

ANALYSIS OF THE NEED FOR THE DEVELOPMENT OF E-MODULE TEACHING MATERIALS INTEGRATED LOCAL WISDOM CULTURE BASED ON PROJECT BASED LEARNING (PJBL) ON REACTION RATE MATERIALS

Citra Sianturi¹, Ramlan Silaban², Edwin Pakpahan³

^{1,2,3}Universitas Negeri Medan

1citrasanturii14@gmail.com, 2drrsilabanmsi@yahoo.co.id

3edwinpakpahan941@gmail.com

ABSTRACT

The purpose of this study is to analyze the need for improvement of chemistry teaching materials for high school grade XI on reaction rate material, and the findings of this study will be consulted for further information in the development of electronic chemistry teaching materials or e-modules that are integrated with project-based learning-based ethnopedagogy. A qualitative descriptive method was employed in this study. The research was conducted at SMAN 2 Percut Sei Tuan through interviews with a chemistry teacher and classroom observations in class XI-C, involving 36 students. The results indicate that the teacher has never used e-modules in chemistry learning, particularly for reaction rate materials. Learning activities are still limited due to the lack of laboratory tools and materials, resulting in the use of simple teaching resources that are not integrated with local wisdom. The teacher also acknowledged that the development of ethnopedagogy-based e-modules integrating local wisdom is highly necessary to provide authentic learning experiences, enabling students to better understand abstract reaction rate concepts and construct their own understanding independently. Furthermore, the results of the student needs analysis questionnaire show that 85.5% of students are interested in and agree with the development of project-based e-modules integrated with ethnopedagogy, as this approach supports independent exploration of their understanding.

Keywords: Ethnopedagogy, reaction rate, local wisdom, development of teaching materials, weir

ABSTRAK

Penelitian ini bertujuan untuk menganalisis kebutuhan pengembangan bahan ajar kimia SMA kelas XI pada materi laju reaksi sebagai dasar pengembangan e-modul kimia terintegrasi etnopedagogi berbasis *Project Based Learning* (PJBL). Metode penelitian yang digunakan adalah deskriptif kualitatif. Penelitian dilaksanakan di SMAN 2 Percut Sei Tuan melalui wawancara dengan guru kimia serta observasi pembelajaran di kelas XI-C yang berjumlah 36 peserta didik. Hasil penelitian menunjukkan bahwa guru belum pernah menggunakan e-modul dalam

pembelajaran, khususnya pada materi laju reaksi. Keterbatasan alat dan bahan laboratorium menyebabkan pembelajaran masih bersifat sederhana dan belum terintegrasi dengan kearifan lokal. Guru menilai bahwa pengembangan e-modul berbasis etnopedagogi sangat diperlukan untuk memberikan pengalaman belajar yang kontekstual sehingga peserta didik dapat memahami konsep laju reaksi yang bersifat abstrak secara lebih bermakna. Selain itu, hasil angket analisis kebutuhan peserta didik menunjukkan bahwa 85,5% peserta didik tertarik dan menyetujui pengembangan pembelajaran dalam bentuk e-modul berbasis proyek terintegrasi etnopedagogi karena mampu mendorong kemandirian dan eksplorasi pemahaman peserta didik.

Kata Kunci: Ethnopedagogi, laju reaksi, kearifan local, pengembangan bahan ajar, menyirih

A. Introduction

According to Law Number 20 of 2003 concerning the National Education System, national education functions to develop abilities and form a dignified character and civilization of the nation in order to educate the life of the nation. National education aims to develop the potential of students to become human beings who believe and fear God Almighty, have noble character, are healthy, knowledgeable, capable, creative, independent, and become democratic and responsible citizens. This mandate emphasizes that education is not only oriented to intellectual intelligence, but also to the formation of the personality and character of students so that a generation of noble characters is born.

However, the reality of education today often places more emphasis on

intellectual achievement than character building. Many school graduates have high academic scores, but have not fully demonstrated behaviors, attitudes, and personalities that are in line with their academic achievements. Therefore, education is expected to be able to produce human resources who are not only intellectually superior, but also have good moral qualities (Jeynes, W. H., 2019).

