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Analysis of Chemistry Learning Based on Ethnoscience of Papuan Indigenous People For High Schools in South Papua Province

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ABSTRACT

Curriculum in Indonesia purpose to build the foundation of student character through local wisdom to develop student competencies in accordance with cultural environment of students. Chemistry learning is closely related to daily life of Papuan indigenous people in Merauke district, South Papua province because their local wisdom contains indigenous sciences related to chemistry which is called ethnoscience as a learning model. Ethnoscience-based chemistry learning can be a solution that makes students easier to understand chemistry material for Papuan indigenous people. The purpose of this research is to determine the extent to which Papuan ethnoscience-based chemistry learning is implemented in high schools. Method used in this research is descriptive qualitative starting from planning, implementation and evaluation. The sample in this study was the typical Papuan state high school, Merauke 1 state high school and Merauke 2 state high school. The results of the research show in planning stage that chemistry learning based on ethnoscience in high school shows that teachers find it difficult to plan ethnoscience-based learning because not all Papuna culture can be applied to all chemistry topics. The implementation stage, several chemical materials have integrated ethnoscience with local culture, including medicinal plants, local food and ornamental ceremonies, in indigenous people in Merauke district, South Papua Province. At the evaluation stage, it is carried out through student learning outcomes which consist of cognitive assessment, affective and psychomotor skills which overall show good results for sustainable learning in chemistry.

Keywords: Ethnoscience, Chemistry Learning, Papuan, Indigenous People, Evaluation

INTRODUCTION

The quality of human resources is determined by the progress of education undertaken by a nation in today's globalized world. In this increasingly sophisticated era, creative and innovative ideas emerge from quality education. One way to improve the quality of education is through curriculum development and becoming the basic point for the continuation of education[1]. "In Indonesia, the implementation of the curriculum has undergone various changes and improvements, namely in 1947, 1964, 1968, 1973, 1975, 1984, 1994, 1997 (1994 curriculum revision), 2004 (Competency-Based Curriculum), and synchronization 2006 (Education Unit Level Curriculum), and in 2013 the government through the Ministry of National Education changed it back to the 2013 curriculum (Kurtilas) and in 2018 there was a revision to the Revised Kurtilas" [2]. At this time, a new curriculum is present, namely the independent curriculum.

The concept of the independent learning curriculum provides a foundation for more adaptive education, oriented towards skills development, and allows students to take an active role in their learning process.[3]. The independent learning curriculum is the latest breakthrough in the world of education that can keep up with the times by integrating the use of local wisdom to create a more inclusive, relevant and meaningful learning environment for students.[4].

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Indicators of successful implementation of independent learning not only prioritize the acquisition of knowledge, but also integrate the values of the character of the Indonesian nation's culture in the learning experience. The concept of learning based on local wisdom is a learning approach that integrates local values, culture, traditions, and knowledge into the educational process that aims to increase the relevance of learning to the local cultural context and the development of cultural and social identity [5].

One of the subjects that requires learning experiences from the surrounding environment is chemistry. The application of the Merdeka curriculum that links learning with local wisdom or culture is very useful if implemented in chemistry learning. The application of chemistry learning based on local culture in a region is called ethnoscience. Ethnoscience is knowledge possessed by a nation (ethnic group) or a particular social group as a system of knowledge and cognition that is unique to a particular culture [6].

Education in Indonesia, especially in Papua, faces the challenge of integrating local contexts into the learning process. In an effort to answer this challenge, the Independent Curriculum is present as an approach that emphasizes the development of student character and competence through the use of local wisdom. Ethnoscience-based learning is one promising alternative to deliver chemistry material in a way that is more relevant to students, especially in areas with diverse cultural richness such as Papua. Ethnoscience, which refers to traditional knowledge systems and local practices, can enrich students' learning experiences by connecting chemistry concepts to their daily lives. Ethnoscience is a knowledge system developed by local communities to explain natural phenomena, including chemical processes that occur in everyday life. This approach has the potential to improve students' understanding of chemistry material in a more contextual and applicable way. one of the efforts that can be made to make it easier for students to understand chemistry material [7] namely through the availability of learning resources that are relevant to the daily lives of students, one of which is through the integration of chemical material with local wisdom of a region which is an application of ethnoscience [8].

