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THE EFFECTIVENESS OF IMPLEMENTING LOCAL WISDOM-BASED CHEMISTRY LEARNING MODULES IN HIGH SCHOOLS TO INCREASE STUDENTS' INTEREST IN LEARNING: A SYSTEMATIC REVIEW

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Abstract: This study aims to analyze the effect of implementing local wisdom-based chemistry learning modules in high school on students' learning interest. Local wisdom is a part of culture in society that can be integrated into chemistry learning to make the material more contextual and relevant to students' daily lives. Attractive and relevant modules can enhance students' comprehension, motivation, and potential. The research method used is the Systematic Literature Review (SLR), in which data were collected from articles indexed in Google Scholar articles indexed on the SITA page. Of 387 articles, 35 met the criteria and were fully accessible for analysis. The results of the study indicate that implementing local wisdom-based modules that are interesting and systematically designed can improve students' interest in learning. This study concludes that integrating local wisdom into chemistry learning not only improves comprehension of the material but also fosters students' love and concern for local culture.

Keywords: Chemistry Learning Module, Chemistry Learning Based on Local Wisdom, Chemistry Learning Interest

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INTRODUCTION

Simple education can be interpreted as a human effort to guide human behavior in accordance with the values of society and everyday life. According to Law No. 20 of 2003 concerning the National Education System, in paragraph 1 (2003: 6), it is stated that education is a secular effort that aims to develop learning and the learning process of students so that they can actively develop their potential to have religious spirituality, self-control, personality, intelligence, noble morals, and skills for themselves, the general public, the nation, and their country. Education has an important role in creating quality and high-potential humans because it is the main means to increase human potential. Because of the importance of the education sector, every country strives to improve the quality of education so that it can compete on the global stage. The development of Science and Technology (IPTEK) is accelerating in the era of globalization, one of which is chemistry (Hemayanti et al., 2020).

Chemistry is a field of study that focuses on teaching students the principles, theories, composition, structure, laws, and chemical reactions that can be related to everyday life (Kurniawati et al., 2023). Students will have difficulty understanding chemistry material if it is presented in an unengaging manner. Conversely, if the concepts taught are related to everyday life, students will experience meaningful learning (Asmaningrum, Irianto, et al., 2018; Asmaningrum, Koirudin, et al., 2018). Because chemistry concepts are highly relevant to everyday life, systematic scientific writing through problem-solving stages is necessary (Raman et al., 2024; Vo et al., 2025) with well-designed teaching tools to facilitate student understanding of the concepts. One systematic and engaging educational medium is a teaching module.

Teaching modules are a medium that supports the learning process for students, especially those with visual learning styles, because they make abstract chemistry material easier to understand (Adelia et al., 2023; Munawwarah et al., 2025) . Teachers can utilize modules to improve students' understanding and encourage them to be capable and motivated to learn independently (Dini et al., 2023; Sidauruk et al., 2025). Therefore, teaching modules need to be designed in an engaging, efficient, and innovative manner, tailored to students' needs and characteristics (Errabo & Ongoco, 2024). Furthermore, modules should also introduce elements of local culture (Fauziah & Ihsan, 2024; Nugraheni & Pratomo, 2025). Developing learning modules that incorporate local wisdom values can help students achieve their learning objectives and foster awareness of preserving, caring for, and developing their surrounding environment (Saputra et al., 2016).

Local wisdom is an inseparable part of a community's culture. Local wisdom encompasses cultural values embedded within communities, including the use of local materials, which are part of a particular community's traditions (Hanapi et al., 2025; Rasidi & Istiningsih, 2025). Local wisdom in chemistry learning can be used as an approach to chemistry learning, making it contextual and relevant to students' environments (Wahyudiati, 2022; Wahyudiati & Fitriani, 2021). Therefore, it is necessary to delve deeper into the importance of integrating local wisdom into school learning, particularly in relation to the teaching modules used. This aims to ensure that learning not only provides students with knowledge but also instills a love and concern for the diversity of local cultures in their environment. This study will also discuss the impact of implementing local wisdom-based learning and the steps teachers can take to integrate it. It is hoped that this study will encourage teachers to design and implement local wisdom-based learning in schools.

