & Firdaus, 2013). By adopting a constructivist approach, students will be actively involved in building their understanding and learning experience through physical and mental interactions to acquire new knowledge, understanding or interpretation, skills and experiences to achieve the best learning outcome (Fadli, 2019; Ador, 2017; Hasanah et al., 2016; Sumardi et al., 2020; Wahyudiati et al., 2019). The availability of constructivism-based chemistry learning resources could positively impact student learning outcomes because the students' knowledge, skills and

experience are obtained directly through sensory experience (Coll et al., 2002; Wahyudiati, 2021).

The lack of availability of constructivism-based chemistry learning resources is one problem in chemistry learning. This obstacle arises because the chemistry learning resources focus more on abstract concepts and tend to be theoretical so that the presentation of material in chemistry teaching becomes monotonous, less factual and challenging for students (Ador, 2017; Sutrisno et al. ., 2020; Wahyudiati, 2016). The solution is to present factual and contextual chemical material through teaching materials or learning media relevant to everyday life. It is a form of implementing an ethnochemistry approach to learning, which combines chemical concepts related to the community's traditional values or daily chemistry activity (De Jong, 2018; Hasanah et al., 2016 Wahyudiati, 2021).

The study aims to explore the traditional values of Samawa's local wisdom related to chemistry as a potential learning resource and natural laboratory for Chemistry Class X at the senior high school level (Abramova & Greer, 2014; Rahmawati et al., 2017). The integration of ethnochemistry into the learning process is expected to create a more significant learning experience for students. Previous research has shown that using cultural products as learning resources can improve students' conceptual understanding, critical thinking skills, and scientific attitudes. The research seeks to address problems in learning chemistry by leveraging the traditional knowledge of Samawa's local wisdom to enhance students' cognitive, affective, and psychomotor aspects (Ador, 2017; Singh, 2016; Sumardi & Wahyudiati, 2021). By incorporating ethnochemistry into the curriculum, the researchers aim to center learning on understanding concepts and natural laboratory-based scientific research based on local wisdom concepts, ultimately leading to improved student learning outcomes. The uniqueness of this research lies in its exploration of Samawa's traditional values and their potential application as teaching materials to enrich Chemistry education at the senior high school level (Aditya Dharma, 2019; R. N. K. Rambe, 2018).

METHOD

This study used a qualitative approach with ethnographic research. The research subjects included community leaders, chemistry content experts, and relevant chemistry literature. The research phase consists of 3 stages: description, analysis, and interpretation. The description stage helps gather information about the causes of a problem through preliminary observations and interviews involving community leaders and content experts .to obtain complete and accurate information. The analysis phase produces the correct data based on the problems and research objectives formulated through analysis of research findings in the form of cultural products and traditional values of the Samawa local wisdom related to chemical bonds. The next stage is the interpretation stage, to get the right final results based on the data analysis.

The data collection methods used in this study included initial observation, communication between the researcher or interviewer and the research subject, and gathering information through written notes or sound recordings and pictures. All methods were carried out based on the type of data taken. The research instrument utilized interview, observation, and documentation guidelines used as references in data collection and then analyzed using Spradley's technique (2007). It consisted of four analysis stages of analysis, namely; (1) domain analysis; (2) taxonomic analysis; (3) componential analysis, and (4) cultural theme analysis. Domain analysis and taxonomic analysis served to select and simplify the raw data recorded in observation sheets, interviews and documentation. After the data had been reduced and analyzed, the next step was to arrange the data to be more structured and then correlated with the theory or results of previous research regarding componential analysis and cultural

themes. In the final stage, conclusions were drawn based on the results of data analysis and research findings that answered the problem formulation.

The samples used in this qualitative ethnographic study consisted of three main components:

1. Community Leaders: These individuals were selected as research subjects because of their positions of authority and influence within the community. As community leaders, they likely possessed valuable knowledge about the cultural practices, traditions, and values related to chemical bonds within the Samawa local wisdom.
2. Chemistry Content Experts: The study included chemistry content experts as research subjects. These experts were likely individuals with significant expertise and knowledge in the field of chemistry. Their insights and understanding were essential for providing a deeper understanding of the chemical aspects of the Samawa local wisdom.
3. Relevant Chemistry Literature: In addition to human subjects, the researchers also utilized relevant chemistry literature as a sample. This literature may have included published research papers, books, articles, or other written sources that explored chemical bonds or related topics, especially in the context of the Samawa local wisdom.

It's important to note that while community leaders and chemistry content experts were directly involved in the data collection process through interviews and communication, the relevant chemistry literature likely served as secondary data sources for the researchers to enrich their understanding and contextualize their findings. The research phase was divided into three stages: description, analysis, and interpretation. The description stage involved gathering information through preliminary observations and interviews with community leaders and content experts. This initial data collection aimed to obtain complete and accurate information about the problem under investigation.

The analysis phase used the gathered data to produce correct data based on the research problems and objectives. The researchers analyzed the research findings in the context of cultural products and traditional values of the Samawa local wisdom related to chemical bonds. This analysis likely involved extracting meaningful insights from the collected data. The interpretation stage followed the analysis phase. In this stage, the researchers aimed to derive the correct final results based on the data analysis. It involved making sense of the analyzed data, drawing connections, and arriving at conclusive interpretations.

