

INTEGRATING BANYUMAS LOCAL WISDOM INTO AI-BASED INTERACTIVE LEARNING MEDIA TO ENHANCE STUDENTS' VOCABULARY

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Abstract. Vocabulary mastery is a fundamental component of English language learning, yet many students struggle due to the lack of engaging and contextual learning media. Integrating local culture offers a promising approach to enhancing relevance and motivation in language acquisition. **Objective:** This study aims to develop an AI-based interactive learning application that integrates Banyumas cultural content to improve vocabulary mastery among students in the English Education Study Program. **Method:** The research employed a Research and Development (R&D) approach using the ADDIE model. The application was developed with five main modules: Banyumas Cultural Gallery, Thematic Vocabulary, Interactive Narratives, Vocabulary Practice Chatbot, and Self-Assessment. The media was tested on 60 students in April 2025 through pre-test and post-test evaluation, perception surveys, and expert validation. **Results:** The findings showed a significant improvement in students' vocabulary scores (from 62.3 to 81.7, $p < 0.001$). Students demonstrated high levels of engagement, ease of use, and strong cultural relevance. The integration of local wisdom not only enhanced vocabulary retention but also strengthened motivation and cultural awareness. This study highlights the pedagogical potential of combining AI technology with local cultural content to create meaningful, adaptive, and sustainable language learning experiences.

Keywords: artificial intelligence, vocabulary learning, local wisdom, banyumas culture, interactive learning media

1. Introduction

Vocabulary mastery is an essential component in English as a Foreign Language (EFL) learning. Vocabulary serves as the foundation for all language skills, including reading, writing, listening, and speaking, and is a primary indicator of students' communicative competence [1]. However, many students in English Education programs face persistent challenges in expanding and internalizing new vocabulary. One of the main causes is the lack of contextual, engaging, and culturally relevant learning media [2].

In today's digital era, Artificial Intelligence (AI) technology provides significant opportunities to revolutionize language learning approaches. AI allows for personalized learning, high interactivity, and integration of multimedia content that can enhance student engagement and motivation [3]. Despite its potential, the use of AI in English language learning in Indonesia remains underutilized—especially in developing media that incorporate local cultural contexts as part of learning content.

Integrating local wisdom into learning media is believed to create a more meaningful and relevant learning experience. Local culture enriches educational content and strengthens students' national identity and cultural values [4]. In the Banyumas context, cultural assets such

as Ebeg traditional dance, Lengger traditional dance, the Raden Kamandaka folktale, and distinctive culinary traditions such as mendoan and getuk goreng hold immense potential to serve as sources for contextual English learning. When new vocabulary is presented through familiar cultural narratives, students tend to comprehend and retain it more effectively [5].

This study aims to develop an AI-based interactive learning medium that integrates Banyumas cultural content to improve students' vocabulary mastery. The media is designed as a multimedia gallery application presenting vocabulary through narration, visuals, and interactive features based on local cultural themes. This approach supports contextualized language learning while simultaneously contributing to the preservation of regional culture through education.

The development model employed is the ADDIE framework—Analysis, Design, Development, Implementation, and Evaluation—which has proven effective for creating technology-based learning media [6]. During the analysis phase, student learning needs and potential local cultural assets are identified. The design and development stages involve creating AI-based multimedia content featuring vocabulary in Banyumas cultural contexts. The implementation stage tests the media with students, while the evaluation phase measures vocabulary improvement and students' perceptions of the tool.

Preliminary findings indicate a significant increase in students' vocabulary mastery after using the developed media, as shown by the statistically significant difference between pre-test and post-test scores. Additionally, most students reported that the media was more engaging, easy to use, and helpful in connecting new vocabulary with real cultural contexts. Feedback also revealed that the integration of local culture enhanced learning motivation and cultural awareness.

This research contributes to the innovation of English learning that is contextual, adaptive to technological development, and sustainable. Beyond producing a prototype interactive application, it also generates international journal articles, seminar presentations, and a draft of a culture-based teaching book. Thus, this approach not only improves students' linguistic competence but also promotes regional culture preservation through technology-based education.