However, in reality, high school students often show low interest and motivation in learning chemistry (Liu et al., 2022; Whatoni & Sutrisno, 2022). One of the main causes is the lack of engaging and contextual learning approaches, which leads to low enthusiasm and ultimately affects student learning outcomes (Huda & Rohaeti, 2023). Although teaching modules have been widely used to support independent learning, many existing modules have not optimally integrated contextual elements such as local wisdom, which could make learning more meaningful and relevant to students' daily lives.

Learning motivation plays a crucial role in determining students' engagement and success in the learning process. It acts as a driving force that encourages students to actively participate, maintain attention, and develop a positive attitude toward learning (In'am & Sutrisno, 2021; Otoo et al., 2018; Usman & Rahmawati, 2021). Therefore, integrating local wisdom into chemistry learning modules is expected to create a more engaging and meaningful learning experience that can enhance students' learning interest.

Based on these gaps, this study aims to specifically investigate the effect of implementing local wisdom-based chemistry learning modules on high school students' learning interest. In particular, this study seeks to answer the following research question: "Does the use of local wisdom-based chemistry learning modules significantly improve students' learning interest compared to conventional learning approaches?"

METHOD

This research is a literature study using the Systematic Review (SR) method, commonly referred to as a Systematic Literature Review (SLR) (Torres-Carrion et al., 2018). This is a systematic technique for collecting, critically examining, integrating, and compiling the results of various research studies on a research question or topic of interest (Lame, 2019). The research began by finding articles related to the research topic to be studied (Nightingale, 2009). The literature search began using data contained in the GS articles indexed on the Sinta page, which served as the primary source of data for this research. The literature search used the keywords: "Chemistry learning module, Chemistry learning based on local wisdom, and interest in learning chemistry."

The literature or articles accessed were published in Indonesian. Screening was carried out to select literature deemed appropriate and relevant to the research title. The literature retrieved was published between 2015 and 2025. The literature search identified a large number of articles from Indonesian national journals, totaling 387. After duplication and filtering, 278 articles were found published between 2015 and 2025. Then, 76 articles related to the research topic were selected from several sources. After further analysis, 35 articles were available for free download.

