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Development of an Ethnochemistry-Based Learning Module to Strengthen Pancasila Student Profile in the Context of Acid-Base Material

Rika Siti Syaadah*, Tiwi Nur Astuti, Andari Thaneshafitri
Department of Chemistry Education, Faculty of Mathematics and Natural Science, Universitas Negeri Jakarta, Indonesia

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*Corresponding Author Email:
rikasitisyaadah@unj.ac.id

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Abstract: Chemistry is inherently a contextual subject that can be connected to various aspects of everyday life. Indonesia's rich and diverse cultural heritage offers great potential for integrating chemistry learning with local wisdom through ethnochemistry. Such integration not only makes learning more meaningful and relevant but also supports the development of the Pancasila Student Profile, which emphasizes values such as creativity, cooperation, and appreciation of cultural diversity. However, in practice, the integration of ethnochemistry into chemistry learning remains limited. This is reflected in most textbooks, which rarely incorporate. This study aims to develop and evaluate the feasibility of an ethnochemistry-based learning module designed to strengthen the Pancasila Student Profile in the context of acid-base topics. The research method used was Research and Development (R&D) employing the ASSURE model, which consists of the following stages: analyze learners, state objectives, select instructional methods, media, and materials, utilize media and materials, require learner participation, evaluate, and revise. Data were collected using instruments, including needs analysis tools such as interview guidelines and questionnaires, as well as student response surveys on the developed module learning. The research subjects consisted of 85 eleventh-grade students from SMAN 38 Jakarta. Expert validation of the ethnochemistry-based learning module integrated with the Pancasila Students Profile yielded a feasibility score of 94.01%, which falls into the 'feasible" category. Meanwhile, the implementation with students demonstrated a high level of effectiveness, with an average score of 96.30%. Based on these findings, the developed module is classified as "very good" and is considered highly suitable for use and broad implementation in chemistry learning at the high school level.

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INTRODUCTION

Contemporary education in Indonesia emphasizes not only the development of academic knowledge and skills but also the cultivation of student character aligned with the nation's foundational values, Pancasila (Putri et al., 2024; Rahayu et al., 2024). Central to this initiative is the Pancasila Student Profile (Profil Pelajar Pancasila), which serves as a cornerstone of the Merdeka Curriculum. This curriculum mandates that students engage in project-based learning activities designed to foster soft skills and character traits reflective of Pancasila principles. The competencies encompassed in the Pancasila Student Profile are formulated into six interrelated dimensions. To fully realize the intended profile, all dimensions must be developed simultaneously. These six dimensions include: Faith in God Almighty and noble character, Global diversity, Mutual cooperation, Independence, Critical thinking, and Creativity (Kemdikbud, 2022; Purnawanto, 2022).

The Pancasila Student Profile (P5) serves as Indonesia's national framework for character education, designed to cultivate an excellent generation embodying six core dimensions: faith and devotion to God Almighty, global diversity, mutual cooperation, independence, critical thinking, and creativity (Kemendikbudristek, 2021). Although the development of P5 represents a key pillar of

Indonesia's educational transformation, its implementation in practice continues to encounter significant challenges (Ritagustiani et al, 2025; Yuntawati, 2023). A primary obstacle lies in the predominance of abstract and decontextualized learning approaches, which risk positioning P5 as an additional component rather than an integral part of meaningful classroom practice (Fadilah & Mulyati, 2023). Furthermore, the gap between the universal ideals of Pancasila and the nation's diverse sociocultural realities often limits the effective internalization of these values, reducing their relevance for students across different regions. To address these challenges, the ethnochemistry approach offers a promising pathway for making P5 more contextual, relevant, and culturally grounded. Ethnochemistry explores the interconnection between traditional chemical practices embedded in local cultures and the concepts of modern chemical science, thereby serving as a bridge between indigenous wisdom and scientific understanding (Zidny & Eliks, 2020; Zidny et al., 2020). Integrating ethnochemistry within the Pancasila Student Profile Strengthening Project (P5) provides an innovative platform to support character education in Indonesian schools. Through this integration, students can develop not only a deeper understanding of chemical concepts but also core Pancasila values such as cooperation, independence, and critical thinking.

