Development of a Web-Based Illustrated Acehnese - Indonesian Dictionary for Primary Education

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Article History	ABSTRACT
	Background: The use of the Acehnese language among young generations has significantly declined in recent years, particularly at the primary school level. One of the main contributing factors is the lack of engaging, interactive, and contextually relevant learning resources for teaching the Acehnese language. **Purpose:** This study aims to design and develop a web-based illustrated Acehnese–Indonesian dictionary as an innovative learning resource to support Acehnese language learning in primary schools. The dictionary is designed to be child-friendly, culturally contextual, and accessible through various digital devices, and is expected to address the scarcity of Acehnese language learning media that teachers have long faced. **Method:** This research employed a Research and Development (R&D) approach using the 4D model (define, design, development, disseminate). Data were collected through observations, interviews, and questionnaires involving 6 primary school teachers, 3 Acehnese language experts, 3 information technology experts, and 30 students as end users. The data were analysed using qualitative descriptive methods to examine the content and technical feasibility, and quantitative descriptive methods to assess user responses towards the developed dictionary prototype. **Results and Discussion:** The results indicate that the web-based illustrated Acehnese-Indonesian dictionary is feasible for use as a learning medium for the Acehnese language in primary schools. Validation by language experts received an average score of 89%, IT experts 83%, limited trials with students 92%, and teachers 94%. **Conclusions and Implications:** These findings suggest that the developed dictionary is effective, user-friendly, and has strong potential to support the revitalisation of the Acehnese language through formal learning in primary schools. The developed dictionary is feasible and recommended for classroom use, yet requires continuous content updates and training for teachers.
	ABSTRAK

Latar Belakang: Penggunaan bahasa Aceh di kalangan generasi muda telah menurun secara signifikan dalam beberapa tahun terakhir, terutama pada tingkat sekolah dasar. Salah satu faktor utama yang berkontribusi terhadap hal ini adalah kurangnya sumber belajar yang menarik, interaktif, dan relevan secara kontekstual untuk pengajaran bahasa Aceh.

Tujuan: Penelitian ini bertujuan untuk merancang dan mengembangkan kamus digital bergambar Aceh-Indonesia berbasis web sebagai sumber belajar inovatif guna mendukung pembelajaran bahasa Aceh di sekolah dasar. Kamus ini dirancang agar ramah anak, kontekstual secara budaya, serta dapat diakses melalui berbagai perangkat digital, dan diharapkan dapat mengatasi keterbatasan media pembelajaran bahasa Aceh yang selama ini dihadapi oleh para guru.

Metode: Penelitian ini menggunakan pendekatan Research and Development (R&D) dengan model pengembangan 4D, yang meliputi tahap define, design, development, dan disseminate. Data dikumpulkan melalui observasi, wawancara, dan kuesioner yang melibatkan guru sekolah dasar, ahli bahasa Aceh, ahli teknologi informasi, serta siswa sebagai pengguna akhir. Data yang diperoleh dianalisis dengan metode deskriptif kualitatif untuk mengkaji kelayakan isi dan aspek teknis, serta metode deskriptif kuantitatif untuk menilai tanggapan pengguna terhadap prototipe kamus yang telah dikembangkan.

Hasil dan Pembahasan: Hasil penelitian menunjukkan bahwa kamus digital bergambar Aceh-Indonesia berbasis web layak digunakan sebagai media pembelajaran bahasa Aceh di sekolah dasar. Hasil validasi oleh ahli bahasa memperoleh skor rata-rata sebesar 89%, ahli teknologi informasi sebesar 83%, uji coba terbatas dengan siswa mencapai 92%, dan penilaian dari guru memperoleh 94%.

Kesimpulan dan Implikasi: Temuan ini menunjukkan bahwa kamus yang dikembangkan efektif, mudah digunakan, dan memiliki potensi yang kuat untuk mendukung revitalisasi bahasa Aceh melalui pembelajaran formal di sekolah dasar. Kamus yang dikembangkan layak dan direkomendasikan untuk digunakan di kelas, namun memerlukan pembaruan isi secara berkelanjutan dan pelatihan bagi guru.

| **Kata Kunci** | *kamus digital bergambar; berbasis web; Aceh–Indonesia; sumber belajar; sekolah dasar.* |