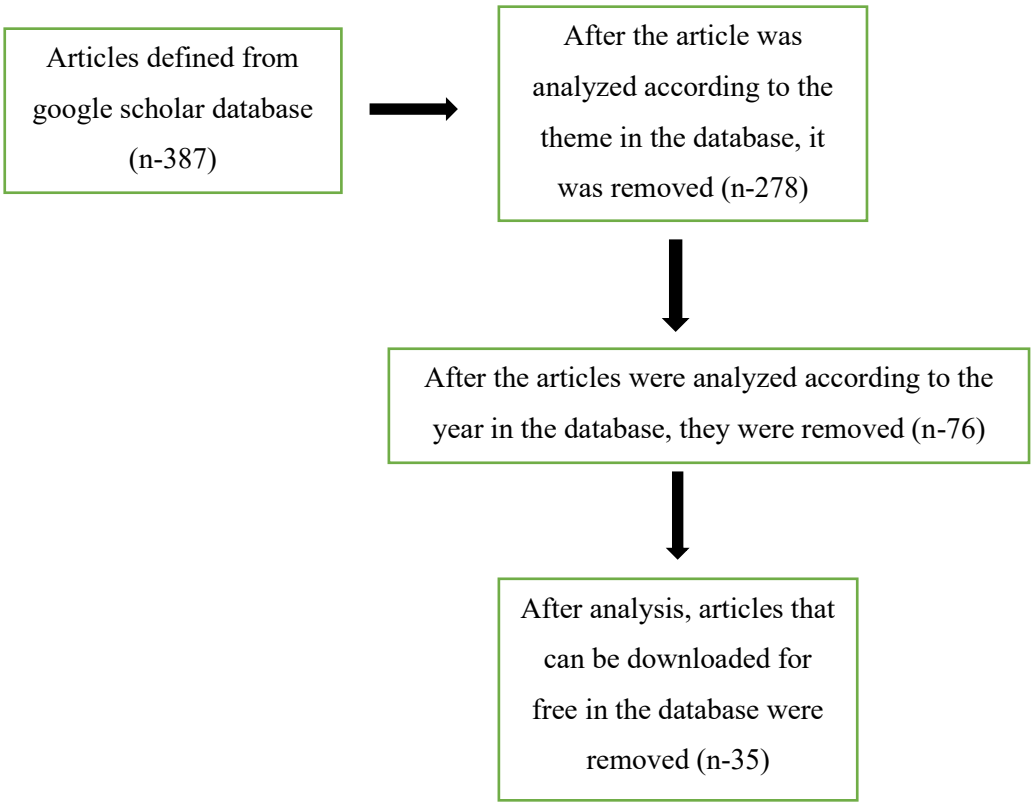

Figure 1. Systematic Literature Review Scheme

Data analysis was conducted using a thematic approach, grouping the literature based on emerging themes or patterns, such as the type of local wisdom approach used, the learning outcomes achieved, and the obstacles encountered in its implementation. The results of this analysis were then synthesized to develop conclusions that describe the influence of local wisdom-based learning approaches on the comprehensive and evidence-based understanding of chemistry concepts

FINDING AND DISCUSSION

This stage is also known as the research and data collection stage. This stage is carried out by analyzing the impact of implementing local wisdom-based teaching modules in high schools to increase student learning interest. The implementation of local wisdom-based chemistry learning modules is an educational innovation that aims to bridge learning materials with local wisdom that exists in students' daily lives. This module aims to facilitate students' understanding of chemistry material. This module is implemented with a constructivist paradigm. This can enable students to construct material concepts independently (Wulandari et al., 2019). The material presented in the module is also linked to everyday life and local wisdom with the aim of students understanding chemistry material comprehensively. Karyadi et al. (2016) stated that the local wisdom-based learning process can enable students to use their scientific abilities to understand the environment (Albar et al., 2025; Lubis et al., 2022). The scientific process can be one of the characteristics of the local wisdom approach. This is in accordance with the basic framework of the Merdeka curriculum. Based on the Pancasila student profile, which is lifelong competence, six main characteristics are outlined: 1) Faith and devotion to God Almighty, and noble character; 2) Global diversity; 3) Mutual cooperation; 4) Creativity; 5) Critical thinking; 6) Independence. Indonesian students maintain a noble culture and are open-minded to respect each other's feelings when interacting with other cultures (Majir, 2020). Local wisdom in the new education system is part of the independent curriculum, which instructs students to love and appreciate their country's culture. Lifelong learning through local wisdom can expand students' abilities and support the realization of the Pancasila student profile. The Pancasila student profile is an effort to build character based on Pancasila values , and can be implemented in daily life to improve the quality of education in Indonesia (Jamaluddin et al., 2020).

The chemistry learning module is presented in full color to stimulate students' interest in learning. The module's content not only presents material but also includes a column on the history of Pekalongan batik, new insights, and ethnoscience chemistry puzzles. This

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ethnoscience learning module also encourages the preservation of batik culture. In presenting the material, students are encouraged to develop concepts so that the material will be retained in their minds for a longer period. Despite the advantages mentioned above, the ethnoscience-oriented module also has drawbacks: its users are still limited to students in Pekalongan. Furthermore, the culture discussed focuses solely on batik (without addressing other ethnicities/cultures). Descriptions of the selected articles are shown in the **Table 1**.

Table 1. list of some studies and the findings of implementing local wisdom-based chemistry learning modules

Authors	Methods	Subjects	Findings
Aminah et al., 2024	R&D (*Research and Development) with 4-D model*	Class XI	Valid 83.25%, practical 91.13% and 87.82%
Ayu et al., 2025	*R&D With ADDIE Model*	Class XI	E-modules based on ethno-stem were validated with a score of 0.91 on the assessment scale and categorized as very valid. The sample in this study, namely 65 students, had an average score of 94, indicating that it was very practical.
Riza et al., 2020	Development using 4-D model design	Class XII IPA	Valid by material experts (average 85.30%), media experts (average 87.32%)
Astuti et al., 2018	*Research And Development* (R&D)	Class XI MIA 1	Valid, effective, and practical
Agussalim et al., 2021	*Research And Development*	Class XI IPA	Validity results from material experts, media experts, and practitioners
Irfandi et al., 2018	*Research And Development*	Class X	The validation test results were 92.59%, categorized as valid.
Lia et al., 2016	*Research and Development (RnD)* with ADDIE development design.	Class X	Valid stage I expert value 82.67%, valid stage II increased by 90%

Irmita, 2018	*Research and Development*	Class XI	Valid according to material experts, media and subject teachers, indicated by a value of 0.71
Handayani et al., 2022	R&D *(Research and Development)*	Class XI IPA	The feasibility level is 0.83, very feasible and very practical at 89.14%.

