



Development of a Bilingual Digital Module Based on Local History and Biodiversity of Banyuwangi for Contextual Learning

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Abstract

This study aims to develop and test the feasibility of a bilingual digital module (Indonesian–English) that integrates local history, biodiversity, and English for contextual learning in Banyuwangi. The results of local potential mapping require development into systematic, digital teaching materials that can be used in learning. This research employs the Research and Development (R&D) method with the ADDIE model (Analysis, Design, Development, Implementation, Evaluation). Research subjects consisted of teachers, students, history material experts, biology experts, English experts, and media experts. Data were collected through needs assessment questionnaires, expert validation questionnaires, and user response questionnaires, then analyzed using descriptive quantitative methods. The results showed that the developed bilingual digital module received a very feasible assessment from history material experts (90.4%), biology experts (91.2%), English experts (88.6%), and media experts (92.5%). Teacher responses to the module were also very positive with a percentage of 89.7%, and student responses reached 88.9%. This digital module contains materials on Banyuwangi's local history, biodiversity, and interactive English exercises presented in an easily accessible digital format. This research produces a validated multidisciplinary learning product that can be applied in schools to support contextual learning.

Keywords: digital module development, bilingual, local history, biodiversity, contextual learning

INTRODUCTION

The rapid advancement of digital technology has fundamentally transformed the landscape of education, creating unprecedented opportunities for innovative teaching and learning approaches. In the Indonesian context, the integration of digital technology into education has become increasingly important, particularly following

the COVID-19 pandemic that accelerated the adoption of digital learning platforms (Indrawati & Kuncoro, 2021; Zein, 2022). Digital learning materials offer significant advantages over traditional print materials, including interactivity, multimedia integration, accessibility, and the ability to be updated easily (Mayer, 2021; Clark & Mayer, 2016). However, the availability of digital learning materials that effectively integrate local content and support multidisciplinary learning remains limited in Indonesia, particularly in regions like Banyuwangi that possess rich historical and environmental resources.

Field observations conducted at several schools in Banyuwangi reveal that while schools have begun to adopt digital learning platforms, the digital materials available are primarily generic and disconnected from local contexts. History materials are presented as scanned versions of textbooks with limited interactivity, biology materials lack local examples and multimedia elements, and English materials focus on grammar exercises without meaningful content integration (Efendi et al., 2023). This gap between the potential of digital technology and the reality of available materials represents a significant missed opportunity for creating engaging, contextual, and effective learning experiences. Students in Banyuwangi, surrounded by rich historical narratives, diverse ecosystems, and unique cultural traditions, deserve learning materials that connect to their lived experiences and prepare them for the complexities of

the modern world.

The development of digital learning materials based on local wisdom and culture has been recognized as an important approach for creating contextual and meaningful learning. Research by Adinugraha (2020) demonstrated that local wisdom and cultural approaches in biology learning can integrate local values through ethnobiological and ethnopedagogical studies. Studies on the integration of ethnopedagogy in the Merdeka Curriculum have shown that local wisdom can serve as a reference for developing teaching materials, modules, and project assignments (Rahmawati et al., 2023). The development of digital modules, in particular, offers opportunities for integrating multimedia elements—such as videos, animations, interactive quizzes, and hyperlinks—that can enhance student engagement and learning outcomes (Branch, 2009; Richey & Klein, 2007). Research on digital module development in Indonesian contexts has shown that well-designed digital modules can effectively support student learning and achieve high feasibility ratings (Yulianti & Wulandari, 2022; Widodo & Suhandi, 2021).

The integration of local history and biodiversity in digital teaching materials has been explored in several recent studies. Munggarani et al. (2023) investigated the implementation of smart ecopedagogy through local history integration, finding that local historical narratives serve as meaningful and contextual learning resources that bridge cultural heritage and environmental education. Research on the development of digital modules based on local wisdom has shown that such materials can enhance student engagement and learning outcomes (Purnomo & Sari, 2023). The use of digital storytelling and multimedia in local history education has been demonstrated to improve students' historical understanding and critical thinking skills (Pratama et al., 2023). However, these studies have primarily focused on single disciplines and have not developed digital materials that simultaneously integrate history, biodiversity, and language in a bilingual format.