Among these challenges are the limited understanding of teachers regarding new pedagogical paradigms and the lack of curiosity or intrinsic motivation among educators to explore innovative teaching practices (Menning, 2019; Jirout et al., 2022). The success of learning activities is strongly influenced by several supporting factors, one of which is the availability and quality of instructional materials (Andi, 2015; Kalbito et al., 2024; Garay Abad, 2025). Instructional materials can be defined as any systematically organized resources designed to facilitate student learning independently, and aligned with the applicable curriculum (Magdalena et al., 2020).

In practice, the role of teachers in designing and preparing instructional materials is a critical factor in the success of the teaching and learning process (Rakhmat et al., 2019). Thus, it can be concluded that instructional materials are a crucial component in effective classroom instruction. Through the use of well-prepared materials, teachers can more effectively implement learning activities. High-quality and relevant instructional materials are positively correlated with improved student learning outcomes. Ideally, these materials should be developed in accordance with the specific needs and characteristics of the subject matter being taught (Pannen, 2001). Moreover, the Pancasila Student Profile Strengthening Project (P5) is designed to provide students with learning opportunities grounded in their surrounding environment. Therefore, the integration of P5 into instructional material development encourages the inclusion of contextual themes and topics. This approach aims to foster a more holistic understanding and meaningful learning experiences for students (Irawati, 2022).

Ethnochemistry bridges chemistry with local traditions and indigenous knowledge, offering a culturally relevant learning experience that is contextualized for students. This approach has the potential to increase students' interest in learning chemistry in a more engaging and concrete way. Through ethnochemistry, students are not only introduced to theoretical concepts but are also encouraged to analyze their real-life applications, thereby fostering a more comprehensive and meaningful learning experience (Aldiansyah, 2023). The ethnochemistry approach links chemical concepts with local wisdom and cultural heritage, offering students a deeper contextual understanding. The implementation of ethnochemistry in chemistry education holds promise in strengthening students' cultural identity while also enhancing their engagement and enthusiasm in the learning process (Rahwati et al., 2020). Furthermore, ethnochemistry-based learning is expected to significantly improve students' communication and collaboration skills through group work and hands-on learning activities (Arif et al., 2021).

The acid-base topic represents one of the fundamental areas of chemistry due to its strong relevance to everyday life, allowing it to be meaningfully contextualized through local cultural practices and traditional knowledge (Jimenez-Liso, 2020; Asli et al, 2023). For instance, the use of natural indicators in Betawi Batik dyeing derived from mangosteen rind or sappanwood extract produces distinct color changes under acidic conditions (from vinegar) and basic conditions (from lime water). This phenomenon vividly illustrates the Bronsted-Lowry acid-base theory and the equilibrium shifts of anthocyanin ions in response to pH variations (Zidny et al., 2021). Integrating such elements of local wisdom not only enhances the applicability and meaningfulness of acid-base learning but also reinforces key dimensions

of the Pancasila Student Profile, particularly critical reasoning, through chemical process analysis and global diversity through the appreciation of Indonesia's rich cultural heritage.

Acid–base chemistry is one of the essential topics in chemistry education due to its strong relevance to everyday life (Jimenez-Liso, 2020; Asli et al., 2023), such as the use of natural substances as pH indicators in traditional practices. However, in practice, the teaching of acid–base concepts often remains abstract and theoretical, making it difficult for students to connect these concepts with real-world experiences. A learning module that incorporates an ethnochemistry approach may serve as a viable solution to bridge this gap.

