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Initial Needs Analysis for the Development of a Chemistry Textbook Based on West Kalimantan Culture to Enhance Chemical Literacy and Cultural Awareness

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Abstract: The limited implementation of chemical literacy and culture-based learning in schools has hindered the development of students' critical thinking and cultural appreciation. This study aims to identify the initial needs for developing a culture-based electronic chemistry textbook grounded in the local traditions of West Kalimantan. A descriptive quantitative method was employed, involving 11 chemistry teachers from schools implementing the Merdeka Curriculum. Data were collected through questionnaires and supported by an extensive literature review. The questionnaire data were analyzed using descriptive statistics, while literature was analyzed qualitatively. The results showed that 54.54% of teachers had not implemented chemical literacy-based learning, and 90.90% had never applied culture-based approaches. Most teachers used government-issued textbooks and encountered challenges in integrating chemistry content with local culture due to limited references. Student characteristics also indicated a need for interactive and contextual teaching materials that align with diverse learning styles and cognitive development stages. In addition, the cultural analysis revealed that thermochemistry concepts can be meaningfully linked to local practices in West Kalimantan. Therefore, the development of a culture-based electronic chemistry textbook is essential to enhance students' chemical literacy and cultural awareness through relevant, contextual, and meaningful learning experiences.

Keywords: Chemical literacy; Cultural awareness; Need Analysis; Textbook; West Kalimantan Culture

Introduction

One of the primary objectives of chemistry education is to cultivate students' critical thinking skills to analyze and evaluate scientific issues and phenomena encountered in daily life (Kemendikbudristek, 2024). This objective can be realized through the development of students' chemical literacy. Chemical literacy is defined as an individual's ability to understand and apply chemical concepts to everyday events, encompassing both chemical knowledge and skills relevant to addressing social and scientific issues (Nada & Sari, 2021; Setyorini et al., 2021).

The significance of chemical literacy lies in enabling students to appreciate nature and to utilize science and technology responsibly (Nisa et al., 2015). (Wiyarsi et al., 2019) emphasized that chemical literacy not only fosters critical and creative thinking but also equips students to solve everyday problems based on scientific knowledge. Furthermore, (Shwartz et al., 2006) categorized chemical literacy into four domains: conceptual chemical knowledge, higher-order learning skills, affective aspects, and chemistry in context.

However, based on the PISA 2022 results, Indonesia ranked 71st out of 81 participating countries, with a reading literacy score of 359 points (OECD, 2022).

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Compared to 2018, this score represents a decrease of 12 points from the previous 371 points. Nevertheless, Indonesia's ranking improved by five to six positions relative to 2018. Despite this increase in ranking, Indonesia's reading literacy score remains significantly below the OECD average of 69%. Furthermore, the gap becomes even more pronounced when compared to Singapore, which achieved a reading literacy score of 85%. These data indicate that, although Indonesia's relative position has improved, the overall quality of reading literacy remains low and requires substantial enhancement to compete at a global level.

The low level of students' chemical literacy in Indonesia can be attributed to several factors within the education system and curriculum, particularly in relation to the teaching methods, instructional models, and learning resources utilized by educators (Lukman et al., 2022). Learning resources have been identified as the most influential, especially in aspects related to chemical literacy skills (Mellyzar et al., 2022).

To effectively develop chemical literacy, learning resources must go beyond theoretical content and incorporate context-based materials that are relevant to everyday life. Such resources should integrate chemical concepts with real-world situations to foster critical thinking and enable students to to connect their scientific knowledge with personal experiences meaningfully. Context-based chemistry learning has been shown to enhance chemical literacy by encouraging students to relate information from authentic problems to their existing conceptual frameworks (Wiyarsi et al., 2021 ; Zandroto & Kelly Sinaga, 2022).

One of the most relevant everyday life contexts for chemistry learning is the cultural context, known as ethnochemistry. Gustina (2022) demonstrated that ethnochemistry-based problem-based learning had a substantial effect, yielding a 93% improvement in students' chemical literacy. Similarly, Heliawati et al., (2022) found that petrochemical-based learning media enhanced students' scientific literacy, with an average achievement score of 80.50% and an N-gain of 80% categorized as high. Pebrianti et al., (2024) also reported that the development of acid-base modules based on mechanochemistry and problem-based learning demonstrated high effectiveness in improving chemical literacy, with an N-gain of 71%. Based on these findings, it can be concluded that ethnochemistry-based learning approaches, whether through problem-based learning models or learning media, are effective in enhancing students' chemical literacy.