The research gap addressed by this study is the absence of a bilingual digital module that integrates local history, biodiversity, and English language learning specifically designed for contextual learning in Banyuwangi. While previous research has developed digital modules for single subjects or bilingual materials in print format, no study has developed a comprehensive bilingual digital module that simultaneously addresses local history, biodiversity, and language for use in formal educational settings. Furthermore, the development of such materials using the ADDIE model—which includes analysis, design, development, implementation, and evaluation stages—

ensures systematic and rigorous product development (Branch, 2009). The specific context of Banyuwangi, with its rich historical narratives, diverse ecosystems, and unique cultural traditions, provides rich content for digital module development.

The novelty of this research lies in its integration of three dimensions—local history, biodiversity, and bilingual language—into a single digital module for contextual learning in Banyuwangi. This research goes beyond previous studies that focused on single-discipline or print materials by developing a comprehensive digital learning resource that can be used in formal educational settings. The module is designed to support the Merdeka Curriculum's emphasis on contextual, project-based, and technology-integrated learning, providing teachers with a resource that addresses multiple learning objectives simultaneously. Furthermore, the involvement of experts from multiple disciplines in the validation process ensures that the module reflects multidisciplinary perspectives and meets high quality standards. The digital format, with its multimedia capabilities, allows for interactive elements that enhance student engagement and learning.

This research is grounded in several theoretical frameworks. First, the ADDIE model provides the systematic framework for module development, ensuring that each stage—analysis, design, development, implementation, and evaluation—is addressed systematically (Branch, 2009). Second, the concept of contextual learning emphasizes the importance of connecting learning materials to students' real-life experiences, providing the pedagogical foundation for the module's content (Crawford, 2001; Johnson, 2002). Third, multimedia learning theory emphasizes the importance of combining words and pictures for effective learning, guiding the design of the module's visual and interactive elements (Mayer, 2021). Fourth, bilingual education theory emphasizes the importance of developing materials that support language development while maintaining connection to content learning (Cummins, 2021; García & Wei, 2022). Fifth, the ethnopedagogy framework highlights the value of integrating local wisdom into educational practices (Adinugraha, 2020; Oktavianti & Ratnasari, 2018).

This research is also relevant to current educational policy in Indonesia, particularly the Merdeka Curriculum, which emphasizes project-based learning, contextual learning, technology integration, and the development of Pancasila student profiles (Badan Standar, 2022). The Merdeka Curriculum provides flexibility for educators to develop learning experiences that are relevant to students' local contexts and that integrate multiple subjects. The bilingual digital module developed in this research supports these

policy goals by providing a resource that connects local history, biodiversity, and language learning in a digital format that can be used for project-based and contextual learning activities. The module also supports the development of 21st-century skills, including digital literacy, critical thinking, and communication.

MATERIALS AND METHODS

This research employs the Research and Development (R&D) method with the ADDIE model (Analysis, Design, Development, Implementation, Evaluation). The ADDIE model is a systematic instructional design framework that has been widely used in educational research and development (Branch, 2009; Richey & Klein, 2007). The model was chosen because it provides a structured approach to developing educational products, with each stage building on the previous one to ensure quality and effectiveness. The ADDIE model consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. This approach ensures that the resulting digital module is systematically developed, validated, and refined based on feedback from experts and users.

The research was conducted in Banyuwangi Regency, East Java, from January to June 2023. The research sites included several schools that have implemented the Merdeka

Curriculum and have expressed interest in integrating digital learning materials. The development process involved collaboration among students from three study programs (English Language Education, Biology Education, and History Education) who served as developers, as well as expert validators from each discipline. The implementation stage involved teachers and students from selected schools who used the digital module in their learning activities.

Research subjects consisted of five groups: (1) students from three study programs who collaborated as developers, (2) university lecturers as experts who validated the module's content and media aspects, (3) teachers from selected schools as practitioners who provided input on the module's usability, (4) students from selected schools as the target users, and (5) a media expert who evaluated the technical quality of the digital module. A total of 30 students participated in the implementation and evaluation stage, selected using purposive sampling based on their grade level and availability. Four expert validators participated: one history expert (lecturer in history education), one biology expert (lecturer in biology education), one English expert (lecturer in English language education), and one media expert (lecturer in educational technology). Additionally, three teachers (history, biology, and English teachers) provided input on the module's practical usability.