Chemistry is an inherently contextual subject that can be linked to various aspects of daily life. Indonesia's rich and diverse cultural heritage holds significant potential for integrating chemistry education with local wisdom through an ethnochemical approach. Such integration not only makes learning more meaningful and relevant but also fosters the development of the Pancasila Student Profile, which emphasizes values such as creativity, cooperation, and an appreciation for cultural diversity. However, in practice, the integration of ethnochemistry into chemistry instruction remains limited. For instance, the teaching of acid-base concepts is often abstract and theoretical, making it difficult for students to connect them to real-world experiences. A learning module that integrates an ethnochemical approach can serve as an effective solution to bridge this gap. This module is expected to enhance students' comprehension of acid-base chemistry while simultaneously supporting character building in accordance with Pancasila values.

METHOD

The type of research conducted in this study was development research, utilizing the ASSURE instructional design model. The ASSURE model is a systematic framework that can be used to design effective learning activities (Nguyen et al., 2025; Batir et al., 2021). ASSURE is an acronym that represents six essential steps in instructional design: (1) Analyze Learners, (2) State Objectives, (3) Select Instructional Methods, (4) Media, and Materials, Utilize Media and Materials, (5) Require Learner Participation, and (6) Evaluate and Revise.

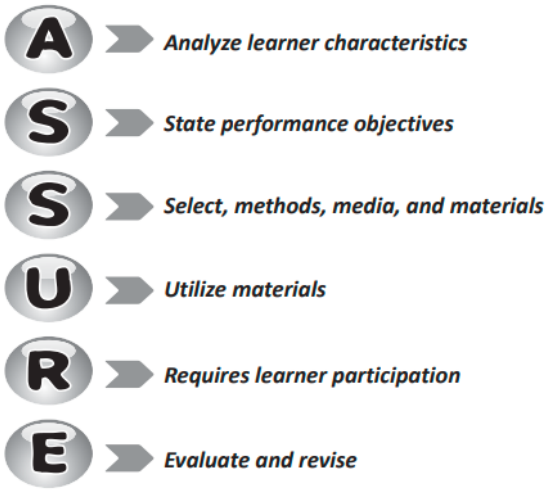

Figure 1. ASSURE Model Research Stages

The ASSURE model as in Figure 1 focuses on developing instructional activities that facilitate students in achieving the desired learning competencies (Pribadi, 2011; Mohammed, 2020). The participants in this study consisted of 85 eleventh-grade students from SMAN 38 Jakarta.

The instruments employed in this study included questionnaires and interview guidelines for conducting a needs analysis, as well as a student response questionnaire for the developed ethnochemistry-integrated acid-base instructional module. The needs analysis was carried out with both teachers and students to identify the types of learning materials required to effectively support the

teaching and learning process. Teacher interviews were conducted to explore their perspectives regarding the necessity and characteristics of instructional modules, using six guiding questions. These interview items focused on identifying the desired features and relevance of instructional modules, as illustrated by the following examples:

1. What are the strengths and weaknesses of the learning modules you have used so far?
2. Do acid-base concepts often lead to student misconceptions?
3. In what ways can instructional modules help students become more actively engaged in the learning process?
4. Can an ethnochemistry-integrated module help students develop a deeper and more contextual understanding of the material?

The needs analysis questionnaire, consisting of eight items was administered to students to obtain a deeper understanding of their requirements for an ethnochemistry integrated module. At the end of the learning process, a media feasibility questionnaire also comprising eight items was distributed to evaluate the feasibility of the developed ethnochemistry module in supporting the implementation of the P5 (Pancasila Student Profile) program in the classroom. Examples of items from the feasibility questionnaire include:

1. Does the content align with the learning objectives?
2. Does integrating ethnochemistry into the acid-base topic help students understand the material more easily?
3. Is the language used in the ethnochemistry module easy to understand?
4. Do the practice exercises provided in the module help students better understand the material and align with the explanations given?

The data analysis technique employed was descriptive analysis, which aims to provide a general overview of the feasibility of the ethnochemistry module on acid–base material (Bryman, 2016; Pebrianti et al., 2024; Insyiroh et al., 2023). Descriptive percentage analysis and categorical classification were applied to determine the product's feasibility using the following formula:

$$\text{Percentage} = \frac{\text{Obtained Score}}{\text{Total Score}} \text{x} 100\%$$

The feasibility level of the developed ethnochemistry module was evaluated following the criteria outlined by Gogahu and Prasetyo (2020), as detailed in Table 1.