Learning that promotes local culture or wisdom to be used as an object of science learning is expected to be able to increase students' motivation and interest in studying science. [9]. Several studies have conducted applications of ethnoscience-based learning, stating that ethnoscience promotes local culture and wisdom as learning objects, thus making learning more meaningful [10]. Several learning implementation activities have also been carried out, including the use of natural ingredients in making traditional medicines by the Papuan people, which contain many chemical aspects that can be taught in class. For example, the concept of chemical reactions can be taught through practical experiences, such as making traditional medicines using natural ingredients that are known to the local community[11].

In this context, the importance of contextual chemistry education is not only to help students understand the theory, but also to develop their ability to apply the knowledge in real life. This approach can increase students' motivation to learn, because they see the relevance of the material to their culture and environment. Research shows that learning that links academic material to local culture can motivate students and has been done, among others, the use of sago as a learning medium for orbital forms. [12][13]. The results of relevant research also prove that the learning process that refers to the context of students' lives with cultural heritage (local wisdom values) as a substance in understanding chemical material, a reference in developing aspects of attitudes and skills, and a reference in conducting scientific investigations based on natural laboratories can improve students' cognitive, affective, and psychomotor learning outcomes [14].

With ethnoscience-based learning, students can connect phenomena or cultures that occur in local communities with scientific studies so that the learning received by students becomes more meaningful, which will later have a positive impact on student learning outcomes[15].

However, despite this potential, research on the application of ethnoscience-based chemistry learning in Papua is still limited. Therefore, this study aims to analyze the application of ethnoscience-based chemistry learning in senior high schools (SMA) in Papua, with a focus on planning, implementation, and evaluation of learning. By understanding how ethnoscience can be involved in chemistry learning, it is hoped that recommendations can be produced that can improve the quality of education in the Papua region especially in Merauke, South Papua Province.

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METHODOLOGY

This study uses a qualitative descriptive approach to analyze the implementation of Papuan culture-based chemistry learning in senior high schools. This method was chosen because it allows researchers to gain an in-depth understanding of the experiences, perceptions and practices of teachers and students in the context of local wisdom-based learning. [16]. The study was conducted in National School that consist of Special state high school of Papuan, Public Senior High School 1 Merauke and Public Senior High School 2 Merauke that have implemented ethnoscience learning. Data collection was conducted through interviews, observations and questionnaires. This study was conducted through 3 stages namely, planning stage, implementation stage and evaluation stage. Data analysis techniques are by collecting, reducing, presenting, and drawing conclusions from data.

RESULTS

(1) Planning Stage

The learning planning carried out by teachers refers to the RPP (Learning Implementation Plan) which has been prepared in accordance with the Merdeka curriculum. Based on the results of interviews with teachers, the learning that has been planned and prepared in the RPP has linked Papuan local wisdom in Merauke with the chemistry material taught in the RPP, but in this case not all RPPs appear to apply learning. Chemistry based on ethnoscience Papuan society in Merauke. From the interview conducted with the first chemistry teacher, he stated "before making the RPP, the teacher matches the chemistry material with the local culture that can indeed be linked to the chemistry material so that it is indeed contextual and can be understood by our students with Papuan local wisdom with chemistry material", The second teacher stated that not all chemistry material can be linked to Papuan local wisdom to be used as ethnoscience-based learning, only certain materials.

The cultural context of Papua in Merauke that is related to ethnoscience in chemistry material includes, staple food sago which is processed into papeda, the tradition of stone burning ceremony, medicinal plants, medicine processing, natural colouring from plants and nature in traditional ceremonies. This cultural context can be seen and followed directly by students so that they have direct experience and observation of chemical phenomena that occur in the activities of the local Papuan community which are indeed based on ethnoscience. To explore learning planning, teachers need to explore and inventory local wisdom related to ethnoscience content in chemistry learning.[17][18].