INTRODUCTION

Since 2022, Regional Language Revitalisation has been one of the main focus programmes of the Ministry Education and Culture, which was officially launched through the 17th episode of the Merdeka Belajar programme [1]. In line with the central government's programme, this has also become a special concern for the Aceh government, as stipulated in Qanun Regulation No. 10 of 2022 regarding the use of the Aceh language as a regional language and its inclusion as a local content subject in the school curriculum [2][3][4][5][6]. In the effort to develop Acehnese language lessons at the primary school level, one of the challenges faced is the limited teaching resources. Other major problems encountered so far include the lack of schools that teach Acehnese, the limited allocation of time for learning Acehnese (only two hours per week in each class), the absence of teachers with special expertise in Acehnese, and the lack of books, both textbooks, reading books, and other supporting reference books. In addition, teachers who have been helping to teach the local content subject of the Acehnese language have never received special training or workshops related to teaching the Acehnese language, both in terms of mastery of the material and teaching methods [4], [7].

From the results of the researcher's interviews with teachers at several primary schools in the city of Banda Aceh, they also complained about the same thing, namely the lack of learning resources that can be provided to students when teaching the Acehnese language in class. Therefore, this study offers specific research objectives, namely 1) designing a Web-based illustrated digital dictionary of Acehnese-Indonesian as a teaching resource for local content subjects in primary schools, 2) creating an accessible illustrated Web dictionary that is expected to contribute positively to the learning of Acehnese local content in primary schools, especially in the Aceh region. With this dictionary, teachers are also expected to be able to integrate it into their teaching methods, thereby opening up opportunities to improve the quality of learning in the classroom.

Based on the research background, the need for a web-based illustrated digital dictionary of Acehnese-Indonesian for primary school students is very important in efforts to preserve regional languages while supporting a more interactive and contextual learning process. However, there are fundamental challenges that need to be overcome, namely how to ensure that the digital dictionary has a design that is in line with the cognitive characteristics of primary school children, in terms of visualisation, ease of access, and the integration of Acehnese and Indonesian content. Unlike previous regional dictionary projects that focused on Android-based applications, this study integrates web-based accessibility with visual and cultural adaptation for Acehnese primary learners, Therefore, the research questions focus on two main points: (1) what needs to be considered in designing a web-based illustrated digital dictionary of Acehnese–Indonesian that is suitable for primary school students, and (2) how to design a web-based illustrated digital dictionary of Acehnese-Indonesian that is suitable for primary school students.

LITERATURE REVIEW

This research was conducted to assist teachers and students in learning the Acehnese language (local content) to overcome the problem of a lack of teaching resources. Although several Acehnese dictionaries have been created, none have been created in a digital, illustrated version [8][9]. However, despite the availability of some Acehnese dictionaries, none have been developed as illustrated, child-friendly, web-accessible tools validated within primary education settings. This research fills that gap by proposing a multimodal, curriculum-aligned digital dictionary grounded in developmental psychology and visual literacy principles. This research is highly urgent to support the revitalisation of regional languages through an approach that is digital, attractive, educational, and in line with the learning characteristics of children, so as to improve the quality of learning and preserve the richness of local culture and language in a sustainable manner [10], [11], [12]. Regarding the limited availability of Acehnese language teaching materials for primary school students, the approach and problem-solving strategy to be implemented in this study is to develop a digital picture dictionary [13], [14]. The problem-solving strategy is carried out through the design and development of a web-based illustrated Aceh-Indonesian digital dictionary that is capable of presenting a visual lexicon list. Dictionaries are the main reference source for understanding the meaning of words [15]. In language learning, understanding the meaning of words is a basic step in building vocabulary and constructing sentences. Dictionaries provide clear definitions and examples of word usage, making it easier for students to apply vocabulary in various contexts. The web-based illustrated dictionary discussed in this proposal is a digital dictionary that uses images to clarify the meaning of words in the Acehnese-Indonesian language.

Several previous studies have been conducted [16], [17], [18], [19], [20], [21], [22]. A study conducted by Akob (2018) examined the reconstruction of Acehnese culture in primary school

textbooks, focusing on Acehnese language learning discourse. The study used qualitative analysis and critical discourse analysis, which revealed that Acehnese cultural identity encompasses religious and socio-humanistic identities. This qualitative study is the first to review and analyse primary school textbooks. Meanwhile, Bagade (2020) discusses the potential of Augmented Reality (AR) technology in improving education for primary school students. He proposes a Visual Dictionary with alphabet and work modules, which can improve the learning process by combining traditional books with a digital touch, making them more interesting and enjoyable. This study focuses on the development of picture book learning media with the theme of Acehnese culture to stimulate children to learn about local culture. Data was collected through qualitative and quantitative methods, including observation, interviews, and documentation. This media was designed using Corel Draw, with a high success rate of 96% among experts. This research has practical implications, contributing to the understanding and introduction of Acehnese culture from early childhood education, as well as ensuring that children do not forget the culture that has developed in Aceh [19].