In addition to fostering chemical literacy, culturally contextualized learning also promotes students' cultural awareness. Cultural awareness refers to the ability to recognize and appreciate cultural values (Constantin et al., 2015) while maintaining one's own cultural identity (Sudarmin et al., 2024). Developing cultural awareness has been shown to strengthen understanding of cultural values (Gilbert et al., 2007), enhance appreciation for cultural diversity (Kertamuda, 2011), and foster greater tolerance toward cultural differences (Suriata & Sasmita, 2022). Sudarmin et al. (2024) demonstrated that learning through Ethno-STEM integrated Project-Based Learning significantly improved students' global diversity awareness, with an average score of 49.48 (high category). Similarly, research by Naila et al. (2024) indicated a significant improvement in students' cultural knowledge at the 5% significance level, with the N-gain classified as high. Hikmawati & Sutajaya, (2021) also reported that ethnoscience-based learning increased students' concern for local culture, with 90% of students preserving local culture, 60% expressing a liking for local culture, and 56.7% introducing local culture to others, resulting in an overall average of 68.9%. These studies collectively suggest that culture-based learning, through Ethno-STEM and ethnoscience approaches, is effective in enhancing cultural awareness, strengthening cultural value appreciation, and fostering positive and tolerant attitudes toward cultural diversity.

Although research on ethnochemistry has been increasingly conducted in Indonesia, most studies have focused on cultures from the Java region, such as the batik culture of Bantul, Yogyakarta (Azizah & Premono, 2021), the use of medicinal plants in Serang, Banten (Pertiwi et al., 2021), traditional foods from Rembang and Pekalongan, Central Java (Rahmila et al., 2022; Khotimah et al., 2022)and the Reog Kendang tradition from Tulungagung, East Java (Suja, 2022). In contrast, ethnochemistry applications in regions outside Java, such as West Kalimantan, remain limited.

Currently, chemistry instruction in West Kalimantan has not widely integrated ethnochemistry into classroom practice. Instead, instructional models such as multiple representations (Safitri et al., 2018), Student Teams Achievement Division (STAD) (Danggus, 2020), guided inquiry (Aisyah et al., 2020), problem-based learning (Choiriyah et al., 2022), project-based learning (Ainun & Rasmawan, 2021; Sholahuddin et al., 2023) problem-solving (Yani et al., 2023), and discovery learning (Meri et al., 2023) have been predominantly employed. Although these approaches effectively develop students' critical and analytical skills, they do not sufficiently accommodate local cultural contexts that can strengthen students' connections between chemistry and the lived experiences of surrounding communities.

In response to these challenges, this study aims to conduct an initial needs analysis for the development of culturally contextualized chemistry textbooks based on West Kalimantan traditions. These textbooks are expected to enhance students' chemical literacy and

cultural awareness by providing contextual, meaningful, and culturally rich learning experiences.

Method

Time and Place of Research

This study was conducted during the even semester of the 2023/2024 academic year in West Kalimantan, Indonesia. The selected schools were those that had implemented the Merdeka (Independent) Curriculum and held an accreditation rating of "A."

Tools and Materials

The tools employed in this study included a questionnaire developed using Google Forms to facilitate the efficient distribution and collection of responses online, as well as an interview guide designed to obtain in-depth qualitative data through virtual interviews. The materials used in the study comprised the official chemistry curriculum aligned with the Merdeka Curriculum, which served as the basis for competency analysis, along with scientific literature relevant to chemical literacy, cultural awareness, and ethnochemistry. Additionally, research instruments—including the questionnaire and interview guide—were constructed by the researchers in accordance with the objectives and scope of the study.

Research Methods

This study employed a quantitative descriptive research design. Quantitative descriptive research focuses on providing detailed explanations of observed phenomena, both natural and human-made, by examining various aspects such as form, activity, characteristics, changes, relationships, and similarities or differences with other phenomena (Creswell, 2017). The sample was selected using purposive sampling techniques. The participants consisted of 30 chemistry teachers from 15 senior high schools in West Kalimantan who had at least two years of teaching experience.

