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Development of PBL-based history e-module integrated with Uma Lenge to improve historical thinking

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Abstract. This study was motivated by students' low historical thinking skills and the limited teaching materials that integrate historical material with the local cultural context of Uma Lengge. These conditions indicate the need to develop more contextual learning resources to support the history learning process. This study aims to develop a PBL-based History E-Module integrated with the local wisdom of Uma Lengge to improve students' historical thinking. The research model used is 4-D R&D, which includes the stages of definition, design, development, and dissemination. The research subjects were 60 tenth-grade students from Wawo 1 Public High School, selected through cluster random sampling, with class X-3 as the experimental group and class X-4 as the control group. Data were obtained through historical thinking ability tests and non-test techniques such as observation, interviews, expert validation, and practicality questionnaires. The instruments included validation sheets, questionnaires, and tests. Data analysis was conducted descriptively, qualitatively, and quantitatively using normality and homogeneity tests, paired-samples t-tests, and N-Gain calculations. The results showed that expert validation of the material and media indicated a highly valid category with an average score of 89.3%. The practicality test conducted by teachers was 90.2% in the highly practical category, while students gave an average rating of 3.29 in the very good category. The effectiveness test showed a significant increase in historical thinking skills, with an average post-test score of 82.17 in the experimental class, compared with 65.17 in the control class. N-gain analysis showed a moderate increase (0.40) in the experimental class and a low increase (0.10) in the control class. This e-module has been proven valid, practical, and effective. This study recommends expanding the use of similar e-modules, providing teachers with training, and developing other teaching materials based on local wisdom.

Introduction

History education in high school plays an important role in shaping students' character, identity, and reasoning by developing historical thinking, an essential component of 21st-century literacy (Sutimin et al., 2018). Historical thinking is not understood as the ability to memorize facts, but as a form of historical cognition that emphasizes the application of procedural knowledge through a systematic, evidence-based investigation (Seixas, 2004). The historical thinking skills students need to master include determining historical significance, using primary sources, identifying continuity and change, analyzing cause and effect, taking a historical perspective, and understanding the moral dimensions of historical interpretation (Seixas, 2013). Recent studies show that mastery of these indicators helps students critically analyze past events, construct evidence-based arguments, and relate them to present-day life (Vijayakumar & Ahmad, 2023; Abbas et al., 2022; Fikri et al., 2022;

Gestsdóttir et al., 2018). Thus, historical thinking is not merely remembering facts, but a cognitive process of interpreting historical evidence and critically constructing narratives of the past.

History education should provide students with space to analyze, draw conclusions, and develop reflective historical awareness. In the Indonesian context, history education is still largely oriented towards memorizing facts, such as the names of figures, years, places, and past events, without understanding the meaning of those events, so that historical reasoning has not developed optimally (van Boxtel & van Drie, 2018; Samsinah et al., 2018; Eftila & Hulu, 2018). This condition underscores the urgency of developing learning innovations that shift the paradigm from teacher-centered to student-centered, with a focus on historical thinking skills.

The results of observations and evaluations of history learning at SMAN 1 Wawo reveal a gap between curriculum requirements and field learning practices. Based on an analysis of learning outcomes for the 2024/2025 academic year, only 45% of 10th-grade students met the minimum passing grade of 75, while 55% did not. This weakness is clearly evident in the indicators of analyzing cause and effect (C4), evaluating impact (C5), and connecting historical events with current social conditions (C6) (Maria et al., 2019; Thorp & Persson, 2020; Hutauruk et al., 2024). In fact, teachers still rely on conventional models, while 82% of students stated that history lessons were not relevant to their lives. This condition confirms the urgent need for learning media and models that can encourage active student participation and improve historical thinking skills.

The problem becomes even more complex when we consider the low level of integration of local wisdom into history lessons. Preliminary survey results show that 70% of students at SMAN 1 Wawo are unaware of the social function of Uma Lengge, and 65% are unable to explain its cultural values. In addition to these findings, teachers also face obstacles in developing innovative teaching materials and learning models. History learning still relies on textbooks and government-provided Student Worksheets, which are not contextually relevant to students' socio-cultural environments. As a result, students' knowledge of the local wisdom of Uma Lengge, a traditional house inherited from the ancestors of the Bima (*Dou Mbojo*) tribe in Maria-Wawo Village, is very low (Hartati & Rusmawan, 2024). In fact, UNESCO research shows that more than 60% of the history curricula in developing countries, including Indonesia, do not integrate historical culture and sever the connection between local identity and history learning (Carney, 2022). This situation highlights the importance of developing learning media that not only focus on national content but also integrate local wisdom as a source of historical learning context to encourage students' historical thinking skills.

One solution to this problem is through the development of PBL-based history e-modules integrated with Uma Lengge Local Wisdom. In this context, the PBL model has a strategic position because it begins with the presentation of authentic problem scenarios that are close to the students' social experiences, encouraging them to analyze, formulate hypotheses, and critically evaluate alternative solutions (Kassymova et al., 2020; Tsatse & Sorensen, 2021; Widana et al., 2023a). This model positions students as agents of knowledge who are actively involved in the investigation process, integrating theoretical concepts with real contexts, and producing academically accountable solutions (Cavicchia et al., 2018; Bindayna & Deifalla, 2020). In history learning, PBL encourages students to carry out activities typical of historians by interpreting sources, analyzing cause and effect, constructing narratives, and considering perspectives so that they are in line with the epistemological framework of historical thinking (Ofianto & Ningsih, 2021; Reisman, 2012; Loppies, et al., 2024; Purnadewi & Widana, 2023). Thus, PBL is an innovative learning model that places students as active participants in exploring real-world and contextual problems, thereby improving their problem-solving skills, independence, confidence, and critical and historical thinking abilities (Rosdiana et al., 2017; Suciyati & Rosdiana, 2024).