Unlike the studies mentioned above, this study proposes a solution in the form of a web-based illustrated Aceh-Indonesian digital dictionary, which not only presents vocabulary in two languages systematically but is also equipped with attractive, child-friendly visual illustrations and navigation that is easy for primary school students to use. The web-based approach provides advantages in terms of cross-device accessibility (computers, laptops, tablets, and smartphones), without depending on a specific operating system. In addition, the development method using the 4D model provides more systematic and structured stages, starting from the formulation of requirements to the dissemination stage to end users. In terms of novelty, this research not only targets media creation but also transforms the role of dictionaries into contextual-based primary teaching resources, rather than mere references. The content was compiled by considering the local curriculum, the characteristics of elementary school children's learning development, and the principles of visual literacy. Therefore, this research is an innovation that integrates technology, local culture, and basic education, and can be used as a replication model for the development of other regional language digital dictionaries nationwide.

METHOD

The research method used in this study is a type of development research or Research and Development (R&D), which aims to develop a new product or improve an existing product. The development procedure uses Thiangarajan's Four-D model, namely: define, design, development and disseminate [23]. This study aims to develop a web-based illustrated digital dictionary of Acehnese-Indonesian for primary school students. In designing this illustrated digital dictionary of Acehnese-Indonesian, the 4D model scheme as shown in the flow chart was used.

The definition stage aims to compile a draft, including determining and defining the Aceh-Indonesian vocabulary to be used in the digital picture dictionary. Next, in the design stage, the researcher creates a prototype or product design that has been adjusted to the content framework. Then, in the development stage, the aim is to determine the feasibility of the developed product by validating the product with three language experts and three IT experts (media/web design). The final stage is dissemination, which is carried out to promote the developed product so that it can be accepted by users, both systems, groups and individuals, by testing it directly with users. The research instruments are oral data sourced from field observations, interviews with primary school teachers, field notes, and Acehnese language documents. Furthermore, oral data is also obtained from the speech of a number of informants who are native speakers of Acehnese. Meanwhile, written data is sourced from dictionaries, literature studies, questionnaire results, and books tailored

to the needs of the research.

This study uses a qualitative and quantitative approach by applying descriptive methods [24], [25], [26]. The oral and written data collected were visual vocabulary words that were relevant to the needs of primary school students. Data collection techniques were carried out using observation, interviews, and questionnaires. The observation method was used to identify vocabulary words that were frequently used by primary school students. Interviews with experts were used to gather more detailed information. Two questionnaires were used, the first to collect data on frequently used visual vocabulary in the Aceh-Indonesian language and the second to gauge user responses to this dictionary application.

The research participants consisted of 3 linguists, 3 information technology experts, 6 Acehnese language teachers, and 30 elementary school students as end users. The data collection instruments included expert validation sheets, practicality questionnaires based on a Likert scale, practicality rubrics, structured observations, and brief interviews. Quantitative data were analysed using descriptive statistics in the form of means and percentages. Qualitative data were analysed through thematic analysis techniques to identify patterns of findings related to content accuracy, readability, and ease of use.

The trial phase was carried out through the implementation of the prototype with 30 students and the assessment of practicality by 6 teachers, focusing on navigation ease, clarity of illustrations, efficiency in vocabulary search, and pedagogical relevance. All input from linguistics experts and IT experts served as the basis for revising and improving the product quality before the field evaluation stage. Data from the Likert questionnaires were converted into percentages based on maximum scores, while the results of observations and interviews were interpreted to strengthen numerical interpretation. This combination of quantitative and qualitative analysis provides a comprehensive overview of the feasibility and practicality of the digital dictionary as a learning medium for the Acehnese language at the elementary school level, while ensuring that the final product meets linguistic, pedagogical, and technical standards.

Two analysis techniques were used: 1. Qualitative descriptive analysis. This qualitative descriptive analysis technique was used to process the results of the experts' reviews. This data analysis technique was carried out by grouping information from qualitative data in the form of input, criticism, responses and suggestions for improvement contained in the questionnaire. The results of this data analysis were then used to revise the dictionary development. The data obtained from the first questionnaire was classified and selected for inclusion in the digital dictionary application. The data from the second questionnaire, which consisted of responses from users, was analysed using a formula to see how users responded to this digital dictionary. Lastly, the determination of vocabulary, design and user responses to the dictionary were described.