Research Stage

The research procedure consisted of three main stages: preparation, implementation, and conclusion. The preparation stage involved identifying and describing the target population and respondents, establishing the objectives of the needs analysis, formulating the research problems, identifying potential sources of problems, and determining possible solutions. This stage also included defining the scope and location of the needs analysis and developing research instruments such as interview guidelines and questionnaires. The implementation stage comprised collecting relevant data, reviewing literature related to teaching material needs analysis, distributing questionnaires, conducting interviews, and documenting the information obtained. The final stage involved analyzing and interpreting the collected data.

Data Analysis

Data collection included both qualitative and quantitative techniques. The questionnaire data were quantitatively analyzed using basic statistical methods to describe percentages and trends. Meanwhile, the interview data were analyzed descriptively to interpret patterns, challenges, and needs as expressed by the participants.

Result and Discussion

Literature Study Results

Based on the literature review, several studies (Asmi et al., 2024; Lusyana Yustin & Wiyarsi, 2019; Nurhasanah et al., 2021; Rahmawati et al., 2020; Wardani et al., 2024) have shown that students' chemical literacy in Indonesia remains relatively low. This is attributed to various factors, including ineffective learning processes, limited teacher competence, suboptimal curriculum implementation, insufficient access to relevant learning resources, and students' negative perceptions of chemistry as a subject. Furthermore, innovation in the development of teaching materials, particularly electronic books for chemistry instruction, remains limited due to a lack of creativity and innovation among teachers.

The challenges posed by globalization have contributed to a declining interest among the younger generation in local cultural traditions, highlighting the need for learning approaches that integrate cultural elements. Research findings indicate that ethnochemistry-based learning positively impacts students' chemical literacy by offering more contextualized and meaningful learning experiences. Moreover, incorporating cultural contexts into chemistry learning not only enhances the relevance and attractiveness of chemical concepts but also fosters students' cultural awareness. This is achieved by connecting chemical concepts with local cultural practices, facilitating cross-cultural discussions, and encouraging curiosity and appreciation for both one's own and others' cultures.

Teachers' Teaching Materials in Schools

Based on the results of the questionnaire distributed to teachers, three types of teaching materials were identified: textbooks, student worksheets, and modules. The distribution of textbooks utilized by teachers is presented in Figure 1.

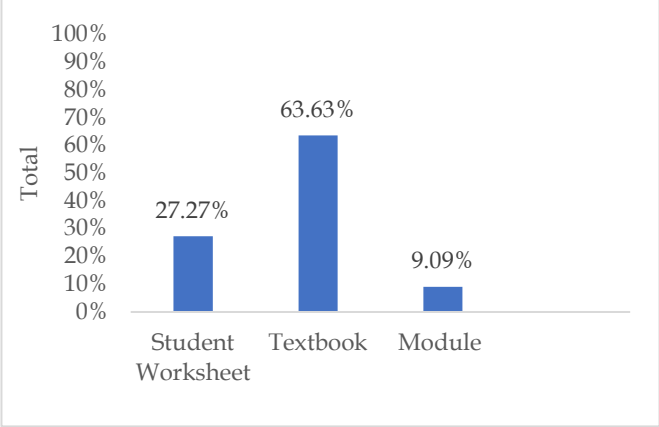

Figure 1. Percentage of teachers' use of teaching materials

Figure 1 shows that 63.63% of teachers use textbooks as the primary teaching material in the classroom. This finding is corroborated by interview results, which revealed that the textbooks commonly used are those published by the Ministry of Education and Culture, selected due to their comprehensive and structured presentation of content. Interestingly, 27.27% of teachers also utilize student worksheets (LKPD), with some preferring to develop their LKPDs to present material more concisely and optimize classroom time. This highlights the need for more flexible and adaptable teaching resources that better address the specific needs of both teachers and students. The use of learning modules remains relatively low, at only 9.09%, suggesting either limited availability of relevant modules or a preference among teachers for the practicality offered by textbooks and LKPDs. These findings are consistent with the results of the literature review, which pointed to a scarcity of relevant learning materials and a lack of innovation in teaching material development.