1.1. Vocabulary Mastery in English Language Learning

Vocabulary is a fundamental component in second and foreign language acquisition. The nation is emphasizing that adequate vocabulary mastery enables learners to comprehend texts, express ideas, and interact effectively in the target language [1]. However, vocabulary learning in traditional classrooms often tends to be mechanical and decontextualized, leading to limited long-term retention [7]. Therefore, approaches that integrate vocabulary within authentic cultural and experiential contexts are highly encouraged.

Webb and Nation argue that exposure to vocabulary in meaningful contexts enhances semantic associations, memory retention, and learner engagement [7]. As a result, contextualized learning strategies that connect new words with cultural content can provide deeper cognitive and affective engagement in vocabulary learning.

1.2. The Role of Local Wisdom in Contextual Learning

Integrating local wisdom into education has become an increasingly strategic approach to building relevant and meaningful learning experiences. Local wisdom encompasses values, practices, and cultural expressions embedded in community life, including traditional arts, folktales, and local cuisine [4]. Within language learning, using local narratives enhances vocabulary acquisition by connecting linguistic content with familiar cultural frameworks [5].

Mustofa et al. are demonstrating that English language instruction rooted in local culture not only improves language proficiency but also fosters motivation and engagement among

students [8]. In the Banyumas region, Rich cultural elements such as egeg, lengger, and the legend of Raden Kamandaka offer abundant material for contextual learning, as they embody local wisdom, moral values, historical narratives, and authentic linguistic expressions that are highly relevant to students' sociocultural backgrounds. For example, egeg performances can be utilized as learning material for descriptive texts, where students identify traditional musical instruments, costumes, and performance structures. Similarly, lengger dance can serve as a medium for teaching procedural texts by guiding students to explain the steps of the dance movements or the preparation of traditional performances. Meanwhile, the legend of Raden Kamandaka can be integrated into narrative text instruction, allowing students to analyze plot structure, character development, moral lessons, and cultural symbolism while simultaneously strengthening their local cultural identity. Incorporating these cultural aspects into digital learning media can strengthen both linguistic understanding and cultural identity.

1.3. Artificial Intelligence in Language Learning

Artificial Intelligence (AI) has transformed the way education is delivered and experienced. In language learning, AI facilitates personalized instruction, adaptive feedback, and interactive engagement that cater to individual learning styles [3]. Chen et al. found that AI systems can tailor vocabulary presentation based on learner performance and preferences, enhancing learning outcomes [9].

Lin et al. further demonstrated that AI-based language learning applications significantly improve vocabulary mastery and motivation compared to conventional methods [10]. AI enables real-time data analysis, allowing systems to adjust learning materials dynamically to suit learners' needs. Such capabilities make AI a powerful pedagogical tool for promoting student-centered learning environments.

1.4. The ADDIE Model in Educational Media Development

The ADDIE model—consisting of Analysis, Design, Development, Implementation, and Evaluation—is widely used in instructional design to ensure systematic development and quality assurance of learning media [6]. It supports iterative evaluation and adaptation at every stage, resulting in more effective and user-oriented learning tools.

Alenezi emphasized that applying the ADDIE framework in digital media development leads to products that better meet learners' needs and improve educational effectiveness [11]. In this research, ADDIE serves as both a developmental and evaluative framework for integrating AI technology with Banyumas cultural content.

1.5. Conceptual Synergy of R&D Methodology with AI-Based Local Wisdom Integration

The use of the ADDIE model within an R&D framework in this study ensures that the resulting learning media are not only technologically advanced but also culturally grounded. Each stage—from analysis to evaluation—is designed to align with local values while leveraging contemporary AI innovations. This methodological synergy ensures that the media developed is contextually relevant, pedagogically sound, and technologically sustainable.

Through this integration, students are expected to achieve comprehensive vocabulary mastery while developing global awareness rooted in local culture. Such alignment represents a form of glocalization in education—combining global technological advances with local cultural identity to produce adaptive and sustainable learning experiences.

2. Methods

2.1. Research Design: Research and Development (R&D) Approach

This study employed a Research and Development (R&D) approach to design and produce innovative, valid, and practical AI-based learning media for improving students' English

vocabulary. The ADDIE model was adopted as the primary framework, encompassing five systematic stages: Analysis, Design, Development, Implementation, and Evaluation [6,11].