RESULT AND DISCUSSION

A. Items to Consider in Designing an Aceh-Indonesian Illustrated Digital Dictionary

Table 1. Important Points in Designing a Web-Based Illustrated Aceh-Indonesian Digital Dictionary

No	Element	Description
1	Curriculum & Content Validity	Mapping vocabulary to KD/CP and expert validation essential for learning relevance.
2	Linguistics	Lexical standardisation, transliteration, and dialect notes prevent ambiguity.
3	Visual	Images suitable for primary school pupils + audio

4	Child-friendly UI/UX	Simple navigation, large buttons, search mode for primary school students.
5	Web performance	Media optimisation and efficient data structure for access in limited environments.
6	Evaluation	A combination of quantitative and qualitative methods is required to demonstrate effectiveness.
7	Ethics & Copyright	Clear licensing and privacy policies must be ensured.
8	Sustainability	The involvement of the local community ensures the updating of dictionary data.

1. Curriculum and Learning Outcomes

The designed Aceh–Indonesian illustrated digital dictionary must be based on the curriculum applicable in primary schools, particularly in the subject of Acehnese language. Each selected vocabulary word should be systematically mapped according to the established Learning Outcomes (CP) and Basic Competencies (KD). This is important so that the dictionary is not only a source of information, but also in line with the objectives of formal education. Thus, the dictionary will have a dual function, namely as a linguistic reference and a learning medium that supports the achievement of regional language literacy among students.

2. Linguistic Accuracy

Linguistic accuracy is a fundamental aspect in the design of a digital dictionary. The Acehnese vocabulary presented must be in accordance with standard forms or the most commonly used variations in an educational context. In addition, transliteration into Latin letters, phonetic descriptions, and word class identification need to be included to avoid ambiguity of meaning. Given that the Acehnese language has a rich variety of dialects, the inclusion of notes on dialect variations is relevant to preserve linguistic richness while preventing user misunderstandings.

3. Visual Design

Visual design is important in supporting primary school students' understanding. Each vocabulary entry is accompanied by clear, simple, and contextual illustrations that are easily recognisable to children. In addition, audio recordings from native speakers are also necessary to reinforce phonological aspects and listening skills. The integration of images and sound has been proven effective in improving memory retention in school-age children.

4. User Interface/User Experience (UI/UX)

Focusing on how digital products interact with users, UI is the visual appearance (colours, buttons, layout) and UX is the overall user experience (ease of use, efficiency, and satisfaction). UI creates a good and attractive design, while UX ensures that the product is easy to use, enjoyable, and helps users achieve their goals. Digital dictionaries need to be designed to be simple, intuitive, and child-friendly [27], [28], [29]. Navigation should be clear, icons easy to understand, and button sizes adjusted for use by children. Accessibility aspects such as colour contrast, alternative text for images, and audio-visual support are important indicators for ensuring user inclusivity.

5. Web Performance

From a technical standpoint, digital dictionaries must be designed with efficient web architecture and support limited network conditions, especially in regional schools. Media optimisation, such as image and audio compression, is necessary to speed up page loading times. Thus, technical performance does not become a barrier to the use of dictionaries as a learning medium.

6. Instrument Evaluation and Validation

The evaluation process is an important stage in ensuring the quality of the digital dictionary. Content validity can be obtained through assessments by Acehnese language experts, IT (web/design) experts, and primary school teachers, while trials with students are used to measure usability and effectiveness. Evaluation instruments can include usability questionnaires, pre-post tests to measure vocabulary improvement, and reliability analysis using Cronbach's alpha to ensure consistency. A combination of quantitative and qualitative data provides a comprehensive picture of product quality.

7. Ethics & Copyright

Image and audio-based digital dictionaries must comply with ethical and copyright law aspects. All visual and audio media used must be clearly licensed, either through an open licence (Creative Commons) or as a result of in-house production. In addition, a privacy policy must be developed to protect user data, especially since the target users are children. This aspect is important to maintain the academic integrity and legality of the product's use.

8. Sustainability

The sustainability of the digital dictionary is highly dependent on the participation of the local community, including teachers, researchers, and observers of the Acehnese language [30], [31]. A maintenance system that allows for the addition of new vocabulary, content improvements, and community involvement will ensure that the dictionary remains relevant. In addition, sustainability can be ensured through collaboration with educational institutions and local governments to support the continuous dissemination and development of the product.