Table 2. Types of local wisdom

Authors	**Locam Wisdom Subject**	**Region**
Tangio et al., 2023	Local plants	Merantai Vilage
Firdaus et al., 2021	Foods	Betawi
Fatkhiyani, 2018	Foods	Cirebon
Ardian Hangga Kelana et al., 2025	Foods	Papua
Khery et al., 2022	Plants	Lombok

Various studies have shown that local wisdom-based chemistry learning modules contribute to improving students' cultural understanding and learning interests. For example, a study by Toharudin & Kurniawan, 2017 suggests that local wisdom encompasses various values that grow and develop within communities. These values have significant potential to serve as a foundation for developing educational values. Introducing local wisdom values to the younger generation can be done through learning activities in schools, universities, and other non-formal educational settings. This aligns with the view that learning that emphasizes local potential is expected to develop regional excellence and foster student creativity and character (Mannan et al., 2015). When students learn something familiar from their parents' or community's lives, the learning process becomes more enjoyable. Furthermore, local wisdom plays a crucial role in maintaining students' closeness to the school environment and encouraging teacher involvement in learning that is relevant to students' lives (Hairida, 2017).

Quality and Strength of Reviewed Studies

Based on Table 1, most of the reviewed studies employed Research and Development (R&D) designs, such as the 4-D and ADDIE models, focusing primarily on validity and practicality testing of local wisdom-based chemistry modules. The reported results consistently indicate high validity (e.g., >80%) and practicality levels.

However, a critical examination reveals several limitations. First, most studies emphasize product feasibility (validity and practicality) rather than measuring learning outcomes or learning interest experimentally. Only a limited number of studies explicitly evaluate the effectiveness of the modules in improving students' learning interest. Second, the sample sizes are relatively small and restricted to specific classes or schools, which limits the generalizability of the findings. Third, many studies lack control or comparison groups, making it difficult to conclude causal relationships between the use of modules and increased learning interest.

Therefore, although existing studies suggest that local wisdom-based modules are valid and practical, the empirical evidence supporting their effectiveness in increasing learning interest is still limited and requires more rigorous experimental investigation.

Relevance of Local Wisdom in Chemistry Learning

Studies summarized in Table 2 demonstrate that local wisdom, such as local plants, traditional foods, and regional practices, can contextualize chemistry learning. This aligns with previous findings that integrating local culture into learning enhances students' connection to the material and makes learning more meaningful.

For instance, the use of natural plant-derived indicators (e.g., starfruit flower extract) provides a concrete example of how abstract chemical concepts like acid-base theory can be linked to students' daily experiences. This contextualization supports students' conceptual understanding and promotes environmentally friendly practices.

However, the reviewed studies also show that the integration of local wisdom is often limited in scope, focusing only on specific cultural elements (e.g., batik in Pekalongan). This indicates that while the approach is promising, its implementation is not yet diverse or scalable across different regions and cultural contexts.

Meanwhile, utilizing natural resources, such as plants, as content and learning media is one way to integrate chemical concepts into everyday life. For example, when studying acids and bases, specifically determining whether a solution is acidic or basic, organoleptic testing cannot be used to determine the taste of acidic and basic solutions because some acidic and basic solutions are toxic if ingested (Andarias, 2018; Nurhujaimah et al., 2016). Therefore, an acid-base indicator, known as pH, is needed to determine whether a solution is acidic, basic, or neutral. The acidity or basicity of a solution can be determined by observing the color changes in the acidic and basic solutions (Solang et al., 2021).

Furthermore, various studies have been conducted on the use of plants as learning media in chemistry. One example is the use of starfruit (*Averrhoe bilimbi* L.) as a natural indicator to identify acidic and basic solutions. In laboratory practice, synthetic litmus paper is commonly

used to test the acidity or alkalinity of a solution. Although this litmus paper is durable and durable, it is quite expensive, and its use can have a negative impact on the environment. As a more environmentally friendly alternative, starfruit flower extract can be used as a natural indicator. Starfruit flowers were selected for their striking color, particularly their intense purple, and for their anthocyanin content, which functions as a pH-sensitive dye. This natural indicator from starfruit flowers can be developed into paper form by dipping filter paper into the flower extract, resembling artificial litmus paper.