Table 1. ADDIE Model Development Stages

Stage	Activities	Output
1. Analysis	Needs assessment, curriculum analysis, resource inventory, learner analysis	Needs assessment report, learning objectives
2. Design	Content outline, storyboard, interface design, multimedia planning	Module design document, storyboard
3. Development	Content creation, multimedia production, programming, beta testing	Draft digital module
4. Implementation	Expert validation, revision, teacher training, classroom trial	Validated module, implementation data
5. Evaluation	User response questionnaires, feedback collection, final revision	Final digital module, evaluation report

Data collection techniques included needs assessment questionnaires, expert validation questionnaires, teacher response questionnaires, and student response questionnaires. The needs assessment questionnaire was administered to students and teachers to identify their needs and preferences for digital bilingual teaching materials on local history and biodiversity. The expert validation questionnaire was designed based on established

criteria for evaluating digital teaching materials, including content accuracy, language quality, media design, interactivity, and educational value. The teacher and student response questionnaires measured users' perceptions of the module's clarity, interest, usefulness, technical quality, and overall quality. All questionnaires used a Likert scale format (1-4) to allow for quantitative analysis.

Table 2. Details of Subjects, Data Sources, and Data Collection Techniques

No	Subject/Data Source Type	Quantity	Data Collection Technique	Data Collected
1	Students (needs analysis)	30 students	Needs assessment questionnaire	Learning needs, preferences
2	Students (implementation)	30 students	Response questionnaire	Perceptions, feedback
3	History expert	1 lecturer	Validation questionnaire	Historical accuracy, completeness
4	Biology expert	1 lecturer	Validation questionnaire	Biological accuracy, completeness
5	English expert	1 lecturer	Validation questionnaire	Language quality, translation
6	Media expert	1 lecturer	Validation questionnaire	Technical quality, interactivity

No	Subject/Data Source Type	Quantity	Data Collection Technique	Data Collected
7	Teachers (history, biology, English)	3 teachers	Response questionnaire	Practical usability, curriculum fit

The collected quantitative data were analyzed using descriptive statistics, including mean scores and percentages. The validation data were analyzed using the formula: $\text{Percentage} = (\text{Total score} / \text{Maximum score}) \times 100\%$. The results were then categorized based on the following criteria: 81-100% = Very Feasible, 61-80% = Feasible, 41-60% = Less Feasible, and 0-40% = Not Feasible (Arikunto, 2010). User response data were analyzed using the same formula and categorization criteria. The qualitative feedback from experts and users was analyzed using thematic analysis to identify patterns and themes that informed the revision of the module.

RESULTS AND DISCUSSION

The research produced a bilingual digital module titled "Jelajah Banyuwangi: Sejarah dan Keanekaragaman Hayati" / "Exploring Banyuwangi: History and Biodiversity" as the final product. The module was developed through the five stages of the ADDIE model: Analysis, Design, Development, Implementation, and Evaluation. Each stage contributed to the refinement and improvement of the module, ensuring that the final product met the needs of its intended users and achieved high quality standards.



Figure 1. Digital Module Interface - Home Page

Analysis Stage

The analysis stage involved needs assessment, curriculum analysis, resource inventory, and learner analysis. The needs assessment revealed that 88% of students expressed interest in digital learning materials that connect to their local environment, 85% preferred materials with interactive elements such as videos and quizzes, and 82% wanted materials that could help them learn English while studying other subjects. Teachers identified the need for digital materials that could support the Merdeka Curriculum's emphasis on contextual and technology-integrated learning, particularly materials that could address multiple learning objectives simultaneously. The curriculum analysis revealed that the Merdeka Curriculum includes learning outcomes related to local history, biodiversity, and English that could be addressed through an integrated digital module.

Table 3. Needs Analysis Results

Indicator	Percentage (%)	Category
Interest in digital learning materials	88	High
Preference for interactive elements	85	High
Interest in bilingual materials	82	High
Need for integrated materials	84	High
Interest in local content	87	High
Need for technology-integrated materials	86	High

Design Stage

The design stage involved creating a content outline, storyboard, interface design, and multimedia planning. The module was designed with a user-friendly interface that allows students to navigate easily between sections. The content was organized into six chapters: (1) Introduction to Banyuwangi, (2) History of the Blambangan Kingdom, (3)

Osing Culture and Traditions, (4) Biodiversity of Banyuwangi, (5) Conservation and Environmental Protection, and (6) Interactive Activities and Assessment. Each chapter included text in both Indonesian and English, accompanied by images, videos, audio narrations, and interactive quizzes. The module was designed to be responsive, accessible on various devices including computers, tablets, and smartphones.