The integration of PBL into the local wisdom context of Uma Lengge enhances the pedagogical relevance of history learning by providing an authentic cultural context for students' historical reasoning. Research by Hartati & Rusmawan (2024) proves that the use of local wisdom in teaching materials increases cultural literacy and emotional closeness. The findings of Suantara et al. (2023) on the Satua Bali module reinforce that the local cultural context deepens learning motivation, cognitive relevance, and understanding of values. The integration of Uma Lengge into the e-module not only provides cultural illustrations but also serves as *living cultural evidence*, connecting students to living cultural practices. Furthermore, recent research confirms that Uma Lengge is a center of cultural, social, and agrarian activities that form the identity of the Bima community (Gunawan & Mugnisjah, 2024; Rustaman et al., 2024). However, previous research has been limited to history or science lessons in elementary schools, and few have developed digital history modules for high school students that integrate PBL and the local wisdom of Uma Lengge. In fact, the high school context requires more complex historical thinking skills, such as analyzing cause and effect, evaluating the impact of events, and connecting history with socio-cultural realities. Therefore, there remains a research gap in developing digital teaching materials that integrate the PBL model with local wisdom from Uma Lengge to improve high school students' historical thinking skills systematically.

With the advancement of digital technology, this e-module is designed to be adaptive and interactive, presenting material in various formats, including text, images, animations, audio, and video (Oktavia & Hanifah, 2023). The combination of the PBL model and Uma Lengge's local wisdom content has great potential to improve high school students' historical thinking skills. Thus, the development of a PBL-based e-module integrated with local wisdom is not only a pedagogical innovation but also a concrete solution to improve the quality of history learning, making it more relevant and aligned with 21st-century competencies.

The problem statement in this study is to investigate the extent to which the feasibility, practicality, and effectiveness of PBL-based history e-modules integrated with Uma Lengge local wisdom can improve historical thinking skills. In accordance with the research question, the objectives of this study are: (1) To produce a PBL-based history e-module integrated with Uma Lengge local wisdom that is suitable for use in history learning. (2) To determine the level of practicality of PBL-based history e-modules integrated with Uma Lengge local wisdom. (3) To analyze the level of effectiveness of PBL-based history e-modules integrated with Uma Lengge local wisdom in improving students' historical thinking skills.

Method

Research Methods and Design

This study uses a research and development (R&D) method with the main objective of developing a learning product in the form of a PBL-based E-Module for History, integrated with the local wisdom of Uma Lengge as a contextual learning resource. The development procedure consists of four core stages, namely *define, design, develop,* and *disseminate*. This model was chosen because each stage provides systematic steps for producing learning products that are valid, practical, and effective for use in history learning.

Research Procedure

The procedure for developing an integrated PBL-based e-module for history using the local wisdom of Uma Lengge consists of four stages, adopting the 4-D model from (Thiagarajan et al., 1974): define, design, development, and dissemination, as shown in Image 1.

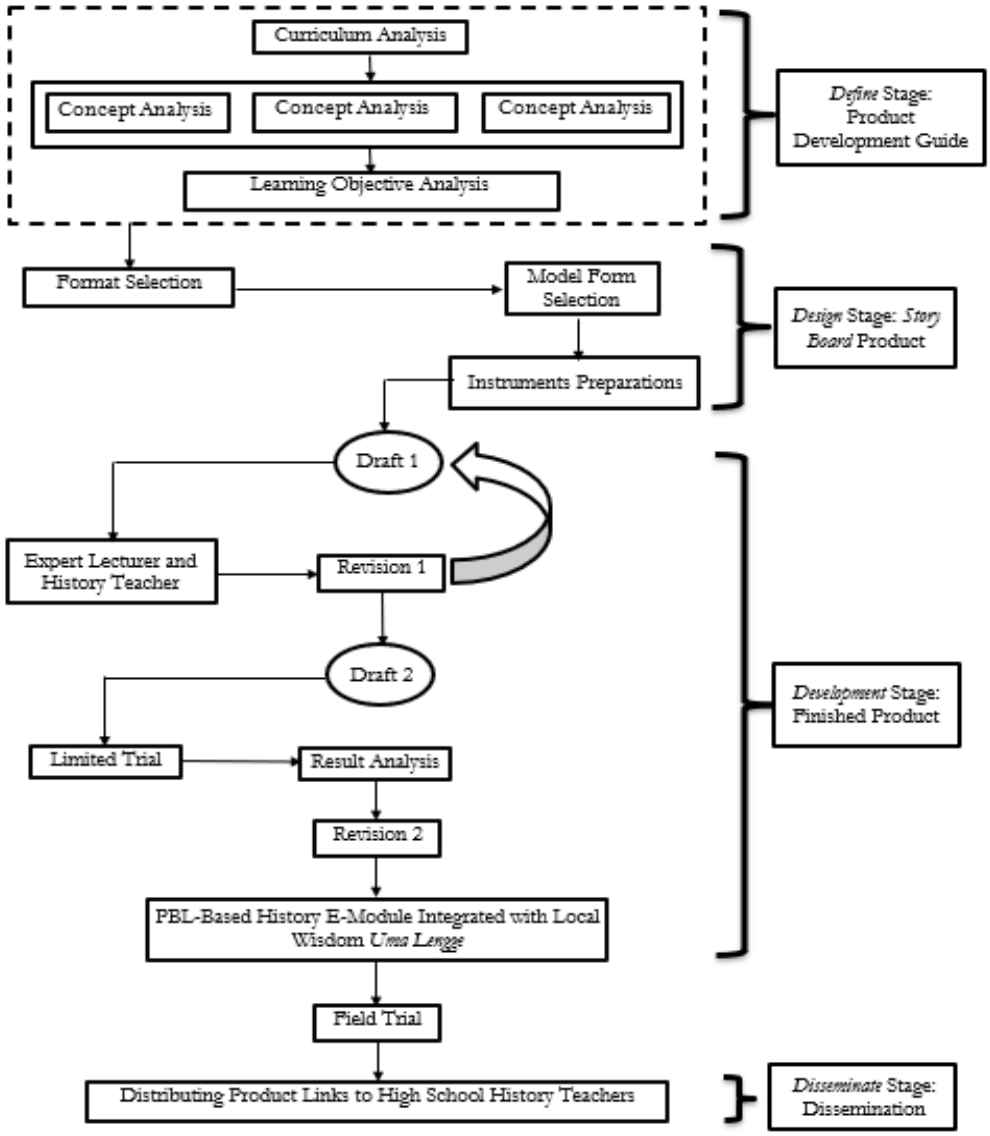


Image 1. Research Flow

The definition stage began with an analysis of the curriculum, student characteristics, and teacher interviews to map learning needs and opportunities for local cultural integration. The results of this analysis formed the basis for the initial draft of the e-module, including the preparation of materials, appearance, and PBL-based activities. The first draft is then validated by subject matter experts and media experts, revised, and tested on a limited basis to assess readability and feasibility. After receiving feedback, the e-module is further developed and tested in target classes to determine its effectiveness in history learning. The final stage involves distributing the product to history teachers so that the e-module can be used more widely.

