

Development of Science and Chemistry Teaching Modules Based on Local Potential Spice Nutmeg and Cloves from Moti Island through Lip to Improve Chemistry Literacy of Junior High School Students

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ABSTRACT

This study aims to develop an IPA-chemistry teaching module based on the local potential of nutmeg and cloves on Moti Island through the Project Inquiry Training (LIP) model to improve junior high school students' chemical literacy. Using an R&D approach with the ADDIE model, the research was conducted up to the development stage through needs analysis, classroom observation, and questionnaires. Descriptive analysis showed that 89.10% of students had never used local-potential-based teaching materials for acid-base topics. A prototype module was then designed and validated by three experts, yielding an average score of 3.56, indicating high feasibility. The findings confirm that the developed module is valid and suitable for use in enhancing students' chemical literacy.

INTRODUCTION

21st-century education meets the demands for contextual learning and science and technology-based products, in line with the Merdeka curriculum. The Merdeka curriculum is characterized by integrating local potential into project-based and contextual learning (Kemendikbudristek, 2022), adapting to student characteristics and learning achievement levels.

The Independent Curriculum refers to student characteristics or adapts to the interests and needs of students throughout the learning process. Therefore, in the teaching of IPA-Chemistry (Natural Sciences-Chemistry) in Indonesia, particularly at the SMP (junior high school) level, there are still various challenges in improving students' understanding of basic chemical concepts. Acids and bases are a crucial topic, but they are often considered difficult by students. One of the main reasons for this difficulty is the lack of real-life context can connect theory to students' everyday experiences related to chemical literacy. Chemical literacy is an understanding of the properties of particles of matter, chemical reactions, and the application of chemistry in everyday life. Chemical literacy has five aspects: knowledge, context, competence, and attitude. However, the chemical literacy scores of students in Indonesia are still low, based on the results of the PISA assessment. (Program for International Student Assessment) by OECD ((Organization for Economic Co-operation and Development) in 2022, namely 67 out of 81 countries with a score of 383 (Nur A.L, Arismunandar & Darman M., 2024). The low chemical literacy skills of students in Indonesia are due to the fact that chemistry material is still considered difficult by some students, or they are unable to connect theory with practice.

One effort to improve students' chemical literacy is to develop an IPA-chemistry teaching module based on local potential for acid-base material for grade VII, as part of a contextual and relevant learning process for the students' environment. The local potential of Moti Island, which is rich in natural resources, such as materials that have acidic or basic properties, namely spice nutmeg and cloves, can provide opportunities to link chemistry learning to real conditions around students. The use of local contexts in learning can increase student engagement (Deasy et al. (2024); Melianti, E. (2020); Hengki, W. & Arismunandar. (2018); Patresia, I., Silitonga, M., & Ginting, A. (2020)) and help them understand chemical concepts more deeply so that it can improve students' chemical literacy (Nur A.L, Arismunandar & Darman M., 2024).

Through an IPA-chemistry teaching module based on local potential, interaction will be created between teachers and students, thus helping students in following the learning process. The development of an IPA-chemistry teaching module based on the local potential of nutmeg and cloves contains general information, objectives, learning steps or RPP, LKPD (student worksheets) and question instruments that can accommodate chemical literacy. The activities of this science chemistry teaching module based on local potential are integrated with the LIP (Inquiry Training-Project) learning model, the syntax of which is confronting problems; collecting data to verify problems and determine hypotheses; designing local potential project designs; monitoring local potential projects; preparing reports and presentations/publications of project results;

making conclusions related to local potential (Nur A.L, Arismunandar & Darman M., 2024). By implementing the LIP learning model, it is hoped that students can freely explore creativity and express themselves according to the topics presented independently or in groups in line with current developments in science and technology.

Based on the background, the researcher has conducted a study entitled "Development of IPA-Chemistry Teaching Modules based on the Local Potential spice of Nutmeg and Cloves on Moti Island through LIP to Improve the Chemical Literacy of Junior High School Students".

LITERATURE REVIEW

Teaching Module

A teaching module is a part of a learning tool that contains general information, learning objectives, learning steps/RPP, LKPD (student worksheets), and question instruments that can accommodate chemical literacy. This teaching module can be used in learning because it can be implemented in student activities to achieve competency standards (Hengki, W. & Arismunandar (2018); Sugiyono (2016)).