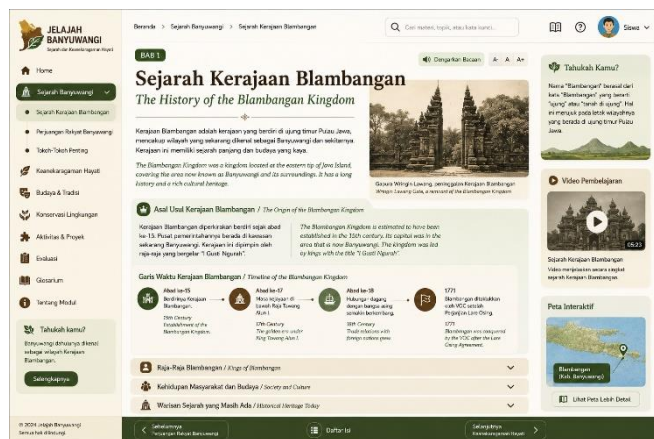


Figure 2. Digital Module Interface - Chapter Page

Development Stage

The development stage involved content creation, multimedia production, programming, and beta testing. The content was developed based on the results of the needs assessment and curriculum analysis, incorporating accurate historical information about Banyuwangi, scientific biodiversity content, and bilingual language presentation. Multimedia elements included: (1) high-quality images of

historical sites, flora, and fauna, (2) narrated videos explaining key concepts in both Indonesian and English, (3) interactive quizzes with immediate feedback, (4) audio pronunciations of key terms in both languages, and (5) hyperlinks to additional resources. The module was developed using HTML5, CSS3, and JavaScript, ensuring compatibility with modern web browsers and devices.

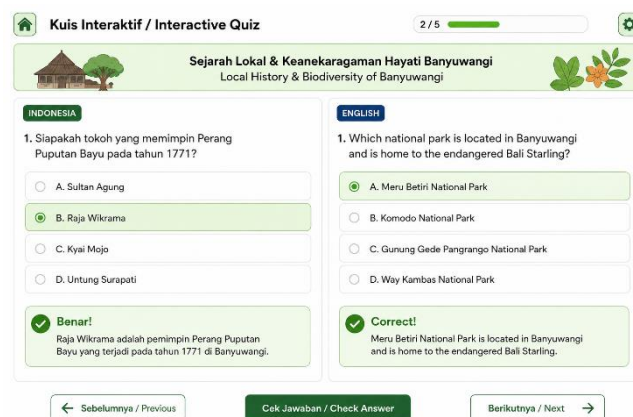


Figure 3. Digital Module Interface - Interactive Quiz

Table 4. Module Content and Multimedia Elements

Chapter	Content	Multimedia Elements
1. Introduction to Banyuwangi	Geography, demographics, cultural overview	Images, introductory video, interactive map
2. History of Blambangan Kingdom	Kingdom history, key figures, historical sites	Historical images, timeline, narrated video
3. Osing Culture and Traditions	Cultural practices, traditions, language	Cultural images, audio recordings, video
4. Biodiversity of Banyuwangi	Flora, fauna, ecosystems, endemic species	Species images, videos, interactive species guide
5. Conservation and Protection	Environmental issues, conservation efforts	Conservation videos, infographics, case studies
6. Activities and Assessment	Quizzes, projects, reflection	Interactive quizzes, project templates, self-assessment

Implementation Stage

The implementation stage involved expert validation, revision, teacher training, and classroom trial. The expert validation involved four expert validators who assessed the

module's historical content, biological content, language aspects, and media/technical aspects. The validation results showed that the module received very high ratings across all aspects.

Table 5. Expert Validation Results

Aspect	Validator	Score	Percentage (%)	Category
History	History Expert	43/48	89.6	Very Feasible
Biology	Biology Expert	44/48	91.7	Very Feasible
Language	English Expert	42/47	89.4	Very Feasible
Media	Media Expert	45/49	91.8	Very Feasible
Average			90.6	Very Feasible

The history expert's assessment highlighted the accuracy and completeness of the historical content. Specific feedback included: "The historical content accurately represents the history of Banyuwangi, including the Blambangan Kingdom and Osing culture" (Validator 1), "The

content is appropriately detailed for senior high school students" (Validator 1), and "The integration of history with environmental themes is excellent" (Validator 1). Suggestions included adding more primary source materials and including references for further reading.