Table 1. Feasibility Categories of Learning Media

Interval	Category
1-20%	Very Infeasible
21-40%	Infeasible
41-60%	Moderately Feasible
61-80%	Feasible
81-100%	Very Feasible

RESULT AND DISCUSSION

The results and discussion of this study were presented according to the ASSURE development model framework, which consists of the following six discussions:

Students Needs Analysis

The needs analysis stage aimed to identify the actual conditions of chemistry learning in schools as well as the types of teaching materials required to support an effective learning process. At this stage, questionnaires were distributed to students of classes X2, X5, X6, and X7 at SMA Negeri 38 Jakarta, with a total of 85 respondents.

The questionnaire analysis results showed that 45% of the students preferred a learning model based on practical activities or experiments, while the remaining 55% favored learning methods through

discussions and direct explanations from the teacher, supported by engaging learning media. Based on these needs analysis data, it can be concluded that experiment-based learning ranks first because practical-based learning can increase student engagement and develop higher-order thinking skills (Reyes, 2024; Arsyad et al., 2024).

Regarding interest in contextual themes, 45% of students showed a high interest in local wisdom themes, while 35% expressed interest in sustainable lifestyle issues. Learning that emphasizes local wisdom can enhance student engagement, increase motivation and learning outcomes, as well as support cultural preservation (Asrial et al., 2021; Dewi et al., 2025; UNESCO, 2017; Ernawati et al., 2024). In addition, the majority of students (90.5%) agree that the use of an engaging chemistry e-module has the potential to help them understand chemistry concepts more effectively. However, in the context of project-based learning, students reported several significant challenges. Limited time to complete projects often becomes the main obstacle and decreasing their motivation to learn. Additionally, low collaborative skills and limited prior knowledge of the material pose specific challenges in implementing project-based learning.

A semi-structured interview was conducted with Mr. Ahmad Riza Maulana, S.Pd., the chemistry teacher at SMA Negeri 38 Jakarta, on Friday, September 13, 2024, as a means of data collection. Based on the interview results, it was found that the use of teaching materials in classroom learning activities was still relatively minimal. The material was generally delivered through PowerPoint presentations, which were considered more suitable for students' needs and learning stages, particularly in constructing understanding from general concepts to more complex ones.

In the context of implementing the Strengthening Project of the Pancasila Student Profile (P5), the teacher stated that project activities were generally not yet supported by specialized modules. However, it was noted that the implementation of P5 learning often aligned with intrakurricular learning activities, such as the topic of green chemistry integrated with the theme of sustainable lifestyles. Furthermore, the interviewee emphasized that the primary need for teaching materials in the school currently was digital products, especially in the form of e-modules. E-modules are considered to have several advantages, including being interactive, easily accessible, and practical to use both inside and outside the classroom. With the availability of engaging and relevant e-modules, it is expected to increase students' interest and involvement in the chemistry learning process in a more independent and flexible manner.

Formulation of Learning Objectives and Outcomes

The stage of formulating learning objectives and outcomes aims to ensure alignment between the material and/or project theme carried out with the competencies to be achieved according to the Merdeka Curriculum. Based on the analysis of this component, several important aspects in module development were mapped out, namely:

1. **P5 Project Learning Objectives**
   The main objective of this project is to develop students' understanding and skills in integrating the values of local wisdom through an ethnochemistry approach, as a means to strengthen the Pancasila Student Profile. The project is designed to encourage students to explore various local cultures and practices related to chemical concepts, particularly acids and bases, to foster love for the nation's culture as well as enhance students' chemical literacy through project-based activities (Yulizah et al., 2025).
2. **Chemistry Topics and Materials**
   The primary chemistry topic presented in this module is the concept of acids and bases, considering students' prerequisite understanding of electrolyte solutions and chemical equilibrium. The selection of this topic is based on the urgency of the material and its relevance to contextual phenomena found in local cultural practices.
3. **Learning Outcomes (LO) Based on the ATP Merdeka Curriculum**
   The learning outcomes targeted through the development of this module include:
   a. Students are able to explain the meaning of acids and bases based on Arrhenius theory.
   b. Students are able to explain the concept of acids and bases based on the Brønsted–Lowry theory.
   c. Students are able to explain the meaning of acids and bases based on Lewis theory.

