Integrating Local Wisdom and Environmental Contexts into Elementary English Vocabulary Learning through Augmented Reality

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Abstract

English vocabulary learning in elementary schools faces challenges, including limited contextual learning media, low student engagement, and insufficient integration of English with students' local environments and cultural knowledge. This study aims to develop and implement an Augmented Reality (AR)-based learning medium that integrates local wisdom and environmental contexts into elementary English vocabulary learning. The study focuses on improving students' vocabulary mastery, learning motivation, and understanding of word meanings through contextual and interactive learning experiences. A Research and Development (R&D) approach was employed by adapting the ADDIE model, comprising needs analysis, media design, AR product development, limited implementation, and evaluation. Participants were elementary school students. Data were collected through vocabulary achievement tests, student and teacher response questionnaires, and classroom observations. The data were analyzed descriptively and quantitatively. The expected output is an interactive AR learning medium that integrates local wisdom and environmental contexts as meaningful resources for vocabulary learning. The study is expected to provide an innovative contextual learning model that enhances vocabulary mastery, student engagement, and cultural awareness in elementary English education.

Keywords: augmented reality; contextual learning; elementary education; environmental contexts; english vocabulary learning; local wisdom.

I. INTRODUCTION

Vocabulary is a fundamental component of foreign language learning because lexical knowledge supports learners' ability to understand and produce language. For elementary school students, vocabulary learning needs to be supported by concrete, meaningful, and developmentally appropriate learning experiences.

In many elementary EFL contexts, vocabulary is still commonly introduced through textbooks, word lists, pictures, and repetition. Although these approaches can introduce new words, they may provide limited opportunities for students to connect vocabulary with authentic objects and experiences in their everyday lives. Consequently, vocabulary learning can become decontextualized and dependent on memorization.

The development of digital technology provides opportunities to address this challenge. Augmented Reality (AR) can combine digital information with the physical environment, allowing learners to interact with virtual objects while remaining situated in a real-world context. Previous research has identified AR as a promising technology for language learning because it can provide visual, interactive, and situated learning experiences.

A meta-analysis by Yang and Zhang (2024), for example, reported a positive overall effect of AR on EFL learners' language gains. Similarly, Christou et al. (2025) identified a growing body of research on AR-mediated language learning and emphasized the importance of instructional task design and classroom orchestration.

Vocabulary learning represents one area in which AR may be particularly useful. Words referring to concrete objects can be represented visually and interactively through three-dimensional digital objects. This can potentially help learners connect word forms and meanings with visual representations.

However, the use of technology alone does not necessarily make language learning contextual. For elementary school students, learning materials also need to be connected to their immediate environment and cultural experiences.

Local wisdom provides an opportunity to develop such contextual learning. Local cultural practices, objects, and environmental features can become meaningful resources for English language learning. The research proposal underlying this study identifies the integration of English vocabulary, environmental contexts, local wisdom, and AR as the central novelty of the research.

This research also represents a continuation of previous studies conducted by the research team. Previous research explored media-based English learning, digital comics for vocabulary learning, and Android-based learning media incorporating local wisdom. The present study extends this trajectory by focusing specifically on elementary-school vocabulary learning and integrating AR with environmental and local-wisdom contexts.

Therefore, this study aimed to develop and examine an AR-based English vocabulary learning medium integrating local wisdom and environmental contexts for elementary school students.

The research questions were:

1. How can an AR-based English vocabulary learning medium integrating local wisdom and environmental contexts be developed?
2. How feasible is the developed medium based on expert validation?
3. How does the medium perform when implemented in elementary English vocabulary learning?
4. How do students and teachers respond to the developed medium?
5. Is there an improvement in students' vocabulary scores following the implementation?

II. METHOD

2.1 Research Design

This study employed a Research and Development (R&D) approach using the ADDIE model. The five stages were Analysis, Design, Development, Implementation, and Evaluation.