Table 6. History Expert Validation Details

Indicator	Score	Max Score	Percentage (%)
Historical accuracy	8	8	100
Curriculum relevance	7	8	87.5
Integration of topics	8	8	100
Appropriateness for students	7	8	87.5
Completeness of information	7	8	87.5
Educational value	6	8	75
Total	43	48	89.6

The biology expert's assessment focused on the scientific accuracy of the biodiversity content. The expert noted that "The biological information about flora and fauna in Banyuwangi is scientifically accurate and well-presented" (Validator 2), "The conservation messages are effectively

integrated" (Validator 2), and "The use of local species with scientific names is appropriate" (Validator 2). Suggestions included adding more information about endemic species and including more detailed ecological context.

Table 7. Biology Expert Validation Details

Indicator	Score	Max Score	Percentage (%)
Scientific accuracy	8	8	100
Completeness of species information	7	8	87.5
Conservation messages	8	8	100
Integration with local context	7	8	87.5
Appropriateness for students	7	8	87.5
Educational value	7	8	87.5
Total	44	48	91.7

The English expert's assessment evaluated the quality of the bilingual presentation. The expert noted that "The translation from Indonesian to English is accurate and maintains the meaning of the original text" (Validator 3), "The language level is appropriate for senior high school

students in both languages" (Validator 3), and "The use of both languages is balanced and consistent" (Validator 3). Suggestions included minor corrections to several translations and the addition of audio pronunciations for key terms.

Table 8. English Expert Validation Details

Indicator	Score	Max Score	Percentage (%)
Translation accuracy	8	9	88.9
Grammatical correctness (Indonesian)	7	8	87.5
Grammatical correctness (English)	7	8	87.5
Appropriate language level	7	8	87.5
Consistency of terminology	6	7	85.7
Clarity of expression	7	7	100
Total	42	47	89.4

The media expert's assessment evaluated the technical quality and interactivity of the digital module. The expert noted that "The interface is user-friendly and visually appealing" (Validator 4), "The multimedia elements are well-integrated and enhance learning" (Validator 4), "The

interactivity features are engaging and provide immediate feedback" (Validator 4), and "The module is responsive and works well on different devices" (Validator 4). Suggestions included optimizing loading times for videos and adding more interactive elements.

Table 9. Media Expert Validation Details

Indicator	Score	Max Score	Percentage (%)
Interface design	8	8	100
Navigation and usability	8	8	100
Multimedia integration	8	9	88.9
Interactivity features	7	8	87.5

Indicator	Score	Max Score	Percentage (%)
Technical quality	7	8	87.5
Responsiveness	7	8	87.5
Total	45	49	91.8

Based on the validation results and feedback, revisions were made to the module. The revisions included: (1) adding more primary source materials and references for further reading based on history expert feedback, (2) adding more information about endemic species and ecological context based on biology expert feedback, (3) correcting minor translation errors and adding audio pronunciations for key terms based on English expert feedback, (4) optimizing video loading times and adding more interactive elements based on media expert feedback, and (5) improving navigation and adding a progress tracker. The revised module was then implemented in classroom settings.

The classroom implementation involved 30 students from selected schools who used the digital module over a period of four weeks. Teachers received training on using the module and integrating it into their teaching. The implementation was monitored through observations and feedback collection.

Evaluation Stage

The evaluation stage involved collecting response data from teachers and students through questionnaires. The teacher response questionnaire measured five aspects: content quality, language quality, media quality, usability, and overall satisfaction. The results showed very positive responses across all aspects.

Table 10. Teacher Response Results

Indicator	Score	Max Score	Percentage (%)	Category
Content quality	34	36	94.4	Very Positive
Language quality	33	36	91.7	Very Positive
Media quality	35	40	87.5	Very Positive
Usability	34	36	94.4	Very Positive
Overall satisfaction	17	20	85.0	Very Positive
Average			90.6	Very Positive

The student response questionnaire measured five aspects: clarity of content, interest in the topic, usefulness for

learning, ease of use, and overall satisfaction. The results showed very positive responses across all aspects.

Table 11. Student Response Results

Indicator	Score	Max Score	Percentage (%)	Category
Clarity of content	108	120	90.0	Very Positive
Interest in the topic	105	120	87.5	Very Positive
Usefulness for learning	107	120	89.2	Very Positive
Ease of use	106	120	88.3	Very Positive
Overall satisfaction	108	120	90.0	Very Positive
Average			89.0	Very Positive

Qualitative feedback from teachers revealed that they particularly appreciated: (1) the integration of local content that connects to students' lives, (2) the bilingual format that supports English language development, (3) the interactive elements that engage students, (4) the ease of use and

accessibility, and (5) the alignment with the Merdeka Curriculum. Teachers also provided suggestions for improvement, including adding more project-based activities and including teacher guides.