d. Students are able to reason mathematically the relationship between the pH of a solution and the concentration of H^+ and OH^- ions in acids, bases, and salts.
e. Students are able to analyze various contextual phenomena in daily life related to the concept of acid and base solutions.

4. **Theoretical Content of the Module**

This module systematically covers three main theories in the discussion of acids and bases, namely:

a. Arrhenius theory, which defines acids as substances that produce H^+ ions and bases as substances that produce OH^- ions in water;
b. Brønsted–Lowry theory, which emphasizes the role of acids as proton donors and bases as proton acceptors;
c. Lewis theory, which views acids as electron pair acceptors and bases as electron pair donors.

In addition to the theories, the discussion also focused on the formation of acid and base solutions in water, as well as understanding the strength of acids and bases, which is determined by the concentration of H^+ or OH^- ions produced. This approach enables students to understand chemical concepts in a more contextual, relevant, and meaningful way by relating them to local cultural practices.

Determination of Methods, Models, and Learning Materials

The stage of designing methods, models, and learning materials was carried out as the basis for preparing the framework of the module to be developed. The teaching material designed, titled *Ethnochemistry Learning Module for SMA/MA*, is compiled as a guide for contextual learning for high school students (SMA/MA), focusing on the topic of acids and bases in chemistry, integrated with the theme of the Strengthening Project of the Pancasila Student Profile (P5), particularly emphasizing local wisdom values.

The main focus of this module is to explore the values of local wisdom of Indonesian communities through an ethnochemistry approach relevant to the topic of acids and bases. One form of implementation in the module is a practical project activity in the form of creating Betawi batik, which represents the local wisdom of the DKI Jakarta community and is linked to the understanding of acid and base concepts in chemistry.

The content structure of this module is organized into four main sections, namely:

1. **Pancasila Student Profile and the Concept of P5**
   This section provides a comprehensive explanation of the meaning of the Pancasila Student Profile, the importance of implementing the P5 project in education, and its role in shaping students' character and competencies in accordance with the noble values of the nation.
2. **The Concept of Ethnochemistry and Its Relation to Local Wisdom**
   This discussion offered an in-depth understanding of the definition of ethnochemistry, its scope, and practical examples of Indonesian local wisdom values that are relevant and have potential to be explored in chemistry learning.
3. **Core Material on Acids and Bases**
   The material coverage included the properties and characteristics of acids and bases, acid-base theories according to Arrhenius, Bronsted-Lowry, and Lewis, as well as acid-base indicators that form the basis for analyzing chemical phenomena in a local context. The material was systematically organized, concise, and clear, complemented by supporting media such as instructional videos and interactive quizzes to strengthen students' understanding.

This module was designed not only to improve students' chemical literacy but also to encourage them to understand and appreciate local culture through a scientific and project-based approach, in line with the values of the Pancasila Student Profile. Local wisdom related to chemistry is often overlooked in the curriculum, even though this approach can enhance students' critical thinking skills and improve their scientific literacy (Zidny et al., 2020).

Utilization of Learning Materials and Media

During the development of the learning module, a feasibility validation was conducted by experts. This validation was carried out to ensure that the module is accurate and suitable for use (Kusworo, 2020).

The validators for this module consisted of two subject matter experts and one expert in media/visual communication. The subject matter experts provided assessments, comments, suggestions, and revisions related to the content aspects, while the media expert gave evaluations, feedback, recommendations, and revisions concerning the media and layout design of the learning module.