Samples and Sampling Techniques

The research was conducted at SMA Negeri 1 Wawo, Bima Regency, NTB Province, involving 60 tenth-grade students as respondents. The sampling technique used *was cluster random sampling*, yielding two groups: class X-3, the experimental class using the integrated Uma Lengge PBL E-Module, and class X-4, the control class using conventional learning. The selection of the school took into account the socio-cultural context and the students' geographical proximity to the Uma

Lengge site. Recommendations from history teachers and curriculum suitability were also considered to ensure the product's implementation could take place optimally and representatively.

Data Collection Techniques and Instruments

Data collection techniques in this study consisted of two types: test and non-test. The instruments used are described as follows.

The test technique is a historical thinking skills test designed to assess students' understanding of six aspects of historical thinking. The questions are compiled based on the indicators for each aspect, and their distribution is presented in the historical thinking skills grid listed in Table 1.

Table 1. Historical Thinking Skills Test Grid

Historical Thinking Aspects	Assessment Indicators	Number of Items
Historical Significance	Identifying the importance of Uma Lengge as cultural heritage and local identity.	3
Use of Primary Sources	Interpreting Uma Lengge's photographs, documents, maps, and artifacts as historical evidence	4
Continuity and Change	Explaining the continuity and change in the function of Uma Lengge over time	4
Causes and Effects	Analyzing the causes of changes in the function of Uma Lengge and its impact on society	3
Historical Perspective	Comparing past and present views of the function of Uma Lengge	3
Moral Dimensions – Historical Ethics	Evaluating moral and ethical values in the practice of the Uma Lengge tradition	3

Non-test techniques in this study were conducted through observation and interviews to obtain an overview of the implementation of learning and student responses. In addition, assessments were performed using a validation sheet for the PBL-based e-module on history integrated with local wisdom of Uma Lengge, completed by subject matter experts and media experts to evaluate the content, language, appearance, and alignment with the learning objectives. In the next stage, a practicality questionnaire was distributed to teachers and students to gather feedback on ease of use, content clarity, and the benefits of the e-module in the learning process.

Validity and Reliability of Instruments

This research instrument underwent expert assessment to ensure the suitability of its content and the accuracy of each item's representation of the historical thinking skills indicators being measured. Further testing was conducted to assess construct validity via *product-moment* correlation analysis and internal consistency using the Kuder–Richardson 20 formula. The analysis results show that the instrument meets the criteria for validity and reliability, as summarized in Table 2.

Table 2. Summary of the Validity and Reliability of the Historical Thinking Ability Instrument

Type of Instrument	Number of Items	Validity Coefficient Range (r)	Average r	Cronbach's Alpha	Description
Historical Thinking Ability Test	20	0.406-0.753	0.58	0.899	Valid and Reliable

Data Analysis Techniques

Data analysis was conducted quantitatively and qualitatively. Qualitative data were analyzed using the Miles and Huberman model through the stages of collection, reduction, presentation, and conclusion drawing, to ensure that the findings emerging during the development of the e-module were truly consistent. Meanwhile, quantitative data are analyzed using descriptive and inferential statistics, beginning with tests for normality and homogeneity, followed by t-tests to assess differences in learning outcomes between the experimental and control groups, and N-Gain calculations to evaluate increases in historical thinking skills. The feasibility and practicality of the product were evaluated by calculating the percentage scores of validators and respondents. The average score for each component was calculated using the following formula.

$$X = \frac{\sum X}{n} \text{ x } 100\%$$

Keterangan:
X = Average score
∑X = Total score obtained
N = Maximum score

The validator's assessment results are then converted into percentages and interpreted based on the following eligibility criteria:

Table 3. Product Feasibility and Practicality Criteria

Score Percentage (%)	Categori
75 < score ≤ 100	Very Valid
50 < score ≤ 75	Fairly Valid
25 < scorer ≤ 50	Less Valid
0 ≤ score ≤ 25	Not Valid

A t-test was used to determine the difference in historical thinking skills between the experimental and control classes after implementing a PBL-based e-module integrated with local wisdom from Uma Lengge. The t-test was performed in SPSS version 21 using the independent-samples t-test with unequal variances to compare the two groups' means. After that, the magnitude of the increase in students' historical thinking was calculated using the following N-Gain formula.

$$< g > = \frac{\%< Sf > - \%< Si >}{(100\% - \%< Si >}$$

The N-Gain value obtained is then interpreted based on the following categories:

Table 4. *N-gain* categories

Category	Average N-gain
Low	(<g>) < 0.3
Medium	0.7 > (<g>) > 0.3
High	(<g>) > 0.7

Results and Discussion

The main product of this research is an integrated PBL-based history e-module on Uma Lengge local wisdom, which was developed to improve students' historical thinking skills. The development process followed the 4-D Model, which consists of four main stages: define, design,

develop, and disseminate. Each stage was carried out systematically to ensure that the resulting product was not only theoretically sound, but also practical and effective when applied in classroom learning activities.

Define Stage

A needs analysis, conducted through observation and interviews with history teachers at SMAN 1 Wawo, shows that history learning remains conventional. Teachers tend to rely on textbooks and worksheets, so students memorize more than they engage in historical reasoning. This situation means that students have fewer opportunities to understand the meaning behind historical events or to explore the relationships between events in greater depth. The limited availability of digital teaching materials and the lack of integration of local culture further weaken students' ability to relate historical knowledge to their social experiences.