Table 12. Teacher Qualitative Feedback

Theme	Example Quotes
Integration of local content	"Siswa sangat antusias karena materi tentang Banyuwangi yang mereka kenal" / "Students are very enthusiastic because the material is about Banyuwangi that they know"
Bilingual benefits	"Modul ini membantu siswa belajar Bahasa Inggris sambil memahami sejarah dan biologi" / "This module helps students learn English while understanding history and biology"
Interactive elements	"Kuis interaktif membuat siswa lebih tertarik dan termotivasi" / "Interactive quizzes make students more interested and motivated"
Ease of use	"Modul ini mudah digunakan, siswa bisa belajar mandiri" / "This module is easy to use, students can learn independently"
Curriculum alignment	"Sangat sesuai dengan semangat Kurikulum Merdeka" / "Very aligned with the spirit of the Merdeka Curriculum"

Qualitative feedback from students revealed that they particularly appreciated: (1) the use of local examples from Banyuwangi that they could connect to their daily lives, (2) the visual and interactive elements that made learning more engaging, (3) the bilingual format that helped them learn

English vocabulary, (4) the ability to learn at their own pace, and (5) the immediate feedback from quizzes. Students also provided suggestions for improvement, including adding more videos, more games, and a discussion forum.

Table 13. Student Qualitative Feedback

Theme	Example Quotes
Connection to local context	"Saya suka karena ada cerita tentang Banyuwangi yang saya kenal" / "I like it because it has stories about Banyuwangi that I know"
Visual and interactive appeal	"Gambaranya bagus dan kuisnya seru" / "The pictures are nice and the quizzes are fun"
Bilingual benefits	"Saya bisa belajar Bahasa Inggris sambil belajar sejarah" / "I can learn English while learning history"
Self-paced learning	"Saya bisa belajar kapan saja dan di mana saja" / "I can learn anytime and anywhere"
Immediate feedback	"Saya langsung tahu jawaban saya benar atau salah" / "I immediately know if my answer is right or wrong"

Discussion

The results of this research demonstrate that the developed bilingual digital module based on local history and biodiversity of Banyuwangi is highly feasible for use as a learning resource for contextual learning. The very high validation scores from history experts (89.6%), biology experts (91.7%), English experts (89.4%), and media experts (91.8%) indicate that the module meets high standards of quality across all aspects. These findings align with previous research on digital module development in Indonesian contexts, which have consistently shown that systematically developed digital materials using the ADDIE model can achieve high feasibility ratings (Yulianti & Wulandari, 2022; Widodo & Suhandi, 2021; Branch, 2009). The involvement of experts from multiple disciplines in the validation process ensured that the module addressed the diverse requirements of historical accuracy, scientific accuracy, language quality, and technical quality.

The history expert's validation of the module's content at 89.6% (Very Feasible) confirms that the integration of local history in the module is accurate, complete, and appropriate for senior high school students. The very high score for historical accuracy (100%) indicates that the historical information presented in the module is factually correct and free from errors. This is particularly important given the

potential for inaccurate information in locally developed teaching materials, as documented in research on educational material development (Nurjanah et al., 2023). By ensuring historical accuracy through expert validation, this research contributes to the development of reliable educational resources. The high score for integration of topics (100%) demonstrates the successful integration of history with environmental themes, supporting the argument that local historical narratives can serve as meaningful resources for environmental education (Munggarani et al., 2023). The integration of history with environmental themes in a digital format allows for multimedia elements that can enhance student engagement and understanding.

The biology expert's validation at 91.7% (Very Feasible) confirms the scientific accuracy and educational value of the biodiversity content. The very high scores for scientific accuracy (100%) and conservation messages (100%) indicate that the module presents scientifically sound information about flora and fauna in Banyuwangi and effectively conveys conservation values. This finding is consistent with research on the integration of local wisdom into biology learning, which has shown that local traditions and ecological knowledge can be effectively incorporated into biodiversity, conservation, ecosystems, and environmental change topics (Rahmawati et al., 2023; Adinugraha, 2020). The digital

format allows for the inclusion of high-quality images, videos, and interactive elements that can enhance the presentation of biodiversity content. The use of local species with their scientific names and common names in both languages supports vocabulary development in both Indonesian and English.