(2) Implementation Stage

The implementation of ethnoscience-based chemistry learning carried out by teachers at school begins with conducting apperception by asking about one of the local wisdoms in Merauke related to the chemistry material that will be taught at each meeting, although this is not always done only if the chemistry material is related to the culture of the indigenous people. The learning implementation process carried out by teachers has previously prepared learning materials that are in accordance with the topic and wisdom of the indigenous Papuan people. The materials designed are adjusted to the learning plan that will be used in line with the demands of learning objectives, the selection of learning media (videos) that require students to be able to integrate local culture with the lesson concepts they learn at school, learning begins by exploring students' initial knowledge of the culture that will be integrated in science learning and guiding students to connect their culture to scientific concepts. The implementation of ethnoscience in chemistry learning has succeeded in increasing student engagement and motivation. However, the variability in teachers' ability to link theory to cultural practices indicates the need for broader professional development.

The implementation of chemistry learning based on the culture of indigenous Papuans in class XI has proven effective in increasing students' understanding of chemical concepts. [19]. By linking subject matter to local culture, students can more easily understand and apply chemical knowledge in contexts relevant to their lives. [20]. The reference for the reconstruction of the original scientific knowledge of the community is the concrete experience of an ethnic community in treating the universe towards universal balance through cultural, anthropological and social approaches.[21]. There are still some schools that have not implemented ethnoscience-based learning. This is due to several factors, including lack of training for teachers, minimal resources, and limited access to relevant teaching

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materials as obstacles to implementation. Some teachers also admitted that they did not understand the term "ethnoscience," even though in practice they delivered chemistry material to students by linking it to the local cultural context. This shows that even though the term is less familiar, they intuitively apply the principles of ethnoscience in their teaching. Some chemistry materials that have been applied in chemistry learning that link the local wisdom of the indigenous Papuan people can be seen in table 1.

Table 1. The relationship between chemical material and of indigenous Papuan Culture

No	Chemical materials	The cultural context of indigenous Papuans	Chemical Process
1	General chemistry concept	Making arak drinks through fermentation. The wati plant as a drink has an important function in the traditional celebrations of the Marind Tribe. Wati itself consists of five types, namely dikoy, palima, kumbilu, sipul and bapin.	Fermentation converts sugar into alcohol and CO_2.
2	Matter and Its Changes	Processing sago into local food by indigenous people called papeda.	Hydrolysis of starch into sugar during cooking.
3	Solution	Making traditional medicine Making herbal drinks from leaves and roots.	- Dissolution of active compounds in water. - The process of separating mixtures
4	Chemical Bonding	Making Noken from tree roots and bark	Physical interactions between fibers that affect strength and elasticity.
5	Energy in Chemical Reactions	The tradition of burning stones during traditional ceremonies, where people cook ceremonial food using traditional methods using hot stones. That called by making sago sep	Exothermic reaction when food is cooked

Implementation of learning directly done at school by doing traditional ceremony that called Stone Burning tradition. The Bakar Batu tradition is one of the traditions or traditional ceremonies that is very typical in Papua, especially among the Papuan tribes. The burning stone tradition is a form of thanksgiving, celebration, or ritual that involves the process of cooking using hot stones, and is often done to celebrate major events such as marriages, births, or success in hunting. The stone burning ceremony is a ritual ceremony involving cooking together (traditional mass cooking) which aims to express gratitude to the giver of life for the gift that has been given. The stone burning process can be seen in figure 1.

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Figure 1. Stone burning ceremony of Papuan indigenous in south papua conducted by student and teacher at school as an implementation of ethnoscience in (source: personal documentation)

(3) Evaluation Stage

The evaluation results were obtained by looking through the teacher's documents, which already included the psychomotor, affective, and cognitive values of the students who had taken part in chemistry lessons based on ethnoscience that were connected to the local knowledge of the Merauke indigenous Papuan community. The findings of the aspect data analysis in learning chemistry can be seen in table 2.