Classroom conditions reinforce these findings. Discussions were passive, with most students merely repeating information without connecting it to social reality. This is consistent with the findings of van Boxtel & van Drie (2018), who argue that rote learning patterns hinder the development of historical analysis skills. This is reinforced by Carney (2022) research, which shows that a lack of integration of local culture makes it difficult for students to see the relevance of history in their lives. When viewed from the perspective of Seixas (2013); Seixas (2017) historical thinking framework, these conditions reflect that the six main dimensions of historical thinking skills, ranging from historical significance to the moral dimension, have not been optimally facilitated in learning.

Interviews with teachers revealed that the teaching materials used were not sufficiently engaging or contextual and did not incorporate elements of local wisdom. This is despite students living in an environment rich in cultural values, including the Uma Lengge heritage, which encompasses values of identity, cooperation, religiosity, food security, and traditional architecture. Research by Rustaman et al. (2024) shows that these values constitute a living culture with significant potential as a resource for learning history. Furthermore, the Problem-Based Learning (PBL) model is effective in encouraging inquiry, argument development, and active student engagement (Cavicchia et al., 2018; Kassymova et al., 2020; Murni et al., 2025).

Initial data from questionnaires and interviews show that 70% of students are unaware of the social function of Uma Lengge, and 65% are unable to explain the cultural values it embodies. These cultural values include identity, cooperation, food security, religiosity, ecological architecture, and educational value. This gap underscores the need for digital teaching materials that connect historical concepts with local culture through problem-based learning models.

Based on these findings, the development of a PBL-based E-Module for History integrated with the local wisdom of Uma Lengge is a strategic step to address the gap between curriculum requirements and actual learning practices. The integration of local culture provides students with space to interpret historical events more meaningfully, while the application of PBL encourages them to build understanding through source analysis, problem-solving, and historical reflection (Widana et al., 2023b). With this approach, students' historical thinking skills can improve while strengthening their awareness and pride in their regional cultural identity.

Design Stage

The Design stage is the second step in the 4-D development model (*Define, Design, Develop, Disseminate)*, which focuses on the initial design of the PBL-based e-module for History integrated with the local wisdom of Uma Lengge. The purpose of this stage is to produce a product design that is theoretically sound and ready for validation before further development. The main activities

include media selection, format selection, initial product design, and research instrument development.

The selection of media was based on the results of a needs analysis, the characteristics of students at SMAN 1 Wawo, and learning objectives that emphasized the development of historical thinking skills. The media selected was a digital module using the Canva Education application, which is integrated with Google Drive and can be accessed via a laptop or smartphone. Canva was chosen based on several considerations: (1) it supports the creation of e-modules with attractive visual displays and interactive navigation, (2) it allows the insertion of multimedia content such as videos, audio, images, and concept maps, and (3) it is easy to use by teachers and students without requiring high technical skills (Tanama et al., 2023). This platform also facilitates the implementation of the PBL model, including the design of collaborative and reflective activities focused on problem-solving. The final result of this stage is an e-module storyboard that describes the flow of material, PBL activities, and the integration of Uma Lengge local wisdom values. The initial appearance of the developed e-module is shown in Image 2.

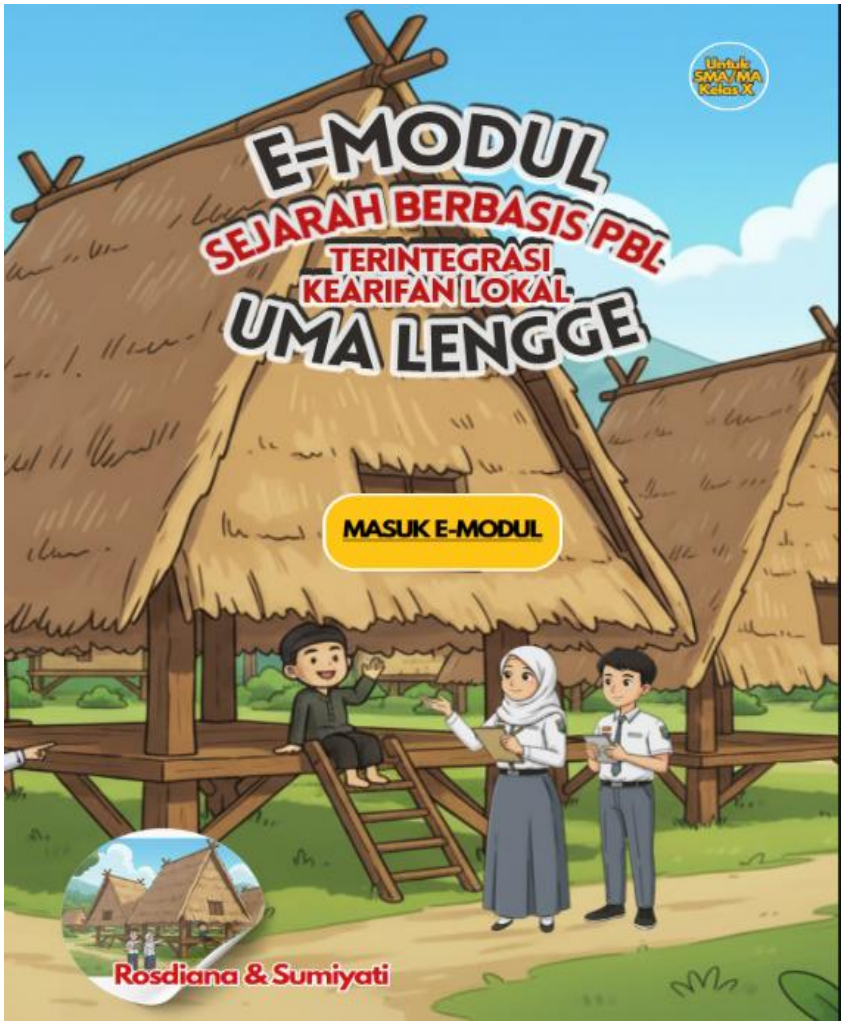


Image 2. E-Module Home Page

The e-module format was selected based on the Merdeka Curriculum standards and PBL model syntax, which includes student orientation to problems, student organization for learning, investigation guidance, work development and presentation, as well as analysis and evaluation of the problem-solving process. The structure of the e-module is systematically designed to facilitate

students' understanding of historical thinking and connect historical concepts with real-life contexts. The initial section of the e-module includes a cover page, introduction, table of contents, and descriptions of Learning Outcomes (CP), Learning Objectives (ATP), and Learning Goals (TP) as a general guide. Furthermore, a historical thinking concept map and instructions for using the e-module are provided to help students navigate the learning content independently. The main content consists of three learning activities: (1) introduction to the concept of historical thinking, covering diachronic, synchronic, causal, and periodization aspects; (2) integration of historical concepts with the local wisdom values of Uma Lengge; and (3) application of the PBL model through contextual problem analysis related to changes in the function of Uma Lengge over time. At the end of the e-module, a summary of the material, competency tests, a glossary, and a bibliography are included to reinforce understanding. Visually, the navigation design is simple, equipped with home, back, next, and exit buttons as follows.