The high reliance on centrally published textbooks suggests a lack of teaching material development tailored to the local context of West Kalimantan, which is the primary focus of this study. Meanwhile, the practice of some teachers developing their LKPDs reflects an initiative to adapt materials to student needs and classroom time constraints. However, this also highlights challenges related to limited time and resources available for teachers to produce high-quality and innovative teaching materials independently. This finding is further supported by the fact that the majority of teachers have not yet implemented chemical literacy-based or culture-based learning approaches, largely due to a lack of references and difficulties in linking chemical concepts with local cultural contexts, as revealed through interviews. Overall, the analysis of teaching materials underscores the urgent need to develop a culturally contextualized electronic chemistry textbook rooted in West Kalimantan traditions. Such a resource is expected to provide a more relevant and meaningful learning experience while simultaneously supporting the enhancement of students' chemical literacy and cultural awareness.

Implementation of Chemical Literacy Based Learning

The questionnaire results revealed that the majority of teachers had not implemented learning approaches that aim to develop students' chemical literacy skills. The detailed percentages are presented in Figure 2.

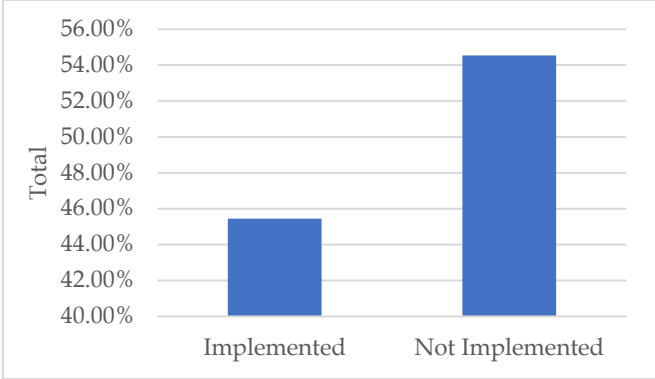

Figure 2. Percentage of the Implementation of Learning Integrated with Chemical Literacy

Figure 2 shows that 54.54% of teachers have not implemented chemistry learning aimed at developing students' chemical literacy skills, while 45.45% of teachers have applied such learning approaches. Based on the interview results, most teachers admitted that they had not implemented chemistry learning that supports the development of students' chemical literacy. This is primarily due to the lack of available references specifically focused on chemical literacy. Teachers generally rely on standard textbooks provided by the school, which are not specifically designed to promote the development of chemical literacy skills. In addition, teachers face time constraints in developing appropriate and relevant teaching materials. Furthermore, students' perception of chemistry as a complex subject presents an additional challenge for teachers in fostering chemical literacy among students.

Teachers emphasized the importance of developing culture-integrated textbooks to facilitate the explanation of chemistry concepts and to foster students' cultural curiosity. The teachers' expressed need for learning resources that integrate chemistry with the local culture of West Kalimantan highlights an increasing awareness of the necessity for a more relevant and meaningful learning approach. Therefore, the analysis in this section further reinforces the urgency of developing an electronic chemistry textbook based on West Kalimantan culture, which is expected to provide a

viable solution to the challenges encountered in implementing chemical literacy-based learning.

Implementation of Culture-Based Learning

The results of the questionnaire distributed to teachers indicated that the majority of teachers had not implemented culture-based learning. The detailed percentage is presented in Figure 3.

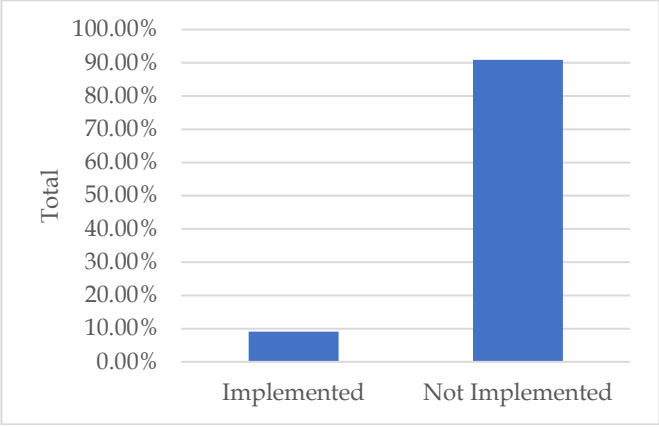

Figure 3. Percentage of the Implementation of Culture-Based Learning

Figure 3 shows that 90.90% of teachers have never implemented culture-based chemistry learning, while only 9.09% have applied it to a single topic. Interview results indicate that teachers find it challenging to integrate cultural elements into chemistry content. This difficulty is primarily due to a lack of available references linking West Kalimantan's local cultures with chemistry topics. Moreover, most teachers are unfamiliar with the concepts of ethnochemistry or culturally responsive teaching approaches. Typically, they relate chemistry to everyday phenomena without incorporating cultural perspectives.