LIP Learning Model

The LIP (Inquiry Training-Project) learning model emphasizes contextual learning that is experienced directly by students, so that students can develop their creativity through practice and projects, so that they will obtain a meaningful product (Hengki, W. & Arismunandar. (2018). The LIP learning model will also make students actively involved in constructing scientific knowledge and attitudes through project activities collaborative, so that learning becomes meaningful (Hengki, W. & Arismunandar. (2018); Adnan, Muharram & Ahmad J. (2019)). 1) Steps of the LIP Learning Model The steps of the LIP learning model are: monitoring local potential projects; preparing reports and presentations/publications of project results; making conclusions related to local potential [9]. 2) Advantages of the LIP Learning Model are: a. Increasing motivation, collaboration and mutual respect. b. Making students more active in learning.

Chemical Literacy

Chemical literacy is an understanding of the properties of material particles, chemical reactions, chemical laws and theories, and general chemical applications in everyday life. According to Shwartz (Swartz, W., Ben-Zvi, R., & Hofstein, A. (2006)), people who have chemical literacy must understand the basic concepts of science/chemistry. Assessing chemical literacy can use the suitability between the PISA assessment framework and the Shwartz framework (Swartz, W., Ben-Zvi, R., & Hofstein, A. (2006)). The aspects of science/chemistry literacy in the PISA assessment are knowledge, context, competence, and attitude.

METHODOLOGY

This research is R&D (research and development), where the product developed in this research is a science-chemistry teaching module based on the local potential spice of nutmeg and cloves from Moti Island. This research design uses the ADDIE development model (Analysis, Design, Development, Implementation, and Evaluation) from Branch (Branch, RM, 2009). However, this research is limited to the stagedevelopment, product development. Systematically, the steps taken in this research are as follows:

1. Analyze The analysis stage is the initial needs analysis, which involves identifying and determining learning requirements. It consists of three stages:
 - a) Student analysis. This step is carried out to identify initial student characteristics that are appropriate for learning design and development.
 - b) Curriculum analysis. Learning analysis is a collection of procedures for determining the content of learning units and curriculum analysis.
 - c) Objective analysis. This analysis is carried out to determine or formulate learning objectives to be achieved by students. After this step is obtained, it is continued with an evaluation (formative evaluation) to be able to determine and define the learning requirements and then revise them.
2. Design StageDesignor this planning stage aims to design a prototype of the learning device. This stage consists of:
 - a) Preparation of a benchmark test, this step is a link between the stagesdefineAnddesign. Benchmark tests convert specific objectives into an outline of learning materials.
 - b) Designing learning strategies.
 - c) Selecting and designing learning materials.
 - d) Designing assessment instruments.
 - e) Selecting and designing validation sheets.
 - f) Designing questionnaires. After this step is made, it is continued with an evaluation (formative evaluation) to obtain a prototype of the learning device in the form of a IPA-Chemistry teaching module, and then revised.
3. Development
Stagedevelopmentis aimed at producing learning tools in the form of IPA-chemistry teaching modules, which have been revised based on input from experts (device validation by chemistry experts).

This research was conducted at SMP Negeri 12 Ternate City, in the 2024-2025 academic year with 36 students. The variable in this study was the feasibility of the IPA-Chemistry teaching module. The instruments used in this study consisted of observation, student response questionnaires, teacher responses, and expert validation sheets. The student response questionnaire was used to obtain initial needs analysis data regarding the IPA-Chemistry teaching module. The expert validation sheet was used to determine the feasibility level of the IPA-Chemistry teaching module product developed based on the assessment of the three validators (experts), as well as to obtain suggestions for improvement from the experts in order to make revisions so that the Science-Chemistry teaching module becomes better.

The research data obtained were then analyzed descriptively, for the validity criteria of the IPA-Chemistry teaching module referring to Nurdin (2007), which is presented in Table 1.