Image 3. E-Module Navigation Design

The initial design combines the module content structure, visual design, and PBL syntax integrated with the local wisdom values of Uma Lengge. The main content is developed using the principles of historical thinking and PBL activities. The material is presented as a historical narrative of Uma Lengge from the Naka period to the modern era, supplemented by "Let's Practice" activities that guide students in exploring the relationships among events, cultural values, and their social context. The module also includes a historical thinking analysis table (diachronic, synchronic, causality, periodization), a historical thinking assessment rubric, and supporting media such as images and videos. An example of these activities is shown in Image 3 below.

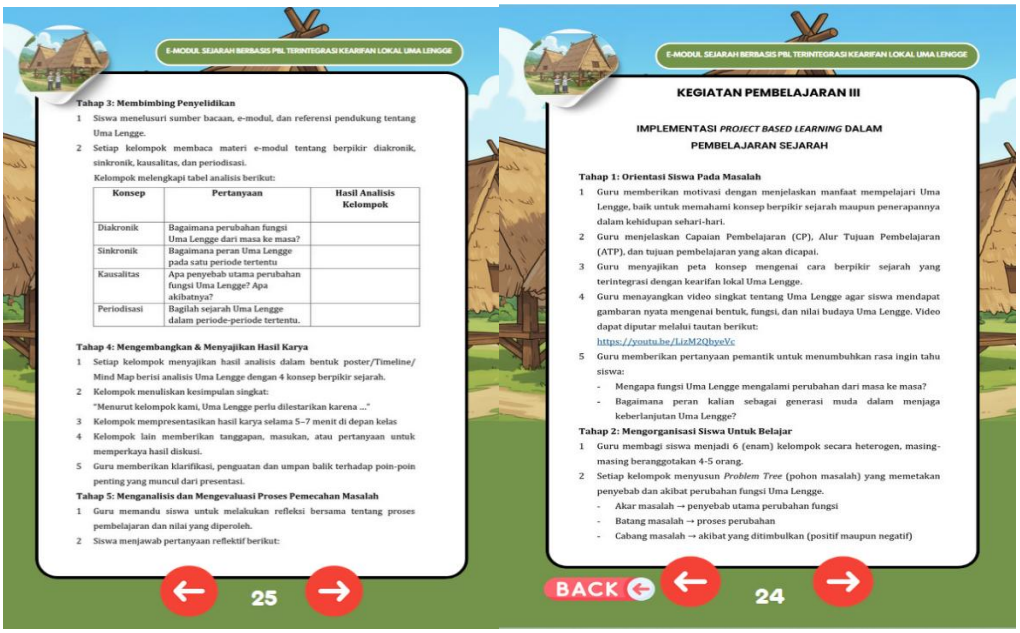
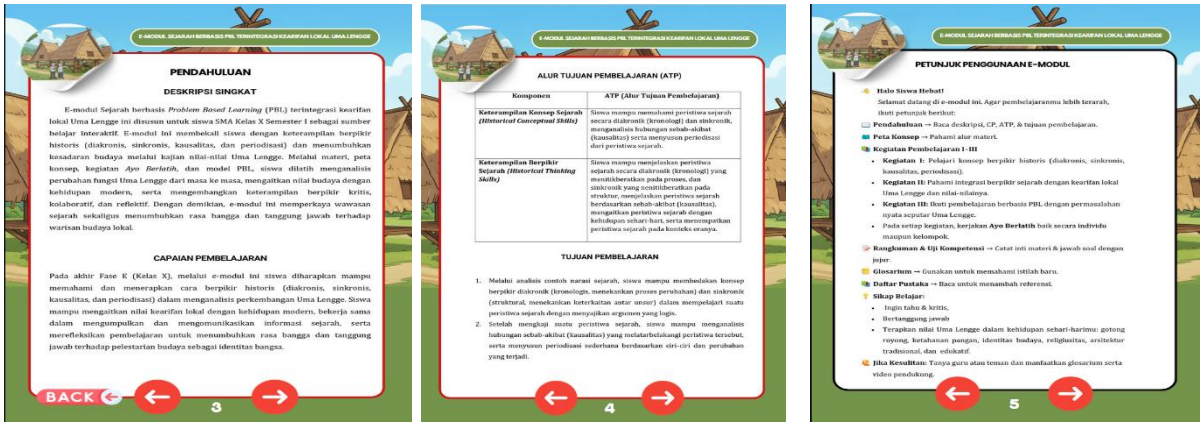


Image 4. Uma Lengge integrated PBL Activity Page

The instrument development stage was conducted to assess the feasibility, practicality, and effectiveness of the e-module. The instruments used included (1) a subject matter expert validation sheet to assess the suitability of content, language, presentation structure, and characteristics; (2) a media expert validation sheet to assess the aspects of graphic display, interactivity, and ease of use; (3) a teacher and student practicality questionnaire to measure the ease of application, attractiveness, and meaningfulness of the e-module in the teaching and learning process. (4) Historical thinking tests in the form of a *pretest* and *posttest*.

Development Phase

The development phase aims to ensure that the PBL-based History E-Module, integrated with Uma Lengge local wisdom, is highly valid, practical, and effective before implementation in the field. The development process includes expert validation, practicality testing by teachers and students, and analysis of implementation results in the experimental and control classes. The following excerpts from the E-Module pages illustrate the integration of the PBL model and Uma Lengge's local wisdom into the material's structure and learning activities.