The high percentage of teachers who have not implemented culture-based learning highlights an urgent need for educational resources that bridge the gap between chemistry concepts and the local cultural context of West Kalimantan. The development of culture-based chemistry textbooks is expected to offer concrete and practical references for teachers, facilitating the implementation of this learning approach. Such resources can make chemistry content more relevant, engaging, and meaningful for students while also fostering a greater appreciation for local culture.

Analysis of Student Characteristics

This analysis aims to provide an overview of learners' characteristics in terms of their prior knowledge, attitudes, and general ability backgrounds. It is conducted through a literature review focusing on the characteristics and learning styles of high school students aged 16–17.

Based on literature studies by Rahmat (2021), Hamuni et al. (2022), and Wahdaniyah & Rinaningsih (2022), the following findings were obtained: (a) The analysis of students indicates that the average age of senior high school students falls within the range of 16–17 years; (b) The intellectual characteristics of students aged 16–17 are marked by the ability to think abstractly, hypothetically, and logically. These abilities enable them to engage with non-concrete concepts, consider multiple possibilities, and draw conclusions based on available information; (c) Alongside intellectual development, students in this age group also undergo moral development, during which they begin to form values and principles that guide their behaviour; (d) Students exhibit diverse learning styles, including linguistic, logical-mathematical, spatial-visual, kinesthetic, musical, interpersonal, and intrapersonal. These learning styles influence students' academic performance and learning outcomes.

Based on the analysis, a suitable textbook for students with the aforementioned characteristics should support the development of abstract, hypothetical, and logical thinking in line with Piaget's formal operational stage of cognitive development. The textbook should present content that encourages critical and analytical thinking through concrete examples while gradually guiding students toward understanding abstract concepts. It should also include activities that foster both deductive and inductive reasoning skills.

Moreover, the textbook should incorporate varied instructional methods to accommodate diverse learning styles, such as interactive multimedia, visual graphics, simulations, as well as collaborative and reflective tasks. Therefore, a culture-based textbook designed in a visually engaging, interactive, and contextually relevant electronic format would significantly enhance students' intellectual growth, moral development, and interest in learning.

Student's Competency Analysis

This analysis aims to examine students' competencies in chemistry learning. The analysis was conducted through descriptive content analysis of the chemistry learning objectives outlined in the Merdeka Curriculum. According to the 2024 decree by the Ministry of Education and Culture regarding the Merdeka Curriculum, chemistry education is expected to foster students' critical thinking skills to analyze and evaluate scientific issues and phenomena in everyday life. It also aims to cultivate values such as integrity, honesty, fairness, responsibility, and respect for the dignity of individuals, groups, communities, and global diversity.

Based on this competency analysis, the textbook developed should present chemistry content relevant to real-life contexts, connect scientific concepts with both local and global phenomena, and emphasise the development of values such as honesty, justice, and respect for diversity. Therefore, the e-book developed in this study includes activities that promote discussion, problem-solving, and collaborative projects, enabling students to apply chemical concepts within the context of their own culture and environment.

Analysis of Culture Attributed to Chemistry Learning

One of the chemistry topics that can be linked to the culture of West Kalimantan is thermochemistry. Cultural elements in this context can be connected to factual, conceptual, and procedural knowledge. The results of the cultural analysis related to thermochemical concepts are presented in Table 1.