Table 2. Evaluation aspect result in learning chemistry

Name of School	Evaluation Aspects	Persentase (%)	Category
Special state high school of Papua	Cognitive	80	High
	Affective	70	High
	Psychomotor	75	High
Public Senior High School 2 Merauke	Cognitive	60	Medium
	Affective	55	Medium
	Psychomotor	50	Medium
Public Senior High School 1 Merauke	Cognitive	52	Medium
	Affective	43	Low
	Psychomotor	47	Low

DISCUSSION

Special state high school of Papua Demonstrates excellent performance with a high category in all aspects, namely cognitive (80.0%), affective (70.0%), and psychomotor (75.0%). This may be due to the application of effective and innovative teaching methods, as well as the use of relevant local wisdom in lesson materials. Learning that links local context with academic material can increase student engagement and understanding of concepts [22]. Special state high school of Papua the integration of Papuan cultural elements in chemistry learning has helped students feel more connected to the material, thereby increasing their motivation and learning outcomes.

Public Senior High School 2 Merauke All aspects are in the medium category, with cognitive (60%), affective (50%), and psychomotor (55%) scores. Even though there is progress, this performance indicates that the learning strategies used are not fully effective in improving students' understanding. This may be related to the lack of teacher training regarding the application of ethnoscience in learning, teachers' understanding of ethnoscience greatly influences the way they deliver material, which in turn has an impact on student learning outcomes[23].

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Public Senior High School 1 Merauke Has low performance in all aspects, with cognitive (40%), affective (36%), and psychomotor (24%) scores. This shows the need for serious attention to the teaching approach in this school. Teachers' lack of understanding about ethnoscience and its application in learning can be one of the main causes. Research shows that students tend to have difficulty understanding chemistry concepts if the teaching is not relevant to their experiences and cultural context context [24][25].

The findings from these three schools highlight the importance of training for teachers in implementing an ethnoscience-based approach. A targeted training program can help teachers develop a better understanding of how to integrate local wisdom into chemistry teaching. According to Sukarno [26] Proper support and training can boost teachers' confidence in using innovative approaches, which ultimately has a positive impact on students' learning outcomes.

Etnoscience-based learning has great potential to enhance student engagement and understanding. By linking chemistry material with cultural context and local wisdom, students not only learn theory but also how science relates to their daily lives. This is in line with constructivist theory, which states that learning is more effective when students can connect new concepts with existing experiences [27].Ethnoscience that implemented in learning chemistry able to motivating students to make links between modern research and traditional knowledge.

Learning chemistry based on ethnoscience has great potential to enhance student engagement and understanding. By linking chemistry material with cultural context and local wisdom, students not only learn theory but also how science relates to their daily lives. This is in line with constructivist theory, which states that learning is more effective when students can connect new concepts with existing experiences[27]. The Burning Stones tradition is a very typical tradition or traditional ceremony in Papua, especially among Papuan tribes. Bakar batu is a form of thanksgiving, celebration, or ritual that involves the process of cooking using hot stones, and is often done to celebrate major events such as marriages, births, or success in hunting. This activity will help student to connect local wisdom with science in daily life by learning chemistry and develop student critical thinking and encouraging students connection between traditional knowledge and scientific knowledge [28]

CONCLUSION

Based on the results of data analysis from the three schools which were analysed based on cognitive, affective and psychomotor aspects, the special state of Papuan High School which has implemented ethnoscience learning has a high category in these three aspects, while Public Senior High School 2 Merauke has a medium category where the school has implemented ethnoscience only on certain topics and the last at Public Senior High School 1 Merauke the application of ethnoscience was only carried out on a few materials and was not sustainable with low category in cognitive, affective and psychomotor aspects .

These findings emphasize the importance of an ethnoscience-based approach in chemistry education, which not only enhances academic understanding but also relates the subject matter to students' local culture, making learning more relevant and engaging. Overall, these results provide valuable insights into the effectiveness of ethnoscience-based chemistry learning and highlight the need for continued efforts to improve the quality of education across schools.

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