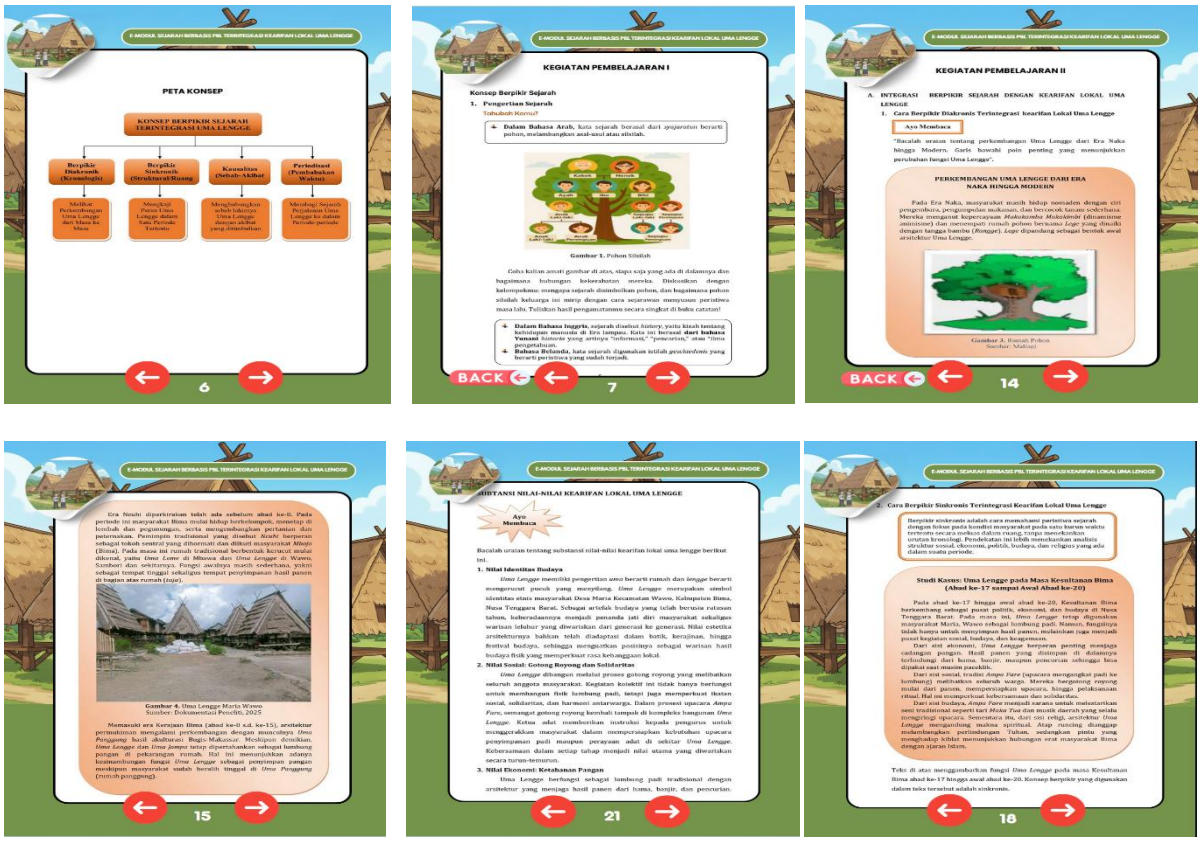


Image 5. Sample Pages of the PBL-Based History E-Module

Material validation was conducted by two experts in History Education at STKIP Taman Siswa Bima. The assessment covered four main aspects: content suitability, presentation, language, and module characteristics. Each element was evaluated using a 1–4 Likert scale. Table 5 below shows the results of the experts' assessment of the developed e-module.

Table 5. Results of Expert Validation

Aspects Assessed	Percentage %	Category
Content Feasibility	87.5%	Very Valid
Presentation Feasibility	87.5%	Very Valid
Language Feasibility	90.6%	Very Valid
Characteristics	91.6%	Very Valid
Average	89.25%	Very Valid

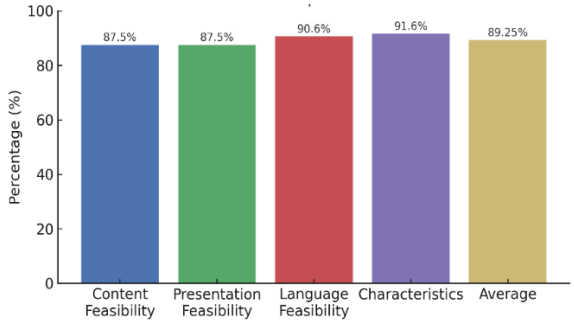


Image 6. Diagram of Material Expert Validation Results

The validation results show that the average feasibility score was 89.25%, indicating high validity, as it exceeded the minimum feasibility threshold of ≥75%. The characteristics aspect received the highest score of 91.6%, indicating that the e-module design was considered highly suitable for contextual history learning needs and supported the strengthening of students' historical thinking skills. The language aspect achieved a high score of 90.6%, indicating the effective use of communicative terms, clear sentences, and simple language structures. The content and presentation aspects both scored 87.5%, indicating that the e-module content aligned with the characteristics of evidence-based history learning. These results are in line with Seixas & Morton (2012) statement that valid history-learning media should encourage students to analyze, interpret, and connect past events to the context of their current lives. Therefore, the developed e-module is considered suitable for testing its feasibility and effectiveness in the classroom.

Media validation by experts on PBL-based history e-modules integrated with Uma Lengge local wisdom was conducted by two lecturers, one from the Information Technology Education Study Program and the other from the Biology Education Study Program at UNSWA. The aspects evaluated included graphic and media characteristics such as visual appearance, layout consistency, color selection, navigation, and ease of use. The results of media validation by experts are presented in Table 6.