Table 1. Validity Criteria Guidelines

Interval Skor	Validity Criteria
$3.50 \leq \bar{v} < 4.00$	Very Valid
$2.50 \leq \bar{v} < 3.50$	Valid
$1.50 \leq \bar{v} < 2.50$	Quite Valid (revised)
$1.00 \leq \bar{v} < 1.50$	Invalid (total revision)

RESEARCH RESULT

The product produced in this research and development is a science-chemistry teaching module based on the local potential of nutmeg and cloves on Moti Island through LIP ((Inquiry Training-Project) to improve the chemical literacy of junior high school students. The development model used refers to the ADDIE model from Branch, 2009 (Analysis, Design, Development, Implementation, and Evaluation). The results of this initial product development are limited to three ADDIE stages, as follows.

Analysis

The Analysis stage is the initial step carried out through literature review and field studies by means of classroom observation and questionnaire distribution. to review the curriculum, learning materials, learning outcomes and learning objectives listed in the SMP IPA textbook. The acid-base material is included in KD (Basic Competence) 4.3 Presenting the results of investigations or works on the properties of solutions, physical changes and chemical changes, or separation of mixtures. With learning activities is to conduct investigations of acids, bases, and salts using artificial and natural indicators.

Based on information from a pre-survey conducted at SMP Negeri 12 Ternate City, which uses the Merdeka Curriculum, this was followed by an analysis of the needs and problems at SMP Negeri 12 Ternate City through direct interviews with teachers and questionnaires administered to eighth and ninth grade students. The results of these interviews and questionnaires indicate that some students still find it difficult to understand IPA, due to several factors, as seen in Table 2.

Table 2. Student Response Percentage Data

Number	Student Response Indicator	Student Responses
1	Students find it difficult to understand the IPA material taught by the teacher	71.40
2	Learning resources or printed teaching materials that are usually used in science or IPA-chemistry learning	67.80

3	In learning, students never use local potential-based teaching modules in IPA-chemistry, especially acid-base material	89.10
4	Learning using learning resources based on the local potential of Moti Island in IPA-Chemistry will increase students' learning motivation	80,25
Average Criteria		77.14

Design

The Design stage is the second stage of the ADDIE model used to design a IPA or IPA-chemistry teaching module on acid-base material based on the local potential of nutmeg and cloves on Moti Island through LIP. The steps taken in the design stage are as follows:

1. In the caver creation stage, the researcher designed an image according to the theme of the local potential spice of nutmeg and clove spices on Moti Island. The caver background contains nutmeg and clove trees using a software application.



Figure 1. Caver Page

2. Compiling the components of the content of the IPA-Chemistry teaching module material on acid-base material based on local potential of nutmeg and cloves on Moti Island through LIP, namely the front cover page containing the title of the IPA-Chemistry teaching module based on the local potential of nutmeg and cloves on Moti Island, title page, foreword, table of contents, general information, learning objectives, learning steps or RPP, LKPD (student worksheets).



Figure 2. General Information

3. Compile information components that will be displayed in the IPA-Chemistry LKPD based on the local potential spice of nutmeg and clove spices on Moti Island based on local wisdom containing material on solutions, acids, bases and salts.

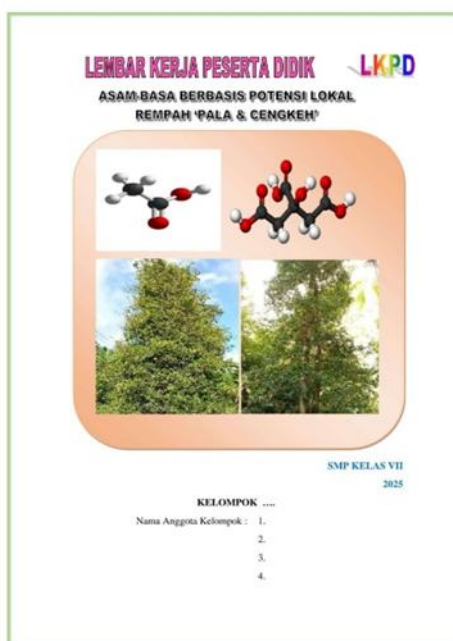


Figure 3. IPA-Chemistry LKPD

4. Determine the type of letter (font) in the IPA-Chemistry teaching module based on the local potential spice of nutmeg and cloves on Moti Island that will be used.
5. Create a IPA-chemistry teaching module design on acid-base material based on the local potential spice of nutmeg and cloves on Moti Island through LIP using Canva. The images or photos included in the IPA-chemistry teaching module on acid-base material based on the local potential of nutmeg and cloves on Moti Island come from the researcher's personal documentation or the internet