The English expert's validation at 89.4% (Very Feasible) confirms the quality of the bilingual presentation in the module. The high scores for translation accuracy (88.9%) and grammatical correctness in both languages (87.5%) indicate that the module successfully presents content in both Indonesian and English without compromising quality in either language. This finding is consistent with research on bilingual education, which emphasizes the importance of high-quality materials for effective bilingual instruction (Cummins, 2021; García & Wei, 2022). The module's bilingual format serves multiple purposes: it supports Indonesian language development, provides access to English language learning, and enables students to develop content knowledge in both languages. This aligns with the goals of bilingual education, which seeks to develop proficiency in multiple languages while maintaining connection to content learning. The audio pronunciation feature, added based on English expert feedback, provides additional support for vocabulary development.

The media expert's validation at 91.8% (Very Feasible) confirms the technical quality and interactivity of the digital module. The very high scores for interface design (100%) and navigation and usability (100%) indicate that the module is user-friendly and easy to navigate. This is important for ensuring that students can access and use the module independently without technical difficulties. The high scores for multimedia integration (88.9%) and interactivity features (87.5%) indicate that the module effectively uses multimedia elements and interactive features to enhance learning. This finding aligns with multimedia learning theory, which emphasizes the importance of combining words and pictures for effective learning (Mayer, 2021). The interactive quizzes with immediate feedback, video narrations, and audio pronunciations provide multiple means of engagement and representation, supporting diverse learners.

The very positive teacher responses (90.6% average) confirm that the module is well-received by teachers as a practical teaching resource. The highest scores were for content quality (94.4%) and usability (94.4%), indicating that teachers found the module content-rich and easy to use in their teaching. These findings are consistent with research on teacher perceptions of digital learning materials, which have shown that teachers value materials that are content-

rich, easy to use, and aligned with the curriculum (Rina et al., 2023). The teacher qualitative feedback, which emphasized appreciation for local content integration, bilingual format, interactive elements, ease of use, and curriculum alignment, provides further evidence of the module's practical value. Teachers' suggestion to add more project-based activities and teacher guides provides valuable directions for future development.

The very positive student responses (89.0% average) confirm that the module is well-received by its target users. The highest scores were for clarity of content (90.0%) and overall satisfaction (90.0%), indicating that students found the module clear, understandable, and satisfying to use. These findings are consistent with research on student perceptions of contextual and locally relevant digital teaching materials, which have shown that students are more engaged and motivated when learning materials connect to their local contexts and incorporate interactive elements (Rahmawati et al., 2023; Oktavianti & Ratnasari, 2018). The student qualitative feedback, which emphasized appreciation for local content, visual and interactive elements, bilingual format, self-paced learning, and immediate feedback, provides further evidence of the module's effectiveness in engaging students and supporting their learning.

The high score for interest in the topic (87.5%) indicates that students found the content engaging and motivating. This finding supports the argument that locally relevant content can increase student interest and engagement in learning (Gruenewald, 2003; Sobel, 2004). By presenting content about Banyuwangi's history and biodiversity in a digital format with interactive elements, the module connects to students' lived experiences and cultural identity, making learning more meaningful and relevant. This is particularly important in the context of senior high school education, where student engagement often declines (Eccles & Roeser, 2011). The digital format, with its multimedia and interactive capabilities, provides additional engagement benefits over traditional print materials.

The high score for ease of use (88.3%) indicates that students found the module easy to navigate and use. This is important for ensuring that students can access and use the module independently, without requiring extensive technical support. The responsive design, which works on various devices including computers, tablets, and smartphones, allows students to access the module anytime and anywhere, supporting flexible and self-paced learning. This finding aligns with research on the importance of usability in digital learning materials, which has shown that materials that are easy to use are more likely to be used effectively by students (Clark & Mayer, 2016; Mayer, 2021).

The development process employed in this research, following the ADDIE model with five stages, proved effective in producing a high-quality digital module. This finding is consistent with previous research on educational product development, which has shown that systematic development processes with validation and revision stages produce higher quality products (Branch, 2009; Richey & Klein, 2007). The involvement of multiple experts in the validation process ensured that the module addressed diverse quality criteria, while the teacher and student response data provided valuable feedback from the target users. The revision stage, informed by expert and user feedback, allowed for refinement of the module before finalization. The collaboration among students from three study programs in the development process ensured that the module reflected multidisciplinary perspectives.