Tabel 1. Analysis of Culture Integrated into Thermochemistry Content

Culture	Factual	Conceptual	Procedural
Meriam Karbit Festival	During the Meriam Karbit festival, a thermochemical reaction occurs when calcium carbide reacts with water, producing acetylene gas. When ignited, this gas releases heat energy.	Definition of Thermochemistry	Observe the change in ambient temperature when the carbide cannon is sounded.
Kelotok Boats	*Kelotok* boats use fossil fuels such as diesel or petrol to power their engines, converting the chemical energy stored in the fuel into mechanical energy.	Energy and enthalpy	Procedure for calculating the amount of energy
Betangas procession	The Betangas procession serves as an example of an endothermic reaction, where the system (the bride's body) absorbs heat from the surrounding hot steam.	Exotherm and Endotherm Reactions	Procedure for making energy level diagrams of exothermic and endothermic reactions
Making *Mandau*	The process of heating iron during the making of a Mandau (traditional sword) involves enthalpy changes, reflecting the energy transformations occurring during the reaction.	Types of Standard Enthalpy Changes	Procedures for calculating standard enthalpy changes based on types of standard enthalpy
Nasi Hadap-hadapan Tradition	The caloric content of glutinous rice used in Nasi Hadap-Hadapan can be determined using a bomb calorimeter, which measures the heat released during combustion.	Calorimeter	Procedure for calculating enthalpy change with a calorimeter
Making *Lempok Durian*	The preparation of Lempok Durian involves the absorption of heat energy to achieve the desired texture and consistency.	Hess's Law	Procedure for calculating Hess' law
Making *Ikan Salai*	Meanwhile, during the chemical process of smoking salai fish, hydrogen bonds within the fish tissue are broken, leading to the evaporation of water molecules.	Bonding Energy	Procedure for calculating bond energy

The analysis results indicate that thermochemical concepts can be effectively integrated with the local culture of West Kalimantan. Each cultural phenomenon is linked to relevant chemical principles in thermochemistry. This cultural integration in chemistry instruction makes the subject matter more contextual and meaningful, supporting students in understanding chemical concepts through real-life experiences. Overall, the concept analysis affirms that the developed e-book can enhance students' understanding of thermochemistry by situating it within a local cultural context. This approach not only makes learning more meaningful but also promotes students' chemical literacy and cultural awareness.

Conclusion

This study concludes that the development of an electronic chemistry textbook based on the local culture of West Kalimantan is necessary to address the problem of low student chemical literacy and the limited availability of teaching materials relevant to the local context. Teachers have not yet fully implemented culture-based chemistry learning or fostered chemical literacy due to the lack of references and the challenges in linking cultural elements with chemical concepts.

The proposed electronic textbook is expected to serve as a solution by presenting contextual and meaningful chemistry content

through the integration of West Kalimantan's cultural elements to enhance students' understanding, chemical literacy, and cultural awareness.

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The authors declare no conflict of interest.

References

Ainun, N., & Rasmawan, R. (2021). Pengembangan LKPD berbasis proyek pembuatan ekstrak indikator alami asam basa. *Jurnal Education and Development*, *9*(3), 103–109. https://journal.ipts.ac.id/index.php/ED/article/view/2730

Aisyah, S., Hairida, H., & Lestari, I. (2020). Pengaruh model inkuiri terbimbing materi korosi terhadap keterampilan kerja ilmiah siswa SMAN 6 Pontianak. *Jurnal Pendidikan Dan Pembelajaran Khatulistiwa (JPPK)*, *9*(3). https://jurnal.untan.ac.id/index.php/jpdpb/article/view/40198

Asmi, A., Silaban, S., & Silaban, R. (2024). Analisis kebutuhan pengembangan bahan ajar kimia berbasis elektronik terintegrasi model pembelajaran problem based learning pada siswa SMA Kelas X Kota Medan. *Efektor*, *11*(1), 94–100. https://doi.org/10.29407/e.v11i1.21594

Azizah, N., & Premono, S. (2021). Identifikasi potensi budaya lokal berbasis etnokimia di kabupaten Bantul. *Journal of Tropical Chemistry Research and Education*, *3*(1), 53–60. https://doi.org/10.14421/jtcre.2021.31-06

Choiriyah, I. N., Masriani, Rasmawan, R., Erlina, & Sartika, R. P. (2022). Pengaruh model problem based learning (pbl) terhadap hasil belajar siswa pada materi elektrokimia. *Hydrogen : Jurnal Kependidikan Kimia*, *10*(2), 162–173. http://ojs.undikma.ac.id/index.php/hydrogen/index

Constantin, E. C., Cohen-Vida, M.-I., & Popescu, A. V. (2015). Developing cultural awareness. *Procedia - Social and Behavioral Sciences*, *191*, 696–699. https://doi.org/10.1016/j.sbspro.2015.04.228

Creswell, John W. 2017. Research Design; Qualitative, Quantitative, and Mixed.