Development

The IPA-Chemistry teaching module developed in this study is a IPA-Chemistry teaching module on acid-base material based on the local potential spice of nutmeg and cloves on Moti Island through LIP as a learning resource for SMP (junior high school) students. The Development stage is the third stage of the ADDIE model used, namely printing the results of the IPA-Chemistry teaching module design using the type of paper and size determined in the design stage. Next, a product validation test is carried out by a validator consisting of 3 experts, to determine the feasibility of the product being developed. Validation data for the IPA or IPA-chemistry teaching module on acid-base material based on the local potential spice of nutmeg and cloves on Moti Island through the LIP consists of aspects of substance, module content, language, and usability. The expert validation results can be seen in Table 3.

Table 3. Validation of the IPA-Chemistry teaching module for junior high schools based on the local potential of Moti Island

No	Aspects assessed	Assessment Results			Average ($\bar{v}$)	Criteria
		V1	V2	V2		
1.	Substance	3.00	3.50	3.50	3.33	Valid
2.	Contents of the Teaching Module	3.00	3.50	3.75	3.42	Valid
3.	Language	3.50	3.75	4.00	3.75	Very Valid
4.	Use of Teaching Modules	3.25	4.00	4.00	3.75	Very Valid
Validation average Teaching Module					3.56	Valid

DISCUSSION

The data from the needs analysis results according to the ADDIE model used, in table 2, obtained a percentage of 89.10% for indicators related to students never using teaching modules based on the local potential of nutmeg and cloves in IPA-chemistry, especially acid-base material in the learning process. Based on the results of the needs and problem analysis obtained, it is necessary to develop a IPA-chemistry teaching module based on the local potential of nutmeg and cloves on Moti Island through the LIP (Inquiry Training-Project). This will make it easier for students to understand the material presented by the teacher because it is in accordance with the needs and characteristics of SMP (junior high school students), which is contextual and relevant to the surrounding environment (Hengki W. & Arismunandar, 2018; Nur A.L., Arismunandar & Darman M., 2024). Students can also construct their knowledge by utilizing local potential in their environment, so that learning will be meaningful for students (Hengki W. & Arismunandar, 2018; Yenni T. T., Firdaus D., & Syamsiah, 2017). Furthermore, a design for developing a IPA-chemistry teaching module based on the local potential of nutmeg and cloves on Moti Island through LIP was designed, then its feasibility was tested (validity test) by a three-person expert team.

Based on the validity data by 3 expert validators in table 3, it is obtained that the content validity in the substance aspect, the content of the teaching module, the language and the usability of the teaching module sequentially obtained an average validation value of 3.33; 3.42; 3.75 and 3.75 with an average validation value for all aspects of 3.56 with a valid category. The data shows that the content validity in the substance aspect is in the high category, this indicates that the form and size of the IPA-Chemistry teaching module are suitable for use as a good learning medium. In the content aspect, the IPA-Chemistry teaching module is in the high category, meaning that the brief and clear content of the teaching module is able to direct the learning outcomes that students want to achieve, so that it can improve students' chemical literacy. In addition, this aspect also contains questions for systematic material delivery, so that it can help students in understanding the content of the material. This can be seen from the presentation of the material, student activities, and project assignments in the LKPD (student worksheet) in the teaching module, which are explained in detail so that they can be understood well by students, thus improving students' chemical literacy. This is in line with the results Research from Deasy, L. at. el., (2024); Hengki, W. & Arismunandar (2018) that the material used is systematic, so students can easily understand and comprehend the content of the material presented in the learning. Meanwhile, the language aspect is in the very high category, meaning that the language used in the developed IPA-Chemistry teaching module is simple and easy to understand so that the learning process becomes more interesting and meaningful. In terms of the usability of the teaching module, it is in the very high category, meaning that the IPA-Chemistry teaching module product is very appropriate to be used as teaching material for teachers as well as a learning resource for students.