Table 2 Expert Validation Result

No	Indicator	Percentage (%)
1	Completeness of the content/learning material in the designed learning module	98
2	Depth of the material discussed in the learning module	96
3	Relevance of the material presentation in the learning module to the learning objectives as outlined in the curriculum	80
4	The activities presented are able to support the achievement of learning outcomes	98
5	The module's ability to motivate students	98
6	Encouragement of critical thinking for students	98
7	Effective and efficient use of the learning module in practical learning	98
	Average	97,75

The validation results as in Table 2 from Subject Matter Expert 1 categorized the developed learning module as highly feasible, with a score of 97.75%**.**

Table 3. Expert Validation Result 2

No.	Indicator	Percentage (%)
1	Completeness of the content/learning material in the designed learning module	80
2	Depth of the material discussed in the learning module	80
3	Relevance of the material presentation in the learning module to the learning objectives as outlined in the curriculum	98
4	The activities presented are able to support the achievement of learning outcomes	98
5	The module's ability to motivate students	98
6	Encouragement of critical thinking for students	80
7	Effective and efficient use of the learning module in practical learning	98
	Average	90,28

The validation results as in Table 3 from Subject Matter Expert 2 categorized the developed learning module as feasible, with a score of 90.28%**.** Thus, the average validation score as in Table 4 from both subject matter experts was 94.01%**,** indicating that the learning module is highly feasible for implementation**.**

Table.4 Average Expert Validation Result

Validator	Score
Expert 1	97,75
Expert 2	90,28
Average	94,01

Subsequently, media validation was conducted by a visual media/communication expert, resulting in a feasibility score of 96.30% as in Table 5 for the module's design and layout, which falls under the "highly feasible" category. Suggestions for improvement included ensuring consistency in the use of chemical symbols, notations, and terminology.

Table 5. Media Expert Result

No	Indicator	Percentage (%)
1	Text readability in the module	100
2	Completeness of the module components	100
3	Module appeal, including: choice of visuals, font, and color combinations used in the developed module	98
4	Accuracy of terminology used, in accordance with the Indonesian Dictionary (KBBI) and/or agreed-upon scientific terms	100
5	Relevance of illustrations to the substance of the message being conveyed	100
6	Consistency in the use of chemical symbols, notations, and terminology	80
	Average	96,30

In the next step of this phase, content development was carried out for the materials to be included in the learning module. Figure 2 were several sample page layouts featured in the designed learning module.

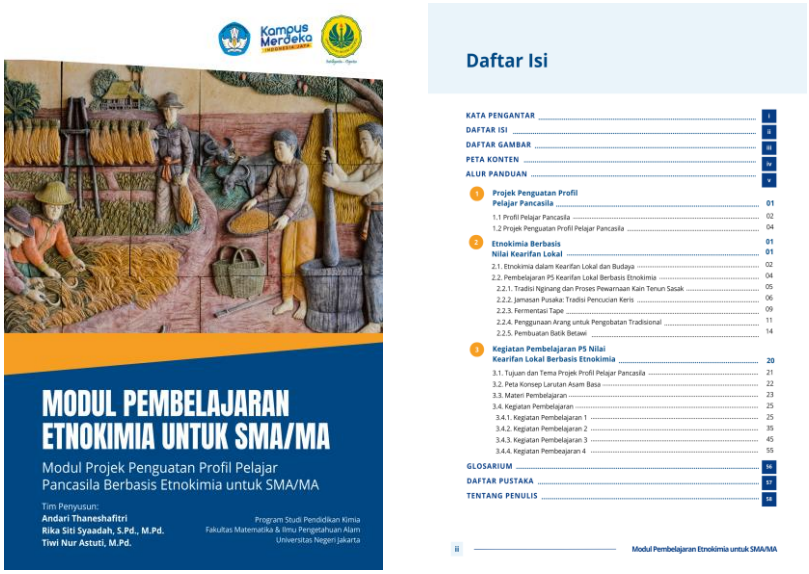

Figure 2. Cover and Table of Contents of the Developed Ethnochemistry Module

In the introduction section of the learning module, information was provided regarding the content map to help students understand the P5-based ethnochemistry module. This section explained that the module was designed specifically for implementing the P5 project with a local wisdom theme rooted in ethnochemistry, aimed at SMA/MA students, focusing on the chemistry topic of acids and bases, accompanied by a step-by-step guide for the learning process.