Gilbert, J., Goode, T. D., & Dunne, C. (2007). Cultural awareness: Curricula enhancement module series. National Center for Cultural Competence, Georgetown University Center for Child and Human Development. https://nccc.georgetown.edu/curricula/documents/awareness.pdf

Hamuni, H., Idrus, M., & Aswati, M. (2022). Student development. Eureka Media Aksara: Purbalingga.

Heliawati, L., Pebriani, F., & Ardianto, D. (2022). Smart Apps creator 3 interactive multimedia based on stream to improve students' scientific literacy during the covid-19 pandemic. *Journal of Innovation in Educational and Cultural Research*, *3*(4), 617–624. https://doi.org/10.46843/jiecr.v3i4.277

Hikmawati, H., & Sutajaya, I. M. (2021). Science learning based on The Sasak tribe tradition to develop student entrepreneurial attitudes. *Jurnal Ilmiah Profesi Pendidikan*, *6*(3), 360–366. https://doi.org/10.29303/jipp.v6i3.222

Kemendikbudristek. (2024). Learning outcomes in the Merdeka Curriculum include early childhood, essential, and secondary education. Jakarta: Kemendikbudristek.

Khotimah, H., Suryaningsih, S., & Muslim, B. (2022). Pengembangan buku pengayaan kimia berorientasi etnosains dengan mengangkat budaya makanan khas kabupaten pekalongan. *Lantanida Journal*, *9*(2), 158. https://doi.org/10.22373/lj.v9i2.12618

Lukman, I., Mellyzar, M., Alvina, S., & Saa'dah, N. (2022). Development of a Chemical Literacy Assessment on Colloid (CLAC) instrument to measure chemical literacy. *Proceedings of Malikussaleh International Conference on Multidisciplinary Studies (MICoMS)*, *3*, 00010. https://doi.org/10.29103/micoms.v3i.50

Mellyzar, M., Herizal, H., & Novita, N. (2022). Pre-service teachers' belief to achieve scientific literacy. 060026. https://doi.org/10.1063/5.0102446

Meri, M., Maria, H. T., & Karolina, V. (2023). Korelasi antara tingkat keaktifan peserta didik dengan hasil belajar melalui model pembelajaran discovery learning. *Jurnal Dimensi Pendidikan Dan Pembelajaran*, *11*(1), 206–211. https://doi.org/10.24269/dpp.v11i1.8448

Nada, E. I., & Sari, W. K. (2021). Analysis of UoS contextual chemical literacy ability of chemistry pre-service teacher on reaction rate topic. *IOP Conference Series: Earth and Environmental Science*, *1796*(1). https://doi.org/10.1088/1742-6596/1796/1/012114

Nurhasanah, L., Siburian, B. P., & Fitriana, J. A. (2021). Pengaruh globalisasi terhadap minat generasi

muda dalam melestarikan kesenian tradisional Indonesia. *Jurnal Global Citizen : Jurnal Ilmiah Kajian Pendidikan Kewarganegaraan*, *10*(2), 31–39. https://doi.org/10.33061/jgz.v10i2.5616

Pebrianti, P., Andromeda, Yerimadesi, Hardeli, & Suryani, O. (2024). Development of the acid-base module based on problem based learning with ethnochemisty to improve students science literacy ability. *Jurnal Penelitian Pendidikan IPA*, *10*(8), 4634–4640. https://doi.org/10.29303/jppipa.v10i8.8582

Rahmat, P. S. (2021). Student development. Jakarta: Bumi Aksara.