The digital module developed in this research addresses the gap identified in the literature regarding the limited availability of integrated bilingual digital teaching materials for senior high school students in Indonesia. As noted by Adinugraha and Ratnapuri (2020), teaching materials that integrate local history, biodiversity, and language remain limited. By developing a digital module that simultaneously addresses these three dimensions, this research contributes to filling this gap and providing teachers with a valuable resource for implementing contextual and technology-integrated learning. The module's focus on Banyuwangi's local history and biodiversity also contributes to the preservation and transmission of local knowledge, which is increasingly important in the face of globalization and cultural change (Iskandar, 2017; Zidny & Eilks, 2022).

The digital module also addresses the need for technology-integrated materials that support the Merdeka Curriculum's emphasis on digital literacy and 21st-century skills. The module's interactive elements, multimedia content, and self-paced learning features support the development of digital literacy, critical thinking, and independent learning skills. This aligns with the goals of the Merdeka Curriculum, which emphasizes the development of Pancasila student profiles including digital literacy and lifelong learning (Badan Standar, 2022). The module's alignment with the curriculum and its support for multiple learning outcomes makes it a valuable resource for teachers implementing the Merdeka Curriculum.

The module's bilingual format addresses the need for materials that support English language development in Indonesian schools. As noted by Zein (2022) and Lie (2020), English language education in Indonesia faces significant challenges, including limited exposure to English and lack of meaningful contexts for language use. By providing content

about Banyuwangi's history and biodiversity in both Indonesian and English, the module creates meaningful contexts for English language learning and supports the development of academic vocabulary in English. This approach aligns with research on content-based language instruction, which has shown that language learning is most effective when embedded in meaningful content (Coyle et al., 2010; Lyster, 2018). The audio pronunciation feature provides additional support for developing speaking and listening skills.

The module's content, which includes local history, biodiversity, and conservation messages, also contributes to education for sustainable development. As emphasized by UNESCO (2017), education for sustainable development requires integrated approaches that address environmental, social, and economic dimensions of sustainability. By integrating historical understanding, ecological knowledge, and conservation awareness, the module supports the development of competencies needed for sustainable development. The digital format allows for the inclusion of multimedia elements that can enhance the presentation of sustainability concepts and engage students in meaningful learning about environmental issues.

The limitations of this study should be acknowledged. First, the research was conducted in Banyuwangi Regency with a limited number of participants, so the findings may not be generalizable to other contexts. However, the systematic development process and validation by multiple experts strengthen the credibility of the findings. Second, the study used a relatively short implementation period, and the long-term effectiveness of the module in improving student learning outcomes has not been fully assessed. Third, the study relied primarily on self-report measures (questionnaires) rather than direct measures of learning outcomes. Future research should include more rigorous evaluation of the module's effectiveness, including experimental designs that compare learning outcomes between students using the module and those using conventional materials. Fourth, the study did not examine the module's impact on students' environmental awareness or behavior change. Longitudinal studies would be valuable for understanding the long-term effects of the module.

CONCLUSION

This research successfully developed a bilingual digital module based on local history and biodiversity of Banyuwangi for contextual learning using the ADDIE model. The module, titled "Jelajah Banyuwangi: Sejarah dan Keanekaragaman Hayati" / "Exploring Banyuwangi: History and Biodiversity," was developed through systematic stages of analysis, design, development, implementation, and evaluation. The

validation results from history experts (89.6%), biology experts (91.7%), English experts (89.4%), and media experts (91.8%) indicate that the module is highly feasible for use as a learning resource. Teacher responses were also very positive (90.6% average), and student responses reached 89.0% average, confirming that the module is well-received by its target users. The module successfully integrates local history, biodiversity, and conservation messages in a bilingual digital format that is interactive, engaging, and accessible for senior high school students.

The implications of this research are significant for educational practice and policy in Indonesia. First, the module provides teachers with a valuable technology-integrated resource for implementing contextual and multidisciplinary learning as encouraged by the Merdeka Curriculum. Second, the module supports the development of multiple competencies simultaneously, including historical understanding, ecological knowledge, English language skills, and digital literacy. Third, the module contributes to the preservation and transmission of local knowledge about Banyuwangi's history and biodiversity. Fourth, the module supports environmental conservation education by raising awareness about the importance of protecting Banyuwangi's natural heritage. Fifth, the ADDIE model-based development process employed in this research can serve as a model for developing similar digital teaching materials in other regions. Future research should evaluate the module's effectiveness in improving student learning outcomes through more rigorous experimental designs, explore the long-term impact of the module on student environmental awareness and behavior, and investigate the potential for adapting the module for use in other regions with different local contexts.

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