Education is essentially a process of optimizing the development of students' abilities and intelligence as well as character building. This process requires the cooperation of all education stakeholders, including the government and teachers. The government plays a role in establishing regulations, curriculum policies, professional development of teachers, and the provision of

adequate educational facilities and infrastructure. Meanwhile, teachers have a strategic role in implementing the curriculum in accordance with the conditions of the educational unit and the characteristics of students. In line with the times, the government continues to update the curriculum by emphasizing essential materials, strengthening character, implementing project-based learning, and granting greater autonomy to schools (Silaban et al., 2020).

These efforts are realized through the implementation of the Independent Curriculum which emphasizes strengthening character through the Pancasila Student Profile Strengthening Project (P5). P5 is a cross-disciplinary learning that encourages students to observe, analyze, and reflect on real problems in the surrounding environment (Aprilia & Hindun, 2023). On the other hand, the rapid development of information and communication technology in the era of the industrial revolution 4.0 requires the world of education to improve the competencies and skills of students in order to be able to compete globally. 21st century learning emphasizes a learner-centered approach to learning,

so teachers are required to continue to adapt to the demands of changing times (Maulidia et al., 2023).

In chemistry learning, many concepts are abstract and require high analytical skills. If learning is still dominated by conventional lecture methods, students tend to be passive and find it difficult to relate chemical materials to daily life. Therefore, the right learning models and media are needed so that students can be actively involved and gain meaningful understanding. One relevant learning model is Project-Based Learning (PjBL), which has proven effective in developing critical thinking skills, creativity, collaboration, and problem-solving through learners' involvement in real projects (Jalil & Shobrun, 2023).

In chemistry learning, especially reaction rate material, students often experience difficulties due to the abstract nature of the material and involve mathematical calculations. Although the concept of reaction rate can be observed through practicum, the limitations of laboratory tools and materials are often an obstacle in its implementation (Sudarmo, 2021). One of the alternative learning media that can be used is e-modules. E-modules

are digital teaching materials that are systematically compiled and can be accessed independently by students. The use of e-modules has been proven to increase students' understanding, interest, and motivation to learn (Silaban et al., 2021)

The integration of local wisdom in science learning, including chemistry, is very important because the cultural context that students have can be the initial knowledge in understanding abstract concepts. The ethnopedagogical approach not only makes learning more contextual and meaningful, but also fosters students' love for local culture (Surdana, 2014). Various studies show that learning based on local wisdom is able to increase students' motivation, involvement, concept understanding, and cultural awareness (Muzakkir, 2021).

In North Sumatra and Aceh Provinces, betel plants (*Piper betle*) are widely used in the tradition of eating betel leaves that mix betel leaves, areca nut, and betel lime to produce a red solution that is believed to have health benefits (Simbolon et al., 2024). This cultural practice is relevant to the concept of reaction

rate, where the collision between reactants results in observable products. Similar traditions are also found in the Karo community through "marsukkil" activities and in Papuan people who use betel plants as a natural indicator of acid-base (Silaban et al., 2024).

Previous research has shown that ethnoscience-based teaching materials on reaction rate materials have received positive responses from students, although their impact on learning outcomes still needs to be further researched (Nugraheni & Pratomo, 2024). Therefore, this research is focused on the development of chemistry e-modules based on Project-Based Learning (PjBL) that are integrated with ethnopedagogy on reaction rate materials. This approach is expected to help students understand the concept of reaction rate more easily and meaningfully, while strengthening cultural values and character education. Based on this description, the researcher submitted a research to analyze the needs of students, teachers and also analyze relevant books currently used by teachers in teaching reaction rate material to find out whether the development of

Project Based Learning (PjBL)-based rate E-modules is integrated ethnopedagogy on reaction rate material.

B. Research Methods

This study uses a qualitative descriptive approach, where data is presented in the form of narrative descriptions in the form of words and visual documentation. Research data was obtained through interview techniques and observation of problems found in the field (Abdussamad, 2020). The sample determination technique used is purposive sampling, with the criteria of the research subject including chemistry teachers who have more than five years of teaching experience, applying the 2013 Curriculum in learning, and teaching reaction rate material to grade XI students. In addition, teachers are also involved in distributing questionnaires to analyze students' needs.

This research was carried out at SMAN 2 Percut Sei Tuan, Medan. Observation and interview activities involving several chemistry teachers and students of grades XI -C. The purpose of the interview is to find out the learning strategies and methods

used by teachers, the suitability of learning with the applicable curriculum, and the type of textbooks used in the learning process. Meanwhile, observations were carried out to examine students' activities during learning, the availability and utilization of learning facilities, student characteristics, problems that arise in the learning process, and the need for learning media in accordance with the researcher's goals.