Further in Figure 3, Chapters 1 and 2 delve deeper into the definitions of the Pancasila Student Profile Strengthening Project (P5) and ethnochemistry. These chapters also presented explanations about several widely recognized local wisdom values in Indonesian society that are connected to ethnochemistry. Next, Chapter 2 provided further explanation regarding several examples of local wisdom phenomena based on ethnochemistry, including: (1) the tradition of chewing betel nut (Lombok); (2) the ritual cleansing of heirlooms (Java); (3) the making of tape (fermented cassava or rice) (Sumatra and Java); (4) charcoal as a traditional medicine (Java and Bali); and (5) the making of Betawi batik (Jakarta).

The next chapter discussed the topic of acids and bases, along with a series of learning activities within the implementation of the Pancasila Student Profile Strengthening Project (P5) based on ethnochemistry. The acid-base material in this module was divided into three main subtopics: (1) introduction to the properties and classification of acids and bases; (2) understanding the roles of acids and bases according to acid-base theories such as Arrhenius, Brønsted-Lowry, and Lewis; and (3) introduction to acid-base indicators.

Figure 3. View of Chapter 1 and Chapter 2 of the Ethnochemistry Module

Figure 4. Presentation of Local Wisdom Values based on Ethnochemistry in The Module.

The designed P5 learning activities consist of five systematic and contextual stages. In Learning Activity 1, students study the basic concepts of acids and bases through video presentations, group discussions, and interactive quizzes to assess their initial understanding. Learning Activity 2 focuses on exploring concepts using digital learning media, specifically PhET simulations, aimed at strengthening students' understanding of acid-base concepts and solution equilibrium. This is followed by students completing a self-assessment table.

Next, in Learning Activities 3 and 4, students related acid-base concepts to contextual phenomena connected to local wisdom popular in the community. Specifically, in Learning Activity 4, students were invited to create Betawi batik as a representation of the local culture of DKI Jakarta, linking it to acid-base concepts. Afterward, students, together with the teacher, complete a reflection journal as part of reinforcing the dimensions of the Pancasila Student Profile. In Learning Activity 5, students conduct a deeper exploration of culture and local wisdom through analysis of relevant scientific journals, then present their findings in the form of blog articles and/or cultural promotional videos.

The entire series of learning activities was designed to be carried out within a total allocation of 20 Learning Hours (JP), with each JP lasting 40 minutes. A detailed breakdown of the time allocation for each learning activity is provided in the accompanying schedule table in Table 6.

Table 6. Series of project-based learning activities on ethnochemistry with the topic of acids and bases.

No	Learning Activities	Time Allocation
1	Recognizing the Properties and Classification of Acids and Bases	4 learning hours
2	Understanding the Role of Acids and Bases Based on Acid-Base Theories	3 learning hours
3	Introducing Acid-Base Indicators	4 learning hours
4	Applying Acid-Base Concepts to the Local Wisdom Values of Betawi Batik Based on Ethnochemistry	6 learning hours
5	Exploring Local Wisdom Values Based on Ethnochemistry in Indonesia	3 learning hours
	Total Learning Hours	20 learning hours

Implementation in Learning

The next stage in the development process is the implementation phase, which aims to test the feasibility of the ethnochemistry learning module based on the Strengthening Project of the Pancasila Student Profile (P5) that had been developed. The trial was conducted using the small-group test method, involving 20 students from Class X7 at SMA Negeri 38 Jakarta as respondents. Assessment was carried out using a questionnaire instrument to measure students' perceptions of the module's quality. The analysis results showed that the module received an average feasibility score of 94.05%, which falls into the "very good" category. This feasibility was achieved because the ethnochemistry-based module aligns with the contextual values of the respondents as residents of DKI Jakarta. Additionally, the appealing visualization in the ethnochemistry module increased students' learning motivation, especially for the acid-base material (Nursamsu et al., 2020).