To collect data, the study employed various methods, including:

1. Initial Observation: Researchers conducted observations within the community to understand the cultural practices and behaviors related to chemical bonds.
2. Communication and Interviews: The researchers interacted with community leaders and chemistry content experts through interviews to gather valuable information and insights.
3. Written Notes, Sound Recordings, and Pictures: Data obtained through observation and interviews were recorded using written notes, sound recordings, and pictures. These methods helped in documenting the information effectively.

The research instrument used for data collection included interview, observation, and documentation guidelines. These guidelines served as references during data collection to ensure consistency and accuracy. To analyze the data, the researchers employed Spradley's technique (2007), which consisted of four analysis stages:

1. Domain Analysis: This involved selecting and simplifying the raw data recorded during observations, interviews, and documentation.
2. Taxonomic Analysis: The data was further categorized and organized to facilitate analysis.

3. Componential Analysis: This step involved analyzing the data in relation to relevant theories or previous research to identify patterns and themes.
4. Cultural Theme Analysis: The final analysis stage focused on identifying and exploring cultural themes present in the data.

In the final stage, conclusions were drawn based on the results of data analysis and research findings, addressing the problem formulation that the study aimed to investigate.

RESULTS AND DISCUSSION

Result

The Samawa local wisdom in the food tradition is related to chemical bonding principles such as electron stability or electron configuration, and positive ions forming (through electron release) and negative ions (through electron acceptance) to have a noble gas-like configuration.

Basaputis and Nyorong on The Pangantan Tradition

The traditional marriage procession (*pangantan*) of the Samawa tribe is called *basaputis* and *nyorong* tradition. It is closely related to electron stability or configuration and forming positive *ions* (releasing electrons) and negative ions (accepting electrons). The connection is that there are similarities with the *bakatoan* theory, especially when there is an agreement between a woman and a man to marry, which is then questioned by a messenger sent by the man and involving respected community figures. The basic concept is mutual need, giving and receiving to live together, and the marriage relationship as the bond is formed through the marriage contract process. At this *basaputi* event, a meeting of the bride's family is held to determine the agreement on offerings (*panyorong*) given to the bride at the *nyorong* event, as shown in Figures 1 and 2. (Coll et al., 2002; Wahyudiati, 2021).

Figure 1. *Basaputis* event in the food tradition (Samawa tribe)

Figure 2. *Nyorong* event in *pengantan* tradition (Samawa tribe)

(Source: https://ntb.genpi.co/sasambo/1884/mengenal-tradisi-nyorong-khas-sumbawa)

The tendency of an atom to achieve stability in its electron configuration or to become a noble gas occurs by giving or receiving electrons in its outer shell. It can lead to a transfer of electrons between atoms and the formation of positive and negative ions. For example, the bond between Al(aluminium) and F(flor). The Al has an unstable electron configuration of 13Al (2.8.3), so Al must release three electrons to form Al^{3+} with an electron configuration of $13Al^{+}$(2.8). Then the Flor element also has an unstable electron configuration, namely 9F (2.7), so that to be stable, the Flor element must receive one additional electron to form an ion (F^{-}) with an electron configuration of $9F^{-}$ (2.8). The two elements are attracted to each other electrostatically because they have opposite charges, forming an ionic lattice. The bond formation that occurs through the handover of electron pairs between Al atoms and F is called an ionic bond. This concept has a close relationship with the food tradition of the Samawa tribe. The concept of food is based on the concept of mutual need and complementarity to achieve the same goal, similar to a chemical bond where two electrons are bonded in a bond or relationship called *besan*. (Aditya Dharma, 2019; R. N. K. Rambe, 2018).

Discussion

Integrating high school chemistry material with Samawa local wisdom, which has the potential as a learning resource, is implementing a visualization approach to the chemical triangle concept (Jhonstone, 2006). An analogical perspective between domains is applied in local wisdom-based chemistry learning regarding chemical bonding. One of the Samawa cultural traditions that have a connection with chemical bonding material is the food tradition, that is marriage within the Samawa tribe) which involves the process of *basaputis* and *nyorong* (proposal). The chemical bond material is closely related to the concept of food, which includes the basic theoretical or concept similarities and the meanings and values contained. The concept of mutual need that underlies local wisdom values in the food tradition is related to chemical bonding, which involves handing over electron pairs to achieve stability. For example, in an ionic bond, electrons are transferred from the positive to the negative ion to reach a stable electron configuration like a noble gas. It has the same meaning as the concept of food, which emphasizes that marriage as a bond between men and women is also needed to achieve stability in life (Prasetiawan, 2009: 161).

The advantage of applying the analogy approach in learning chemistry is that it can increase the interest and meaning of learning for students so that they become more involved and active in the teaching-learning process. Likewise, applying an analogical approach to chemistry learning can improve chemistry learning outcomes (Lerman, 2003; Sutrisno, Wahyudiati, Louise, 2020).