C. Results And Discussion

The results of this research are to establish facts and determine the requirements needed in the creation of teaching materials. At this stage, it is carried out with 3 stages of analysis, namely the initial analysis of the needs of teachers and students, the analysis of the Learning Objective Flow (ATP) currently used by teachers and the analysis of the textbooks used by teachers. During this phase, the researcher observed chemistry teachers at SMA Negeri 2 Percut sei tuan Medan to collect relevant information for the study. This process is carried out using an interview instrument, as detailed in. Based on observations and interviews with chemistry teachers, it was found that

the curriculum implemented was an independent curriculum based on RPM (Deep Learning Plan). The explanatory part of this needs analysis is as follows:

1. Teacher needs analysis

This teacher needs analysis aims to identify the fundamental challenges faced in the chemistry learning process. During this phase, the researcher observed chemistry teachers at SMA Negeri 2 Percut Sei Tuan Medan to gather relevant information for the study. This process is carried out using interview instruments. Based on observations and interviews with chemistry teachers, it was found that the curriculum implemented was an independent curriculum based on RPM (Deep Learning Plan)

Based on the results of interviews with chemistry teachers at SMAN 2 Percut Sei Tuan, it is known that teachers have never used e-modules in classroom learning, especially in reaction rate materials. In the learning process, reaction rate materials are still very limited due to the limitations of tools and materials in the laboratory, so learning usually only uses simple materials and has not been integrated with local wisdom.

Chemistry teachers at SMAN 2 Percut Sei Tuan also realize that the development of e-modules through an ethnopedagogical approach based on local wisdom is very necessary because it is able to provide real experience to students, so that abstract material can be learned directly and students are able to find their own understanding correctly.

The requirements for integrating the independent curriculum, as outlined in Government Regulation (PP) No. 4 of 2022, affirm that educational standards must be based on Pancasila, the 1945 Constitution of the Republic of Indonesia, the Unitary State of the Republic of Indonesia, and Bhinneka Tunggal Ika, namely regarding the importance of cultural integration in the curriculum. However, when conducting an interview with a chemistry teacher at SMA N 2 Percut Sei Tuan Medan, it was found that the application of PjBL to reaction rate material based on wisdom and local culture had never been carried out as long as the resource person was a teacher there.

The teaching materials used by students so far are only through printed books, worksheets and power

points. The researchers did not find the use of E-modules as an effective and interactive learning resource.

Based on the analysis, some students do not have difficulty in learning the rate of chemical reactions because basically to learn this material students need experiments or direct observation to see how the rate of reaction occurs. In this material, they are asked to conduct experiments to be able to more easily understand the material of the reaction rate and to be able to see directly the relationship between the reaction rate factors of substances involved in chemical reactions.

The purpose of this observation is to find the problem points that are used as guidelines for the creation of E-modules. After knowing the problem, it can be concluded that there is a need for innovation in the form of teaching materials to support chemistry learning that is more effective, interactive, guiding and structured in learning chemical materials at the reaction rate and based on local wisdom so that when the materials or laboratories do not support it, experiments on this material can still be carried out and can help students understand the reaction rate correctly.

The resource person also explained that it is very necessary to develop teaching materials related to daily life. Indonesia is very rich in culture. Therefore, it is very necessary to integrate chemistry with culture, especially those based on culture, because it is very rare for the topic of chemistry to be raised and related to culture in Indonesia.

2. Student Needs Analysis (Questionnaire)

The analysis of student needs in this development research aims to identify whether students need the development of e-module-based teaching materials that are integrated with local wisdom to equate with the needs of teachers. During this phase, the researcher provides a demonstration related to the E-module to be developed. This learning was carried out for a class at SMAN 2 Percut Sei Tuan grade XI who had studied reaction rate, so that they could estimate whether they needed teaching materials in the form of PjBL-based E-Modules that were integrated with ethnopedagogy on reaction rate materials. To collect relevant information for the research, this process is carried out by distributing questionnaires in the form of

questionnaires about student needs analysis. Based on the results of the questionnaire analyzing the needs of grade XI students who have studied the reaction rate, it is known that 85.5% of students are interested and agree that learning needs to be developed in the form of project-based e-modules that are integrated with ethnopedagogy. They feel that through a project-based approach, learners can explore their understanding independently.