The assessment included several key indicators such as clarity of presentation, visual appeal, relevance of the material to daily life, and effectiveness in aiding the understanding of chemistry concepts. These findings indicate that the module has high potential to be used as teaching material that supports contextual and character-based learning, particularly in strengthening the values outlined in the Pancasila Student Profile. A detailed distribution of the feasibility test results from the small group test is systematically presented in Table 7.

Table 7. Results of the Learning Module Feasibility Questionnaire from the Small Group Test

No.	Assessment Aspect	Score (%)
1	Overall, the presentation style of the module is enjoyable	100
2	The illustrations in the module are attractive	92
3	I prefer reading this module over regular textbooks	80
4	I can understand the material in the module well	90
5	The practice questions in the module are challenging enough for me to complete	88
6	The sentences/terms in the module are easy for me to understand	92
7	Learning using this ethnochemistry module motivates me and makes me more focused and enthusiastic in studying	100
	Average feasibility aspect score	91,7%

Learning Evaluation

The final stage of the development process for this learning module was the feasibility evaluation through a limited trial (small group test) and validation by experts. This evaluation is important to determine compliance with educational standards and to ensure the quality of the module (Yanuarti et al., 2022; Alfina et al., 2021). The evaluation results showed that the module received an overall very good rating, with an average score of 91.7%. The assessed aspects included presentation style, illustrations, visual appeal, material clarity, and the quality of practice questions. Positive assessments were also given

by teacher validators and media experts. Chemistry content validators awarded an average score of 94.01%, indicating that the module is highly suitable for use in the learning process. Meanwhile, assessments from media/visual communication experts showed a very high feasibility level, with an average score of 96.30%.

Nonetheless, the evaluation also identified several areas for improvement to further refine the module. These include: (1) enhancing the consistency in the use of chemical symbols, notations, and terminology to improve accuracy and readability of the material; (2) adding more comprehensive content on acid-base topics to enrich students' conceptual understanding; (3) developing a variety of cognitive levels in the practice questions to address a broader range of student abilities; and (4) including a glossary as a reference for chemical terms used in the module to strengthen students' scientific literacy.

With evaluation results indicating a high level of feasibility and constructive feedback for improvements, this learning module has great potential to be effectively implemented in project-based chemistry learning aligned with the strengthening of the Pancasila Student Profile.

CONCLUSION

Based on the analysis of research data, it can be concluded that the developed ethnochemistry learning module was classified as highly feasible for implementation in chemistry learning at the high school level, particularly within the framework of the Strengthening Pancasila Student Profile Project (P5). The module's feasibility validation, which included small-group testing and assessments by content and media experts, yielded consistently positive results. The feasibility score of 91.7% from small group testing, categorized as "excellent", confirmed the module's strengths in material presentation, illustration quality, visual appeal and relevance of exercise. Furthermore, validation by teachers as content experts resulted in a score of 94.01%, indicating the accuracy of the chemistry content and its alignment with learning objectives. Meanwhile, assessment by media or visual communication experts, with a score of 96.30%, reinforced that the module's design and presentation aspects optimally support the learning process.

Based on these findings, the P5-based ethnochemistry learning module has proven to be not only technically and substantively feasible but also capable of presenting an innovative learning approach through the integration of acid-base concepts with local cultural contexts, realized through learning videos, interactive quizzes, and project guides. This approach successfully creates contextual, engaging, and meaningful learning experiences while supporting the development of student character and scientific literacy in line with the vision of the Merdeka Curriculum. For further development, it is recommended to expand the scope of cultural elements in acid-base materials and develop ethnochemistry modules for other chemistry topics to enrich the repertoire of local wisdom-based learning.

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