The respondents of this study were first-semester undergraduate students of the English Education Study Program in the 2025/2026 academic year. A total of 60 students participated in the field testing phase. The second-semester students were purposively selected for three main reasons. First, they were enrolled in a Basic Vocabulary course, making the developed media highly relevant to their current learning needs. Second, their vocabulary proficiency was still at the elementary to lower-intermediate level, allowing measurable improvement through instructional intervention. Third, they had sufficient digital literacy to interact effectively with AI-based learning tools.

The implementation phase was conducted over four weeks, consisting of eight instructional sessions (two sessions per week), with each session lasting approximately 90 minutes. During the experiment, students engaged in structured vocabulary activities using the AI-based media, including interactive exercises, contextual vocabulary tasks, pronunciation practice, and adaptive quizzes. Pre-test and post-test assessments were administered to measure vocabulary improvement, while questionnaires and observation sheets were used to evaluate practicality and user responses.

The evaluation stage involved both formative evaluation during development and summative evaluation after implementation to determine the validity, effectiveness, and practicality of the developed learning media.

2.2. Analysis Stage

The first stage involved a comprehensive needs analysis. Researchers identified learning gaps in students' vocabulary mastery, explored challenges they faced in acquiring new words, and investigated potential integration of Banyumas local wisdom into innovative media. Data collection methods included interviews, questionnaires, and curriculum document analysis.

The analysis also examined student profiles, learning interests, and technological readiness—both from the users' and the institution's perspectives. The primary outputs of this phase were: (1) identification of AI media features suitable for vocabulary learning, (2) thematic vocabulary scope, and (3) a curated list of Banyumas cultural elements to be integrated into the content.

2.3. Design Stage

In this stage, researchers created conceptual designs, including flowcharts, storyboards, and user interface (UI) layouts for the interactive media. The design emphasized three major aspects:

- a) Vocabulary enrichment,
- b) Integration of Banyumas cultural values, and
- c) Optimization of AI functionalities, such as adaptive quizzes, chatbots, and progress tracking.

The prototype design adhered to the principles of Universal Design for Learning (UDL) and instructional design to ensure accessibility for diverse learning styles. Cultural mapping was also conducted to select authentic stories, idioms, and cultural practices that represent Banyumas identity while being pedagogically relevant.

2.4. Development Stage

During development, the prototype was built collaboratively by a multidisciplinary team consisting of software developers, linguists, and Banyumas cultural experts. AI technologies were embedded within the media to provide features such as pronunciation detection, culturally themed vocabulary banks, and conversation practice simulations inspired by Banyumas life scenarios (e.g., markets, festivals, or tourism sites).

Expert validation was conducted involving English lecturers, IT practitioners, and local cultural figures. Validation focused on linguistic accuracy, cultural authenticity, AI functionality, and user experience. Revisions and refinements were made iteratively based on feedback to ensure pedagogical and technical soundness.

2.5. Implementation Stage

The implementation phase involved field testing the interactive media with students. The pilot testing was conducted in two phases: a limited trial and a broader field trial. Students were divided into small groups to explore the application, complete vocabulary exercises, and engage with AI-based tasks such as quizzes, dialogue simulations, and chatbot interactions themed around Banyumas culture.

Data collection included classroom observation, activity logs, pre-test and post-test assessments of vocabulary mastery, and student perception surveys. Both instructors and researchers monitored the process to ensure optimal participation and usability feedback.

2.6. Evaluation Stage

Evaluation was conducted through both formative and summative approaches. Formative evaluation occurred at each development stage, incorporating expert and user feedback for ongoing improvement. Summative evaluation was performed at the end of the implementation phase, analyzing quantitative and qualitative data to assess media effectiveness.

Quantitative evaluation employed descriptive and inferential statistics, including paired sample t-tests to measure pre-test and post-test score differences. Qualitative data—such as open-ended survey responses—were analyzed through triangulation to assess student engagement, perceptions of cultural integration, and ease of AI use.

The main success indicators included:

- a) Significant improvement in vocabulary test scores,
- b) Positive student reception of cultural integration, and
- c) Ease of AI feature utilization during learning.

3. Results And Discussion

3.1. Results of Learning Media Development

The developed learning media took the form of an AI-based interactive educational application presenting English vocabulary through narration, visuals, and interactive cultural content. The application consisted of five main modules:

- a) Banyumas Cultural Gallery,
- b) Thematic Vocabulary,
- c) Interactive Narratives,
- d) Vocabulary Practice Chatbot, and
- e) Self-Assessment.