3. ATP Analysis

The ATP analysis stage is carried out to determine a directed, systematic and consistent design. The ATP analysis can be seen in Appendix 1. This ATP analysis is also important for researchers to compile modules and adapt them so that all students have the same opportunity to develop. ATP is carried out by subject teachers in accordance with the independent curriculum, which is the curriculum that applies to the school year. Furthermore, the results of ATP analysis will be used as a reference in the design and development of PjBL-based module E which is integrated with ethnopedagogy on Reaction Rate material in high school.

4. Textbook Analysis (BSNP Standard)

At this stage, material analysis is carried out in accordance with the topic of the problem so that the material can be systematically rearranged. Material analysis of reaction rates can be seen in the self-curriculum teaching module. The researcher conducted an analysis of this material on several books with different authors. The selection of this book was based on the use of chemistry books at SMA N 2 Percut Sei Tuan. Thus, 3 books were selected to be analyzed for the design content needs of the E-learning module, which are listed in table 1.1

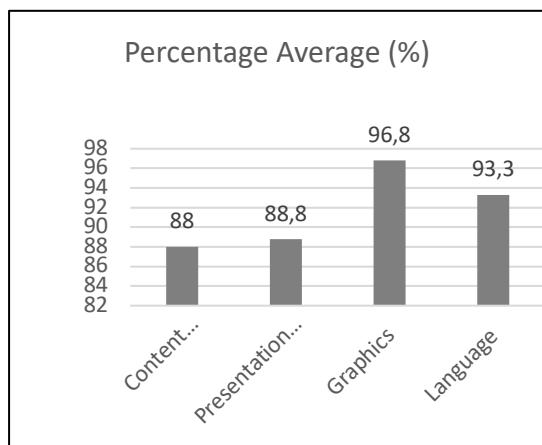
No	Book Title	Author	Publisher	Year
1	Buku Kimia Untuk SMA	Munasprianto Raml dkk	Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi	2022
2	Kimia Untuk SMA Kelas XI Kurikulum 2013	Watoni.,dkk	Yrama Widya	2013
3	Buku "Kimia Untuk SMA Kelas XI -Cambridge International AS & A Level "	Cann.P& Hughes.P.	Kementerian Pendidikan, Kebudayaan, Riset,dan Teknologi	2021

An average analysis table of the three books can be seen in this table

Yes	Assessment	Percentage	
		Aspect	Average (%)
1	Content suitability	88	
2	Presentation suitability	88,8	
3	Graphics	96,8	
4	Language	93,3	
Average		91,7	
Category		Very Suitable	

The average analysis graph of the book can be seen in the image below.

Figure 4.1. Graph of analysis of chemistry textbooks used based on BNSP.



These three books are not books in the form of modules designed based on project-based learning that is integrated with local wisdom of betel eating culture in them. This is the

answer that this study is designed to produce an E-module according to PjBL that is integrated with the ethnopedagogy of betel eating culture and spiritual values in reaction rate chemistry in accordance with the feasibility aspect of BSNP

D. Conclusion

Based on the results of the research on the analysis of student needs in teaching materials, it can be concluded that teachers still use conventional teaching materials in the form of textbooks, learning is still centered on the teacher, students feel bored in the learning process. Students need teaching materials that are more practical and can help students understand the material. Not only does it receive material, but it also needs material that is more imaginable for students and close to daily life. One of the most appropriate learning models is PBL, students can explore learning from various problems/cases given by teachers to be discussed by students based on existing theories, so that students are more active in the learning process. The main conclusions of this study can be presented in sections. The results of the analysis of the three books that

have been carried out have also not applied Problem Based Learning (PjBL) and do not integrate local wisdom of the weir culture. This gap creates a need for innovation in teaching materials. Therefore, it can be concluded that the development of teaching materials integrated with local wisdom of culture and weighs in the material is needed.

Chemistry E-Modules with an Ethnopedagogical Approach to Train Science Literacy and Student Learning Independence. *Journal of Classroom Action Research. Journal of Classroom Action Research*, 4(1), 1-8.

DAFTAR PUSTAKA

Aprilia, T. (2023). THE IMPACT OF CHANGING THE EDUCATIONAL CURRICULUM (INDEPENDENT CURRICULUM) ON STUDENTS AT SMA NEGERI 1 RUMPIN. In *Scientific Journal of Multidisciplinary Studies* (Vol. 7, Issue 12).