Impact on Students' Learning Interest

The literature suggests that local wisdom-based modules can increase students' interest in learning by making it more engaging, contextual, and meaningful. Indicators of learning interest include attention, curiosity, active participation, and enjoyment during learning activities.

However, the relationship between local wisdom-based modules and learning interest is not always directly measured. Many studies infer increased interest from positive student responses or practical results, rather than using standardized instruments to measure learning interest.

This indicates that while there is strong theoretical support for the role of local wisdom in enhancing motivation, empirical evidence remains indirect and somewhat limited.

Other Factors Influencing Learning Interest

The findings also highlight that students' learning interest is influenced by multiple factors beyond instructional modules, such as (1) Learning time management, (2) Teaching methods, (3) Students' prior motivation, and (4) the abstract nature of chemistry content.

This suggests that local wisdom-based modules alone are not sufficient to fully address low learning interest. Instead, they should be integrated with effective pedagogical strategies and supportive learning environments.

As mentioned above, students' learning interests are not only determined by local wisdom-based learning modules but also by various other factors. Learning interest can be identified through several indicators, including feelings of enjoyment or liking for learning activities, a tendency to prefer learning activities over others, a sense of interest, an awareness of the need to learn independently without being instructed, active involvement in the learning process, and the ability to concentrate during learning activities.

However, in reality, many high school students lack interest in chemistry. Not all high school students have a high level of learning interest (Hemayanti et al., 2020; Huda & Rohaeti,

2023). Students' low interest in chemistry is due to the abstract nature of the material, which tends to be difficult to understand (Huda & Rohaeti, 2023; Uswatun & Mubarak, 2024).

Meanwhile, learning interest will not develop without motivating factors that tap into students' emotions. One motivating factor that influences learning interest is learning time. If learning time is managed appropriately, it can encourage greater student interest in learning, optimize the learning process, and improve learning outcomes.

On the other hand, learning interest can be seen through curiosity, attention, participation, and the drive or awareness to learn. Student learning interest is not solely measured by learning outcomes, but is also reflected in a deep interest in something, a preference for certain activities, and a tendency to actively participate in various activities (Otoo et al., 2018). Learning interest is evident through students' expressions of joy, attention, interest, awareness, involvement, and curiosity.

Synthesis and Research Gap

Overall, the reviewed studies indicate that local wisdom-based chemistry learning modules are valid, practical, and theoretically promising for enhancing learning interest. However, there are notable gaps (1) Lack of experimental or quasi-experimental studies, (2) Limited measurement of learning interest as a primary variable, and (3) Restricted contextual diversity of local wisdom integration

Therefore, this study is important because it aims to provide more robust empirical evidence by directly examining the effect of local wisdom-based chemistry learning modules on students' interest in learning chemistry.

CONCLUSION

Based on the literature review of 35 selected articles indexed in Google Scholar and SINTA, it can be concluded that the implementation of local wisdom-based chemistry learning modules shows promising potential to enhance students' learning interest. This is mainly because the materials are contextual and closely related to students' daily lives, which can encourage greater engagement, participation, and motivation in the learning process.

However, this conclusion should be interpreted with caution. Most of the reviewed studies focus primarily on validity and practicality aspects, with limited empirical evidence from rigorous experimental designs that directly measure students' learning interest. In addition, the scope of the review is restricted to specific databases and contexts, which may limit the generalizability of the findings.

Therefore, further research using more robust methodologies and broader data sources is needed to confirm the effectiveness of local wisdom-based chemistry learning modules in improving students' learning interest.

LIMITATION

This study has limitations because it only used articles accessed through Google Scholar and was limited to Indonesian-language articles that can be downloaded for free. This limits the scope of the data analyzed and may not represent the full range of research relevant to the topic.

Consequently, further research is recommended to expand literature sources from other, more diverse databases and consider the use of foreign-language articles to obtain more comprehensive and in-depth results.

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