The integrated cultural materials included egeg traditional dance, lengger performance, the Raden Kamandaka folktale, and typical Banyumas foods such as mendoan and getuk goreng.

Expert validation indicated that the media met pedagogical, technological, and cultural criteria. Language experts confirmed that vocabulary selection aligned with students' proficiency levels, while cultural experts evaluated the representation of Banyumas traditions as authentic and educational. Limited trials involving ten students revealed that the application was easy to use, engaging, and effective in facilitating contextual vocabulary learning.

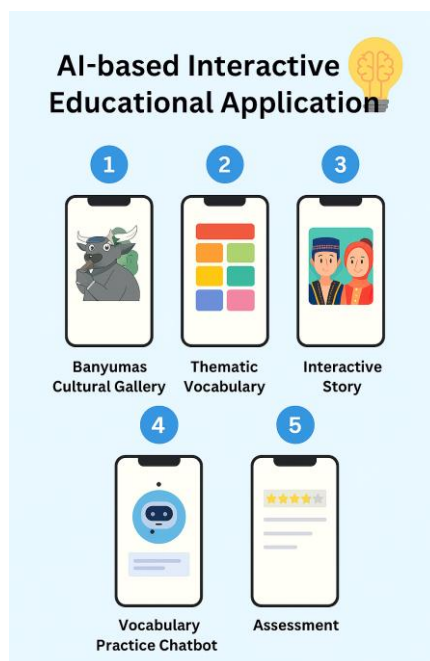


Figure 1. AI-Based Interactive Educational Application

3.2. Effectiveness Test Results

To assess effectiveness, the media was tested on 60 students in the English Education Study Program using a **pre-test and post-test design**. The vocabulary test included 40 multiple-choice items covering both general and culture-based vocabulary.

Statistical analysis using **paired sample t-test** showed a significant improvement in post-test scores compared to pre-test scores ($t = 9.87, p < 0.001$). The average pre-test score was **62.3**, while the post-test average increased to **81.7**. This improvement of **19.4 points** demonstrates the application's effectiveness in enhancing students' vocabulary mastery.

These results are consistent with previous studies by Lin et al. [10] and Chen et al. [9], which found that AI-based learning applications significantly enhance vocabulary acquisition and motivation through interactive multimodal content.

3.3. Student Perceptions of the Media

Perception data were obtained from student questionnaires and open-ended responses. The findings revealed that **88%** of respondents found the media more engaging than conventional learning methods, while **91%** agreed that integrating local culture made learning more relevant and meaningful. Furthermore, **85%** stated that connecting new vocabulary to familiar Banyumas contexts improved their retention and understanding.

Table 1. Students' Perceptions toward AI-Based Local Culture Learning Media (n = 60)

Statement	Strongly Agree	Agree	Disagree	Strongly Disagree	Agreement (%)
The media is more engaging than conventional methods	30	23	5	2	88%
Local culture integration makes learning meaningful	34	21	3	2	91%
Banyumas context improves vocabulary retention	28	23	6	3	85%

Students's qualitative feedback highlighted that the *Raden Kamandaka* narrative and *lengger* dance visuals enhanced comprehension of cultural vocabulary. Many also praised the AI chatbot for providing interactive and adaptive vocabulary practice. These findings align with

Mayer's multimedia learning theory, which posits that meaningful connections between words and visuals strengthen understanding and memory [12].

3.4. Integration of Local Culture as a Pedagogical Strategy

The integration of Banyumas culture within the AI-based media functioned not merely as a decorative feature but as a **pedagogical strategy**. It encouraged emotional engagement, reinforced cultural identity, and facilitated semantic associations between new words and lived experiences.

Mustofa et al. [8] argued that culturally grounded English learning strengthens learners' connection to their heritage while enhancing motivation. This study corroborates that claim: students expressed pride and ownership when their local culture became the subject of academic learning.