These results indicate that the developed teaching module product has met the validity criteria even though in the IPA-Chemistry teaching module on the acid-base material based on the local potential spice of nutmeg and cloves on Moti Island through LIP there are still some suggestions, input from the validator. Suggestions and input from the validator for improvements to the shortcomings of the IPA-Chemistry teaching module on the acid-base material based on the local potential spice of nutmeg and cloves on Moti Island that was developed, so that the developed learning module becomes better. The revised suggestions and input obtained from the IPA-Chemistry teaching module product are briefly presented in Figures 4 and 5.

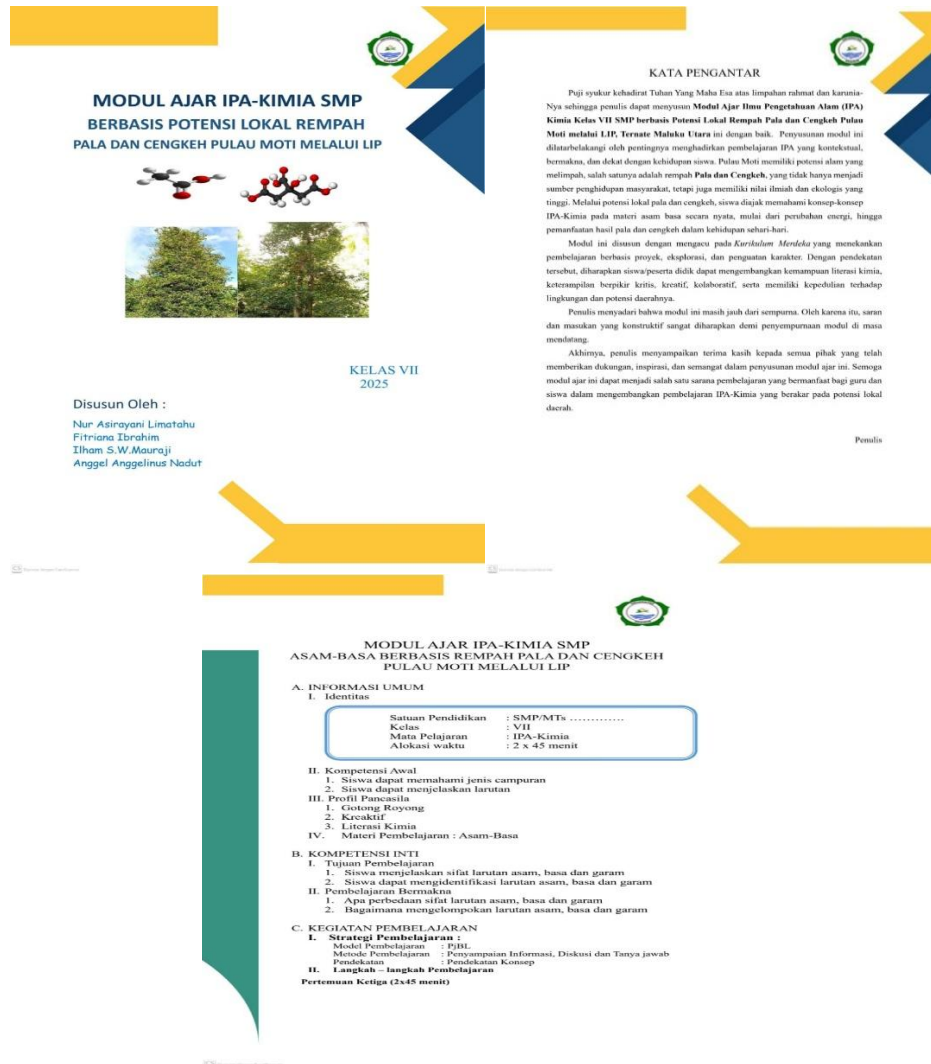


Figure 4. Module Cover Page, Foreword, General Information After Validation

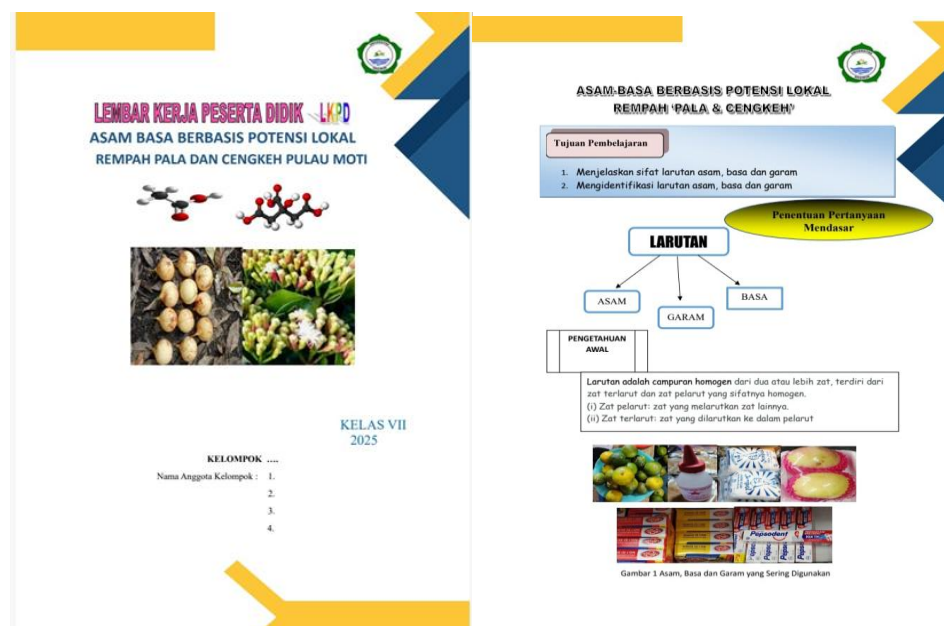


Figure 5. LKPD Cover Page, and Learning Objectives After Validation

In line with the results of research conducted by Yenni T.T, Firdaus D., & Syamsiah (2017), it was stated that the learning module was suitable for use, because the developed module had met the validity standards assessed by the validator. Therefore, the product of the development of the Junior High School IPA-Chemistry teaching module on acid-base material based on the local potential of nutmeg and cloves on Moti Island through LIP was declared valid and suitable for use in the learning process.

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

The results of the needs analysis obtained a percentage of 89.10% indicating that students have never used a teaching module based on the local potential of nutmeg and cloves in IPA-chemistry, especially acid base material in the learning process. Furthermore, a design for developing a IPA-chemistry teaching module based on the local potential of nutmeg and cloves on Moti Island was designed through LIP.

Validity test of the development of the SMP (Junior High School) IPA-Chemistry teaching module on acid-base material based on the local potential spice of nutmeg and cloves on Moti Island through LIP can be seen from the validation results by 3 expert validators. The results of the content validity data obtained that in the aspects of substance, content of the teaching module, language and usability of the teaching module sequentially obtained an average