In addition, ethnochemistry-based learning also increases students' interest in learning chemistry concepts, which are considered uninteresting lessons since they tend to be dominated by abstract concepts.The novelty of this research is in the form of an ethnochemistry approach that is rarely used. In addition, this research is also the result of combining Samawa's local wisdom with chemistry concepts that have never been done. The findings of this study are expected to contribute to chemistry learning innovation. In addition, this research agrees that learning chemistry can be more engaging, meaningful and fun if presented in concrete examples that often occur in students' daily lives (Aldian & Wahyudiati, 2023; Santos & Arroio, 2016; Wahyudiati, 2016).

In addition, chemistry learning resources integrated with Samawa's local wisdom significantly affect scientific attitudes and love of culture. (Wahyudiati, 2020). The results of previous research showed that the application of an ethnochemistry approach in the learning process,

either through integration with learning models or as a source of learning for scientific investigations, as well as as a natural laboratory, can develop students' abilities to think critically, skills in carrying out scientific processes, and learning outcomes. Therefore, students' cognitive abilities can be improved (Ador, 2017; Wahyudiati, 2020; Wahyudiati & Fitriani, 2021). Exploring the potential of Samawa's local wisdom as an innovation in chemistry learning could grow the younger generation's love for their culture.

CONCLUSION

The novelty of the research findings in the conclusion section lies in the discovery that Samawa's local wisdom can serve as a valuable source for chemistry learning, particularly when integrated into the subject of chemical bonds. This integration was analyzed from the perspectives of analogy, representation, and visualization. The key novelty in the research results can be summarized as follows: Integration of Samawa's Local Wisdom: The study found that Samawa's local wisdom contains valuable insights and knowledge related to chemical bonds. By integrating this local wisdom into chemistry learning, educators can enhance the students' understanding and engagement with the subject. Relevance of SMA Class X Chemistry Material: The research assessed the relevance of the Chemistry material taught to Class X students in SMA (Senior High School) when connected with Samawa's local wisdom.

This implies that there are cultural connections and applications of chemistry concepts within the local context. Analyzing Perspectives of Analogy, Representation, and Visualization: The researchers explored how Samawa's local wisdom could be effectively integrated into chemistry education by using analogies, representations, and visualization techniques. These approaches likely help students grasp complex concepts more easily by relating them to familiar cultural elements. Implications for Contextual Chemistry Teaching Materials: The research findings have practical implications for developing contextual chemistry teaching materials. By incorporating local wisdom, educators can create learning resources that resonate with students' cultural background, making the learning experience more meaningful and relevant. Overall, the novelty of the research lies in demonstrating the potential of integrating local wisdom into chemistry education, providing a new perspective on making chemistry learning more meaningful and culturally relevant for students in the Samawa community. This approach may have broader implications for integrating local knowledge and context in science education, fostering better understanding and appreciation of scientific concepts among students from diverse cultural backgrounds.

RECOMMENDATIONS

Integrating high school chemistry material with Samawa local wisdom, which has the potential as a learning resource, is implementing a visualization approach to the chemical triangle concept (Jhonstone, 2006). An analogical perspective between domains is applied in local wisdom-based chemistry learning regarding chemical bonding. One of the Samawa cultural traditions that have a connection with chemical bonding material is the food tradition, that is marriage within the Samawa tribe) which involves the process of *basaputis* and *nyorong* (proposal). The chemical bond material is closely related to the concept of food, which includes the basic theoretical or concept similarities and the meanings and values contained.

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of food, which emphasizes that marriage as a bond between men and women is also needed to achieve stability in life (Prasetiawan, 2009: 161). The advantage of applying the analogy approach in learning chemistry is that it can increase the interest and meaning of learning for students so that they become more involved and active in the teaching-learning process. Likewise, applying an analogical approach to chemistry learning can improve chemistry learning outcomes (Lerman, 2003; Suanda & Wahyudiati, 2023; Sutrisno, Wahyudiati, Louise, 2020). In addition, ethnochemistry-based learning also increases students' interest in learning chemistry concepts, which are considered uninteresting lessons since they tend to be dominated by abstract concepts.

The novelty of this research is in the form of an ethnochemistry approach that is rarely used. In addition, this research is also the result of combining Samawa's local wisdom with chemistry concepts that have never been done. The findings of this study are expected to contribute to chemistry learning innovation. In addition, this research agrees that learning chemistry can be more engaging, meaningful and fun if presented in concrete examples that often occur in students' daily lives (Santos & Arroio, 2016; Wahyudiati, 2016; Wahyudiati, 2023).

In addition, chemistry learning resources integrated with Samawa's local wisdom significantly affect scientific attitudes and love of culture. (Wahyudiati, 2020). The results of previous research showed that the application of an ethnochemistry approach in the learning process, either through integration with learning models or as a source of learning for scientific investigations, as well as as a natural laboratory, can develop students' abilities to think critically, skills in carrying out scientific processes, and learning outcomes. Therefore, students' cognitive abilities can be improved (Ador, 2017; Wahyudiati, 2020; Wahyudiati & Fitriani, 2021; Wahyudiati & Qurniati, 2023). Exploring the potential of Samawa's local wisdom as an innovation in chemistry learning could grow the younger generation's love for their culture.

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