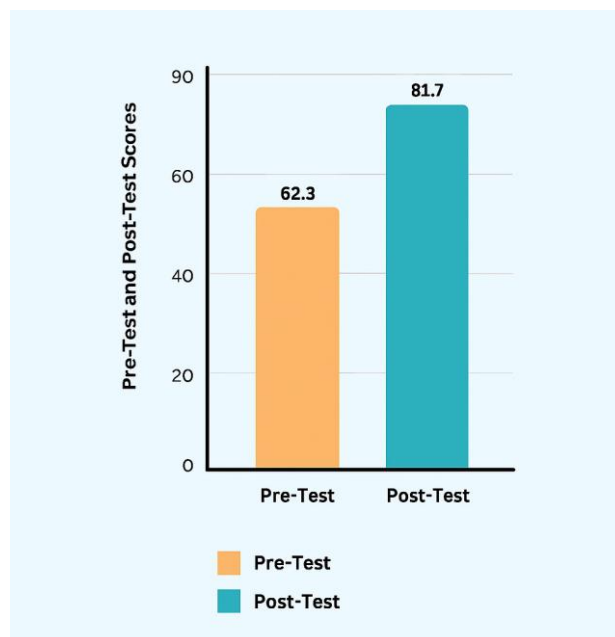
Cultural integration also reflects the **glocalization paradigm**—bridging global technological advancements with local wisdom to create adaptive and sustainable educational practices [3]. Here, AI served as the medium that revitalized cultural heritage through digital transformation.

3.5. The Role of AI in Enhancing Learning Effectiveness

Artificial Intelligence in this media enabled personalized learning experiences. Through **Natural Language Processing (NLP)** and **Machine Learning (ML)** algorithms, the system recognized students' responses, provided instant feedback, and adjusted the difficulty level of exercises.

The chatbot component simulated conversation practice based on Banyumas scenarios such as markets, folklore settings, and local events. Meanwhile, the self-assessment module tracked learners' vocabulary growth and recommended subsequent learning paths.

These features mirror the findings of Chen et al. [9], who showed that AI-driven personalization increases learner autonomy and motivation. Students in this study also reported feeling more actively involved and independent, perceiving AI as not merely a tool but as a **pedagogical agent** that supports self-directed and reflective learning.



Grafik1. Statistical Analysis

A **quasi-experimental one-group pre-test–post-test design** was employed to evaluate vocabulary gains. The **paired sample t-test** confirmed a statistically significant difference between pre-test and post-test scores ($t(59) = 9.87, p < 0.001$).

Table 2. Paired Sample t-Test Results

Measure	N	Mean Pre-Test	Mean Post-Test	Mean Difference	<i>t</i>	<i>p</i>
Vocabulary Mastery	60	62.3	81.7	19.4	9.87	<0.001

The analysis validates that the AI-based media significantly enhanced vocabulary acquisition. The 19.4-point increase supports the conclusion that combining adaptive AI features with cultural context fosters deeper learning engagement and retention, consistent with earlier findings by Lin et al. [10] and Chen et al. [9].

4. Conclusion

This research demonstrates that integrating **Banyumas local wisdom** into an **AI-based interactive learning application** significantly improves students' English vocabulary mastery. The ADDIE-based development process successfully combined cultural elements—such as traditional arts, folklore, and culinary heritage—into thematic vocabulary modules, interactive narratives, and adaptive AI chatbot exercises.

Statistical results confirmed substantial vocabulary improvement ($p < 0.001$), supported by highly positive student perceptions of cultural relevance, usability, and motivational impact. The study reinforces the pedagogical premise that **contextual learning rooted in cultural identity enhances engagement and retention**.

AI technology further enabled personalized and dynamic vocabulary acquisition, providing a model for culturally responsive and technology-integrated language learning. This approach not only advances EFL pedagogy but also supports the **preservation of local culture through digital education**.

Despite promising outcomes, several limitations must be noted. First, the study was confined to a single institution and program, limiting generalizability. Second, the media focused primarily on vocabulary learning and did not yet include other language skills such as grammar, speaking, or writing. Future research should therefore expand the scope and test the application across diverse populations and linguistic competencies.

The study's findings have several pedagogical implications:

- Contextual Learning:** Integrating local culture allows vocabulary learning to be more contextual and meaningful, fostering better retention and comprehension.
- Technological Innovation:** AI supports personalized, interactive, and adaptive learning experiences that promote autonomy.
- Cultural Preservation:** By embedding Banyumas culture into English learning, the study contributes to regional cultural preservation through education.
- Curriculum Development:** The research outcomes can inform curriculum design by embedding local wisdom within digital English learning programs.
- Replicability:** The model can be adapted for other regions by localizing cultural content, supporting linguistic diversity and cultural sustainability.

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