Table 6. Media Expert Validation Results

Aspects Assessed	Percentage	Category
Graphic	88,5%	Very Valid
Characteristics	90%	Very Valid
Average	89,25%	Very Valid

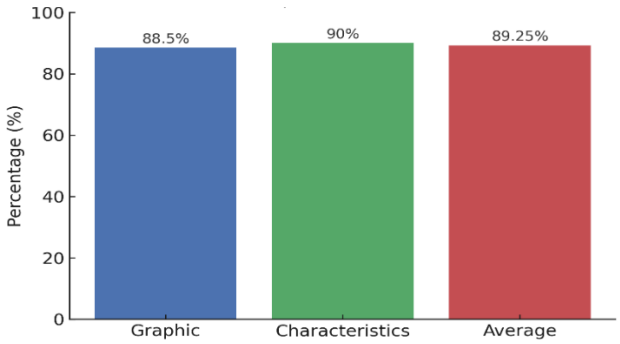


Image 7. Media Expert Validation Results Diagram

The average validation score from media experts was 89.25%, indicating high validity. The characteristics aspect received the highest score of 90%, indicating that the e-module design was considered easy to use, efficient, and visually appealing. Meanwhile, the graphics aspect received a score of 88.5% in the highly valid category, indicating that the layout, color selection, and proportion of visual elements were in accordance with the aesthetic principles of learning media. Overall, the validation results from the material and media experts confirm that the PBL-based History e-module integrated with Uma Lengge local wisdom falls into the highly valid category, with an overall average of 89% or higher. This indicates that the product has met the academic and technological criteria for testing at the implementation stage in schools.

After being declared valid, the module was tested to determine its suitability for learning. The feasibility test involved two history teachers and ten students from class X-3 at SMA Negeri 1 Wawo in the odd semester. The results of the teachers' assessments are shown in Table 7 below.

Table 7. Trial Data of Practitioners by History Teachers

Aspects Assessed	Percentage %	Category
Content Feasibility	95%	Very Practical
Presentation Feasibility	87.5%	Very Practical
Language Feasibility	88.3%	Very Practical
Implementation Feasibility	94%	Very Practical
Characteristics	86.3%	Very Practical
Average	90.2%	Very Practical

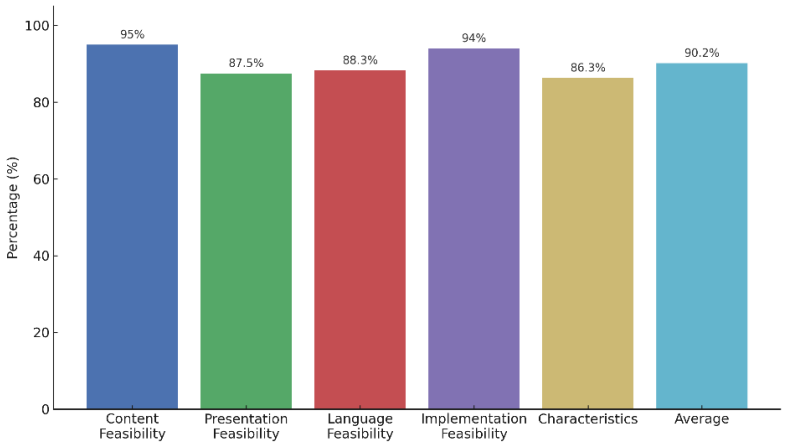


Image 8. Trial Data Diagram of Practitioners by History Teachers

Based on teacher assessments, the e-module received an average score of 90.2%, which is categorized as highly practical. The highest-scoring aspects were content suitability (95%) and implementation (94%), indicating that the module is highly relevant to the curriculum and easy to apply in learning. The language and presentation aspects also received high scores, indicating that the material is easy to understand and coherent. These findings are supported by the opinion of Aqshallazuardi & Kurniawan (2025) that clear instructions, contextual relevance, and ease of classroom implementation are characteristics of practical PBL learning materials. Therefore, this e-module has met the criteria for practicality for teachers. Meanwhile, the results of student practicality are shown in Table 8 below.

Table 8. Data on the Practicality of the History E-Module by Students

Practitioner (Students)	Total Score	Average	Category
Student 1	29	3.22	Very Good
Student 2	31	3.44	Very Good
Student 3	29	3.22	Very Good
Student 4	26	2.89	Good
Student 5	30	3.33	Very Good
Student 6	33	3.67	Very Good
Student 7	32	3.56	Very Good
Student 8	30	3.33	Very Good
Student 9	29	3.22	Very Good

Student 10	27	3.00	Very Good
Average		3.29	

The practicality test involving 10 students from class X-3 of SMAN 1 Wawo produced an average score of 3.29, which is considered very good. Most students gave a very good rating (score range 3.22–3.67), while one student gave a good rating (score 2.89). These results indicate that the E-module is generally easy to understand, the learning flow is clear, and it helps students learn historical material. The highest score of 3.67 indicates that the module is considered interesting, interactive, and in line with a problem-based approach. Although there was a difference in assessment scores between students, the results still show that the product can be used effectively, even though it needs a little adjustment to accommodate variations in learning experiences. Thus, the students' findings align with the teacher test results, namely that the E-module is practical, communicative, and feasible to implement, and can proceed to the effectiveness test stage.

Teacher and student assessments show that 90.2% of teachers rated this module as very practical, while 3.29% of students rated it as "very good." Teachers rated the module content as relevant to the curriculum and easy to implement, while students found it useful for understanding the material. This shows that this module can be used effectively in everyday learning. According to Atmaja et al. (2021), practical PBL-based teaching materials are characterized by clear instructions, ease of use, and suitability for student learning experiences.

E-Module Effectiveness Test Results

This stage aims to test the effectiveness of the Uma Lengge integrated PBL-based History E-Module in improving students' historical thinking skills. This test was conducted using pretest and posttest instruments in the experimental class (X-3) and control class (X-4).

Normality test using one-sample Kolmogorov-Smirnov, both experimental and control classes. The results of the normality test are shown in Table 9 below.

Table 9. Summary of Normality Test Results.

No	Class	N	Sig.(p)	Significance	Description
1	Experimental Pretest	30	0.200	0.05	Normal
2	Experimental Posttest	30	0.176	0.05	Normal
3	Control Pretest	30	0.187	0.05	Normal
4	Control Posttest	30	0.091	0.05	Normal

Based on the results of the normality test, all data groups, both pretest and posttest, in the experimental and control classes showed significance values above 0.05. These values indicate that the data are normally distributed.

Next, homogeneity testing was conducted using Levene's Test. A variance is considered homogeneous if the significance value is greater than 0.05 or Fcount<Ftable. Based on the analysis results, the homogeneity test can be presented as follows.