Nugraheni, R., & Pratomo, H. (2024). Analysis Of Ethnoscience Integrated Chemistry E-Modules On Reaction Rate Material To Strengthen Chemical Literacy Of High School Students. *Indonesian Journal of Chemical Education*, 1(1), 14-20. <https://l1nq.com/7sSbW>

Jasahuldia, R. A. (2022). Validation of Ethnoscience-Based

Jeynes, W. H. (2019). A meta-analysis on the relationship between character education and student achievement and behavioral outcomes. *Education and Urban Society*, 51(1), 33-71

Jelodari, Z., Zenouzagh, Z. M., & Hashamdar, M. (2025). Exploring PBL and e-PBL: implications for 21st-century skills in EFL education. *Discover Education*, 4(1). <https://doi.org/10.1007/s44217-025-00773-3>

Maulidia, L., Nafaridah, T., Fraick Nicky Gillian Ratumbuysang, M., Maya Kesuma Sari, E. (2023) National Seminar (PROSPEK II) "Transformation of Education Through Digital Learning to Realize Independent

Learning" February 1, 2023 Economics Education Study Program, FKIP, Universitas PGRI Mahadewa Indonesia Analysis of 21st Century Skills Through the Implementation of the Independent Learning Curriculum at SMA Negeri 2 Banjarmasin The Analysis of 21st Century Skills Through the Implementation of the Independent Learning Curriculum at SMA Negeri 2 Banjarmasin.

Muzakkir, I., Hafiz, M., & Rayoga, M.A. (2025). Sustainable School Management Based on Local Wisdom and Sustainability: A Literature Review on Educational Leadership. Sustainability: Educational Innovation and Local Identity, Vol 1. (1) : 15- 28

Rahayu, R., Iskandar, S., & Abidin, Y. (2022). 21st Century Learning Innovation and Its Application in Indonesia. *Journal of Basic Education*, 6(2), 2099–2104. <https://doi.org/10.31004/basicedu.v6i2.2082>

Silaban, R., Tua Musa Panggabean, F., Mutiara Hutapea, F., Hutahaean, E., & Josafat Alexander, I. (2020). *THE IMPLEMENTATION OF PROBLEM-BASED-LEARNING (PBL) AND A SCIENTIFIC APPROACH USING CARD MEDIA TO IMPROVE STUDENTS' LEARNING OUTCOMES ABOUT TEACHING CHEMICAL BONDS.* 8(2), 69–76. <http://ejournal.uncen.ac.id/index.php/JIPI>

Silaban R., Septiani B., Hutabarat W. (2015). *PREPARATION OF INNOVATIVE CHEMISTRY TEACHING MATERIALS INTEGRATED REACTION RATE MATERIAL FOR HIGH SCHOOL STUDENTS' CHARACTER EDUCATION 1)* (Vol. 12, Issue 1).

Septiani, F., Suriani, C., Purba, I. S. U. B., Ginting, N. B., Oktavia, A., Fadilla, C., & Violencia, G. (2025). *BETEL LEAF (PIPER BETLE L.) AS A CULTURAL SYMBOL AND SOURCE OF*

MEDICINE FOR THE BATAK PEOPLE: AN ETHNOBOTANICAL STUDY. *Journal of Intellectual and Scholars of the Archipelago*, 2(5), 7960-7977.
<https://jicnusantara.com/index.php/jicn>

Setiawan, P., & Ginanjar Arip, A. (n.d.). Application of the Project Based Learning (PjBL) Model through Making Tempe to Improve Student Learning Outcomes and Creativity. In *International Journal Publishing INFLUENCE: International Journal of Science Review* (Vol. 5, Issue 2).
<https://influence-journal.com/index.php/influence/index>

Shiddiq, A. A. N. K., Sutama, I. W., & Astuti, W. (2024). Advancing 21st-Century Skills in Early Childhood Through the Project-Based Learning Model: Evidence from Children Aged 5–6 Years. *Journal of Early Childhood Education Undiksha*, 12(2), 263–271.
<https://doi.org/10.23887/paud.v12i2.75057>

Tanjung, A., & Siregar, E. (2019). *CUSTOMS AND CULTURE OF MANGAN BURANGIR (EATING SIRI LEAVES) DURING THE TRADITIONAL FESTIVAL OF BATAK ANGKOLA SOUTH TAPANULI, SOUTH TAPANULI. Journal of Education and Development of South Tapanuli Institute of*