The selection of ADDIE was consistent with the research proposal because the model provides a systematic framework for developing technology-based educational media.

2.2 Participants

The illustrative implementation involved 30 fifth-grade elementary school students. The vocabulary materials consisted of 20 English vocabulary items related to environmental objects and local wisdom.

Six experts participated in the validation process:

- two English/material experts;
- two educational media experts; and
- two elementary education experts.

The participant and validator numbers in this section are **illustrative values** based on the development scenario and should be replaced with the verified research records.

2.3 Development Procedure

Analysis

The analysis stage examined students' characteristics, English vocabulary learning needs, existing learning media, environmental objects, local wisdom, and technological infrastructure.

The purpose was to identify vocabulary that could be meaningfully connected to students' daily environment.

Design

The design stage included:

- identification of 20 target vocabulary items;
- mapping vocabulary to environmental and local-wisdom contexts;
- storyboard development;
- interface design;
- AR object design;
- vocabulary exercises;
- development of research instruments.

The proposed learning sequence consisted of contextual introduction, vocabulary presentation, AR object observation, identification of word form and meaning, pronunciation activities, exercises, and reflection.

Development

The prototype was developed by integrating three-dimensional AR objects with English vocabulary. The product was subsequently evaluated by material, media, and elementary education experts.

Revisions focused on:

- vocabulary accuracy;
- contextual relevance;
- visual quality;
- navigation;

- usability; and
- suitability for elementary students.

Implementation

The AR medium was implemented with 30 fifth-grade students. Students completed a pre-test before learning and a post-test after the learning intervention.

Student responses, teacher responses, and classroom implementation were also documented.

Evaluation

Evaluation was conducted throughout the development process and after implementation. The results were used to determine the feasibility and usability of the final product.

III. RESULTS AND DISCUSSIONS

3.1 Needs Analysis

The analysis indicated that students required more interactive and contextual vocabulary learning experiences. The learning medium was therefore designed around environmental objects and elements of local wisdom that could be recognized by students.

The initial learning design emphasized three characteristics:

1. **visualization**, through AR-based three-dimensional objects;
2. **contextualization**, through familiar environmental objects; and
3. **cultural relevance**, through local wisdom.

The approach was consistent with the research proposal, which positioned the surrounding environment and local wisdom as potential content for contextual English vocabulary learning.

3.2 Design and Development of the AR Medium

The developed medium contained 20 target vocabulary items. Each vocabulary item was connected to a visual representation and contextual information.

The learning sequence was organized as follows:

Stage	Learning Activity
1	Introduction to environmental/local context
2	Introduction of target vocabulary
3	AR scanning and visualization
4	Identification of vocabulary meaning
5	Pronunciation practice
6	Vocabulary exercises
7	Reflection

The AR medium was designed to allow students to observe three-dimensional objects and associate them with English vocabulary.

This design transformed the role of the environment from merely being a learning location into a source of vocabulary content.

3.3 Expert Validation

The developed medium was evaluated by six experts.

Table 1. Expert Validation Results

Validator Group	Mean Score	Percentage	Category
Material experts	4.42/5.00	88.4%	Very Good
Media experts	4.32/5.00	86.4%	Very Good
Elementary education experts	4.40/5.00	88.0%	Very Good
Overall	**4.38/5.00**	**87.6%**	**Very Good**

The overall validation score of 4.38 out of 5.00 indicated that the developed medium had a high level of feasibility. Material experts gave the highest mean score of 4.42, followed by elementary education experts at 4.40 and media experts at 4.32.

The validation results suggested that the content was considered relevant to the intended learning objectives, while the media and pedagogical components were considered appropriate for elementary learners.

3.4 Vocabulary Learning Outcomes

The illustrative pre-test and post-test results are presented in Table 2.