Table 10. Summary of Homogeneity Test Results

Variable	F count	Sig. (p)	Criteria	Description
Historical Thinking	1.283	0.265	0.05	Homogeneous

Based on the homogeneity test results, the significance value for the historical thinking variable is 0.265, which is above the 0.05 threshold. Thus, the data on the historical thinking variable can be declared homogeneous and eligible for analysis using parametric tests.

Table 11. Independent Samples t-test Results

Variable	Class	Mean	Sig. (p)	Description
Historical Thinking	Experimental	82.17	0.001	There is a difference
	Control	65.17	0.001	There is a difference

The results of the Independent Samples t-test indicate that the posttest scores for historical thinking differ significantly between the experimental and control classes, with a p-value of 0.001 ($p < 0.05$). The experimental class achieved an average score of 82.17, higher than the control class's 65.17. These findings indicate that the use of PBL-based e-modules contributes positively to students' historical thinking skills. This improvement was evident in their ability to arrange chronological sequences, analyze cause-and-effect relationships, and understand continuity and change. These results align with those of Abbas et al. (2022) and Fikri et al. (2022), which show that the PBL model enriched with local context can strengthen critical and historical thinking processes through students' active involvement in investigation and reflection.

Table 12. Gain Score Results for Historical Thinking Skills

Class	*Gain Score*	Category
Experimental	0.40	Moderate
Control	0.10	Low

Based on the Gain Score calculation results, the increase in historical thinking skills in the experimental class was higher than in the control class. The experimental class scored 0.40, which is in the moderate category, while the control class only scored 0.10, which is in the low category. This difference shows that the improvement in historical thinking skills in the experimental class was much greater than that in the control class. Thus, learning using PBL-based e-modules integrated with Uma Lengge local wisdom proved to be more effective in encouraging the development of students' historical thinking skills than conventional learning.

These quantitative findings are consistent with observations made during the learning process. The integration of the PBL model with the cultural context of Uma Lengge encouraged students to be more active in exploring sources, connecting events, and discussing social changes over time. This improvement was evident across several key dimensions of historical thinking, including chronology, cause-and-effect analysis, continuity and change, and the ability to understand the perspectives of past actors (Abbas et al., 2022; Gestsdóttir et al., 2018). The uniqueness of this study lies in the use of digital e-modules that specifically combine PBL syntax with Uma Lengge cultural values, an approach that has never been applied to history learning in the Bima region.

Theoretically, these findings reinforce Seixas (2013); Seixas (2017) view that the use of relevant cultural contexts enables students to interpret historical events more critically and meaningfully. The integration of local culture into problem scenarios aligns with van Boxtel & van Drie (2018) view that using real contexts and authentic sources improves the quality of students' historical reasoning. Thus, PBL enriched with local cultural context enables a more in-depth process of historical inquiry and reflection (Ofianto & Ningsih, 2021).

From a practical perspective, the developed e-module offers structured, easily accessible digital learning media aligned with the Merdeka Curriculum. Teachers receive clear activity guidelines, assessment rubrics, and examples of relevant problem scenarios (Cavicchia et al., 2018). Meanwhile,

for students, these e-modules help foster reflective independent learning while connecting historical material to their own cultural identities (Hartati & Rusmawan, 2024; Rustaman et al., 2024).

Based on these findings, it is recommended that similar e-modules be tested in other grade levels and in various schools to ensure consistency in effectiveness. Teachers are also encouraged to continue integrating local cultural values in the application of PBL so that history learning becomes more contextual. Media developers can consider adding interactive features, such as videos, simulations, or three-dimensional visualizations, to enrich students' learning experience (Kassymova et al., 2020; Tsatse & Sorensen, 2021).

This study has several limitations. The relatively small sample size and the fact that the study was conducted in only one school mean that the findings must be generalized with caution. In addition, the short implementation period did not allow for an assessment of the long-term impact on the development of historical thinking skills. The proximity of students to the Uma Lengge culture may also influence results, so further studies in other cultural contexts are needed to determine the extent to which this model can be adapted and replicated (Maria et al., 2019; Thorp & Persson, 2020).

Disseminate Stage

The Dissemination Stage is the final step in the 4-D development model, which aims to ensure that the target users widely use the e-module. After being declared valid, practical, and effective, the PBL-based e-module integrated with Uma Lengge local wisdom was distributed to history teachers at SMAN 1 Wawo. Distribution was carried out via digital links to facilitate access and use, in line with the field-trial flow outlined in the development diagram. During this stage, teachers had the opportunity to try out the e-module in their learning context and provide additional feedback on the clarity of instructions, the relevance of the material, and the ease of use in the classroom. This input is used to assess the module's readiness for wider implementation and to identify areas that can still be improved. Thus, the distribution not only complements the development process but also improves product quality and strengthens replication opportunities in other schools.

Conclusion

This study produced an integrated PBL-based e-module on the history of Uma Lengge local wisdom, suitable as a teaching material for history lessons. Through expert assessment of content, language, presentation, and media characteristics, this module was declared to meet the eligibility criteria and be suitable for supporting contextual history learning within the framework of the Merdeka Curriculum. The practicality test results indicate that this module is easy to understand and interesting for both students and teachers. The logical flow of activities, clear instructions, and a supportive visual display make this module easy to implement in the classroom with minimal obstacles. This shows that the e-module can facilitate effective problem-based learning. Using the module also strengthens students' historical thinking skills. The learning process encourages students to be more active in examining chronology, understanding cause-and-effect relationships, reviewing continuity and change, and adopting a historical perspective. The connection between the material and the culture of Uma Lengge makes the analysis more meaningful, thereby enhancing students' historical abilities and surpassing conventional learning. These findings indicate that the e-module not only enriches the history learning process but also strengthens students' cultural identity by integrating local contexts into problem-solving. This module aligns with the demands of digitalization and 21st-century literacy. For future implementation, teacher training is needed to ensure the effective application of PBL and optimal use of digital modules. Its implementation is

also recommended to be expanded to various levels and schools to see the consistency of the findings. This product can be further developed by adding interactive features, such as videos, simulations, or virtual cultural elements, to deepen students' learning experience.

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