Rahmawati, Y., Ridwan, A., Faustine, S., Syarah, S., Ibrahim, I., & Mawarni, P. C. (2020). Pengembangan literasi sains dan identitas budaya siswa melalui pendekatan etno-pedagogi dalam pembelajaran sains. *Edusains*, *12*(1), 54–63. https://doi.org/10.15408/es.v12i1.12428

Rahmila, R., Iriani, R., Kusasi, M., & Leny, L. (2022). Pengembangan media poster melalui aplikasi canva bermuatan etnosains pada meteri koloid untuk meningkatkan motivasi dan hasil belajar. *Quantum: Jurnal Inovasi Pendidikan Sains*, *13*(2), 188. https://doi.org/10.20527/quantum.v13i2.13079

Safitri, S., Kurniawan, R. A., & Fadhilah, R. (2018). Pengaruh pembelajaran kooperatif tipe teams game tournament berbantuan media teka-teki silang terhadap motivasi siswa pada materi koloid. *Edukasi: Jurnal Pendidikan*, *16*(1), 20. https://doi.org/10.31571/edukasi.v16i1.779

Setyorini, A. D., Yamtinah, S., Mahardiani, L., & Saputro, S. (2021). A Rasch analysis of item quality of the chemical literacy assessment for investigating student's chemical literacy on chemical rate concepts. *European Journal of Educational Research*, *volume-10*-(volume-10-issue-4-october-2021), 1769–1779. https://doi.org/10.12973/eu-jer.10.4.1769

Sholahuddin, S., Fadhilah, R., & Kurniasih, D. (2023). Efektivitas model pembelajaran berbasis proyek terhadap pemahaman konsep pada materi larutan asam basa. *Hydrogen: Jurnal Kependidikan Kimia*, *11*(5), 666. https://doi.org/10.33394/hjkk.v11i5.8675

Shwartz, Y., Ben-Zvi, R., & Hofstein, A. (2006). The use of scientific literacy taxonomy for assessing the development of chemical literacy among high-school students. *Chem. Educ. Res. Pract.*, *7*(4), 203–225. https://doi.org/10.1039/B6RP90011A

Sudarmin, S., Prasetya, A. T., Kusuma, A. H., Setiawan, B., Pujiastut, R. S. E., Zain, H. H. B. M., & Winarto, W. (2024). How to increase students' global diversity character: study of the influence of ethno-stem-integrated project learning model on Indonesian tea aroma volatile compounds. *Pakistan Journal of Life and Social Sciences (PJLSS)*, *22*(1). https://doi.org/10.57239/PJLSS-2024-22.1.00347

Suja, I. W. (2022). Revitalisasi etnosains untuk mendukung literasi. *BCSJ: Bivalen Chemical Studies Journal*, *5*(1), 1–10.

Wardani, S. F., Yamtinah, S., Mulyani, B., Susilowati, E., Ulfa, M., Masykuri, M., & Shidiq, A. S. (2024). Differentiated learning: analysis of students' chemical literacy on chemical bonding material through culturally responsive teaching approach integrated with ethnochemistry. *Jurnal Penelitian Pendidikan IPA*, *10*(4), 1747–1759. https://doi.org/10.29303/jppipa.v10i4.6167

Wiyarsi, A., Fachriyah, A. R., Supriadi, D., & Bin Muhamad Damanhuri, M. I. (2019). A test of analytical thinking and chemical representation ability on 'rate of reaction' topic. *Cakrawala Pendidikan*, *38*(2), 228–242. https://doi.org/10.21831/cp.v38i2.23062

Wiyarsi, A., Prodjosantoso, A. K., & Nugraheni, A. R. E. (2021). Promoting students' scientific habits of mind and chemical literacy using the context of socio-scientific issues on the inquiry learning. *Frontiers in Education*, *6*. https://doi.org/10.3389/feduc.2021.660495

Yani, T. I., Enawati, E., Junanto, T., Muharini, R., & Rasmawan, R. (2023). Description of problem solving ability of class X students of Al-Azhar 10 Pontianak islamic high school on chemical bonding subject material. *Hydrogen: Jurnal Kependidikan Kimia*, *11*(5), 720. https://doi.org/10.33394/hjkk.v11i5.9102

Yustin, D., & Wiyarsi, A. (2019). Students' chemical literacy: A study in chemical bonding. *Journal of Physics: Conference Series*, *1397*(1), 012036. https://doi.org/10.1088/1742-6596/1397/1/012036

Zandroto, & Kelly Sinaga. (2022). Analisis kemampuan literasi kimia siswa pada materi senyawa hidrokarbon melalui pendekatan kontekstual. *Jurnal Pendidikan Mipa*, *12*(2), 349–358. https://doi.org/10.37630/jpm.v12i2.596