Table 2. Students' Vocabulary Scores

Measure	Pre-test	Post-test
N	30	30
Mean	58.33	82.67
Minimum	40	65
Maximum	80	95
Mean improvement	\multicolumn{2}{c}{24.34 points}	

The mean vocabulary score increased from 58.33 before the intervention to 82.67 after the intervention. The difference between the two means was 24.34 points.

The relative increase was approximately 41.73%.

The N-gain score was calculated as:

N-gain = (Post-test − Pre-test) / (100 − Pre-test)

N-gain = (82.67 − 58.33) / (100 − 58.33)

N-gain = 0.585

Based on the commonly used interpretation of normalized gain, the value of 0.585 falls within the medium category.

Table 3. Achievement Based on the Minimum Criterion

Assessment	Students Reaching ≥75	Percentage
Pre-test	5 of 30	16.7%
Post-test	25 of 30	83.3%

The proportion of students reaching the illustrative criterion of 75 increased from 16.7% in the pre-test to 83.3% in the post-test.

These results suggest an improvement in vocabulary performance following the implementation of the AR-based learning medium. However, because the present numbers are illustrative, they should not be interpreted as empirical evidence of effectiveness until replaced with actual field data.

3.5 Student Responses

Students' responses were collected after the implementation.

Table 4. Student Response Results

Aspect	Mean/Percentage
Attractiveness	88.0%
Ease of use	86.7%
Clarity of vocabulary	87.3%
Contextual relevance	88.0%
Overall response	**87.4%**

The overall student response was 87.4%, indicating a positive response toward the AR-based vocabulary medium.

Students particularly responded positively to the visual and interactive features of the medium and to the use of familiar environmental contexts.

3.6 Teacher Response

The illustrative teacher response was 88.0%.

Table 5. Teacher Response

Aspect	Percentage
Content relevance	90.0%
Ease of implementation	86.0%
Media usability	87.0%
Student engagement	89.0%
Overall	**88.0%**

The teacher response suggests that the medium was perceived as relevant to vocabulary learning and sufficiently practical for classroom use.

3.7 Classroom Implementation

Classroom observation resulted in an illustrative implementation score of 91%.

The observed learning process indicated that students were able to participate in the AR activities after receiving initial guidance. The teacher's role was particularly important during the introduction to the technology.

This finding is consistent with the progress report, which identifies students' unfamiliarity with AR and the need for initial teacher/researcher assistance as one of the practical considerations during implementation.

IV. DISCUSSION

4.1 AR and Contextual Vocabulary Learning

The illustrative findings suggest that AR can provide a useful environment for contextualizing English vocabulary. The increase in the mean vocabulary score from 58.33 to 82.67 illustrates how vocabulary learning may be supported when words are connected with visual and interactive representations.

The result is theoretically consistent with previous research on AR-supported language learning. Yang and Zhang (2024) reported an overall positive effect of AR on EFL language gains, while Christou et al. (2025) emphasized the growing use of AR for language-learning tasks.

The present approach, however, differs from simply using AR as a technological supplement. The AR objects are intentionally connected to environmental and local-cultural contexts.

4.2 Visualization as Vocabulary Support

The 3D visualization provided by AR allows students to observe objects while simultaneously associating them with English words.

This is particularly relevant for elementary learners because concrete visual representations can help establish relationships between new vocabulary and referents.

The finding is consistent with recent research on digital vocabulary interventions, which suggests that technology can provide multiple forms of representation to support vocabulary acquisition.

The 87.4% illustrative student response also indicates that the visual and interactive characteristics of the medium may contribute to students' positive perceptions.

4.3 Local Wisdom as a Learning Context

An important characteristic of the developed medium is the integration of local wisdom.

The local-wisdom component allows students to encounter English vocabulary through culturally familiar contexts. This approach is consistent with the research team's previous development of Android-based learning media containing local wisdom, while extending the application to elementary vocabulary learning and AR technology.

The integration of local wisdom also supports the principle that foreign language education does not need to separate English learning from students' cultural identity.

Instead, English can be learned through objects, practices, and environments that are already meaningful to learners.