validation value of 3.33; 3.42; 3.75 and 3.75 with an average validation value for all aspects of 3.56 with a valid category. These results indicate that the product of the development of the SMP IPA-Chemistry teaching module on acid-base material based on the local potential spice of nutmeg and cloves on Moti Island through LIP is valid and suitable for use to improve students' chemical literacy in learning.

Recommendation

This research recommendation requires further research to be implemented widely, because in this research has only reached the stage of developing a junior high school IPA-chemistry teaching module on acid-base material based on the local potential spice of nutmeg and cloves on Moti Island through LIP to improve students' chemical literacy so that learning becomes more meaningful and in depth. By producing a junior high school IPA-chemistry teaching module on acid-base material based on the local potential spice of nutmeg and cloves on Moti Island through LIP, it is hoped that teachers can apply the IPA-chemistry teaching module especially in SMP Negeri 12 Ternate City and SMP/MTs in general.

ADVANCED RESEARCH

Further research will focus on implementation for product effectiveness testing. teaching modules IPA-Chemistry based on the local potential spice of nutmeg and cloves on Moti Island through LIP for improve students' chemical literacy. Product this IPA-chemistry teaching module can be applied on a wider

scale because its quality has been assessed by a team of experts. This can be achieved through a long-term research project that examines the impact of chemical literacy and the choice of materials. innovative, creative according to local potential as a learning resource to improve educational quality. Furthermore, researching chemical literacy in acid-base material is a sustainable method for students who can construct their knowledge through the utilization of local potential so that learning will be meaningful for students in accordance with in-depth and impactful learning. The results of this study can provide recommendations for the development of a broader teaching module for the local spice potential project so that it can be applied throughout Indonesia through the diversity of local potential in Indonesia that can be developed as a learning resource.

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