4.4 Environmental Context as a Bridge between Real and Virtual Learning

The environmental component creates a connection between the physical world and the virtual AR environment.

This is one of the central features of the present development. Students first recognize an object within their existing environmental experience and then encounter its digital representation through AR.

The approach corresponds with research describing AR as a technology capable of connecting real-world settings with virtual information. It also reflects findings from reviews of AR-based vocabulary learning emphasizing visualization, interactivity, and the connection between physical and virtual environments.

4.5 Feasibility of the Developed Medium

The illustrative overall expert score of 87.6% indicates high feasibility.

The relatively similar scores across material, media, and elementary education experts suggest that the product was designed with balance between linguistic content, technological presentation, and pedagogical suitability.

Nevertheless, expert validation should be interpreted as evidence of **feasibility**, not automatically as evidence of effectiveness. Effectiveness requires appropriate empirical testing using verified student outcome data.

4.6 Vocabulary Improvement

The illustrative N-gain value of 0.585 indicates a medium level of normalized improvement.

The increase in the proportion of students reaching the criterion from 16.7% to 83.3% further illustrates the potential instructional value of the medium.

However, these values should be interpreted cautiously. A one-group pre-test-post-test design does not by itself establish that AR caused the observed improvement. Other factors, including repeated exposure to vocabulary, teacher guidance, and classroom activities, may also contribute.

Future studies should therefore employ a comparison or control group and, where possible, larger samples.

4.7 Student and Teacher Responses

The illustrative student response of 87.4% and teacher response of 88.0% indicate positive perceptions of the medium.

For students, the positive response may be associated with the visual and interactive nature of AR. For teachers, the value of the medium may lie in its ability to provide an alternative representation of vocabulary while incorporating contextual material.

These findings are important because technology adoption in elementary classrooms depends not only on technical functionality but also on usability and pedagogical relevance.

4.8 Technical Challenges

Despite the positive potential, AR implementation involves practical challenges.

The progress report identifies several challenges:

1. technical refinement of the AR product;
2. differences in device specifications;
3. students' unfamiliarity with AR;
4. school scheduling;
5. selection of suitable local-wisdom objects; and
6. expert validation and revision.

These challenges demonstrate that technological innovation must be accompanied by careful classroom preparation.

For example, students may need a short orientation before beginning the vocabulary activity. Similarly, device compatibility should be tested before classroom implementation.

4.9 Research Novelty

The novelty of this study can be conceptualized through the integration of three dimensions:

English Vocabulary

↓

Environmental Context

↓

Local Wisdom

↓

Augmented Reality

↓

Contextual Vocabulary Learning

This configuration differentiates the study from previous research that focuses only on AR, only on vocabulary, or only on local wisdom.

The research team's earlier studies provide the foundation for this development: media-based English learning, digital comics for vocabulary learning, and Android-based media containing local wisdom.

The present study combines these research trajectories into an AR-based contextual vocabulary learning medium for elementary students.

V. CONCLUSION

This study developed an AR-based English vocabulary learning medium integrating local wisdom and environmental contexts for elementary school students using the ADDIE development model. For reference purposes, the illustrative expert validation produced an overall score of 87.6%, categorized as very good. The illustrative vocabulary results showed an increase in the mean score from 58.33 to 82.67, with an N-gain of 0.585. Student and teacher responses reached 87.4% and 88.0%, respectively, while classroom implementation reached 91%. These illustrative findings indicate the potential of integrating AR, environmental contexts, and local wisdom into contextual English vocabulary learning. The principal contribution of the study is not AR technology alone but the contextual integration of technology with students' surrounding environment and local cultural knowledge. Such integration can provide a meaningful bridge between English vocabulary and students' everyday experiences. Nevertheless, all numerical findings presented above are illustrative data for manuscript development only. The final article must replace them with verified empirical data obtained from the actual validation, testing, questionnaires, and observations before submission to an international journal.

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