B. The Design Process of the Web-Based Illustrated Aceh–Indonesian Digital Dictionary

1. Define

During the definition stage, interviews with teachers revealed that the main problem in teaching Acehnese at primary schools was the low use of the local language in daily communication, both at school and at home. Teachers observed that many students no longer mastered their mother tongue because they were more accustomed to using Indonesian in daily interactions, even when their parents still used Acehnese. This condition had an impact on the gap between the curriculum outcomes and the actual abilities of students, so learning media that could rekindle students' interest in learning and exposure to Acehnese vocabulary was needed.

Furthermore, teachers emphasised that pictorial media would be very helpful for primary school students because of their visual characteristics and tendency to be easily attracted to illustrations. In addition, the audio feature was considered important to reinforce phonetic understanding, given that some Acehnese vocabulary has multiple meanings and confusing pronunciation differences for students. Teachers also explained the limitations of existing printed teaching materials and the lack of digital learning resources that are appropriate for children. Therefore, the need for a web-based digital picture dictionary is considered relevant as a learning innovation, which not only supports the learning process at school but can also be used independently by students at home.

In addition, the teacher also emphasised the importance of direct involvement of students and teachers in the process of developing learning media so that the resulting product meets the real needs in the classroom. For example, the selection of vocabulary should be adjusted to the grade level and daily experiences of students, such as the themes of family, school environment, and students' daily activities. Teachers even suggested collaborative activities in which students

could try using the digital dictionary in weekly lessons, so that teachers could directly assess the effectiveness and ease of use of the product. Thus, the definition stage not only produced a needs analysis from a curriculum perspective, but also incorporated empirical input from field practice that reinforced the urgency of developing a web-based Aceh-Indonesian illustrated digital dictionary.
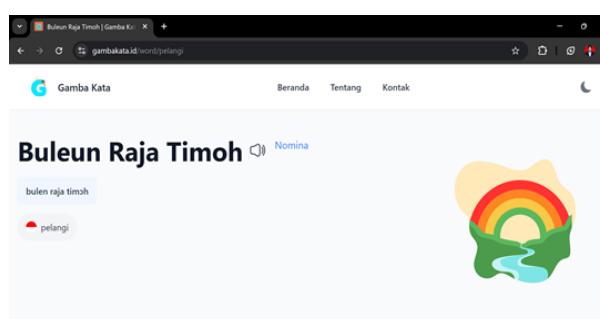
2. Design

In the conceptual design stage, the content structure of the digital dictionary was arranged to suit the learning needs of primary school students. Each word entry includes vocabulary in the Acehnese language, accompanied by equivalents in Indonesian, word class (noun, verb, adjective, etc.), attractive illustrations, and audio recordings of the correct pronunciation. The vocabulary is grouped into categories that are familiar to children, such as family, animals, school supplies, nature, clothing, and fruits, making it easier for students to understand the meaning in a real context.
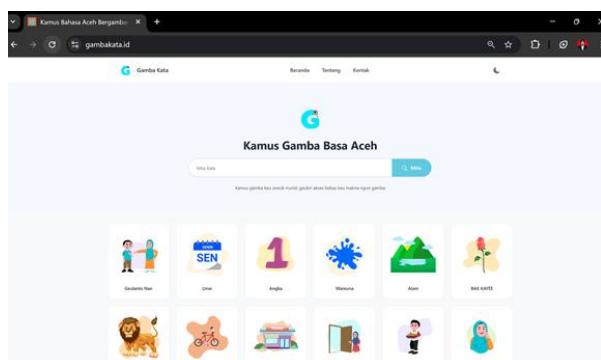
Picture 1. Front page of the Aceh-Indonesian Web Dictionary (https://gambakata.id/)

The navigation model is designed to be simple, using category icons that are easily recognisable to children, and is equipped with a word search feature so that users can find specific vocabulary quickly. The user interaction flow begins with selecting a category, for example, the animal category. After that, a list of illustrated vocabulary words will appear according to the selected theme. Users can then click on a specific image to see the complete details, including the word in Acehnese, its Indonesian translation, its part of speech, and listen to the audio pronunciation, making the learning process more interactive, multimodal, and enjoyable.

Picture 2. Display of one of the vocabulary words in the nature category (https://gambakata.id)

3. Development

The development stage is the phase of implementing the design that has been compiled in the design stage into a usable digital product. This process begins with the collection and processing

of vocabulary data that has been validated by Acehnese language experts. Each vocabulary word is then paired with its Indonesian equivalent, part of speech, and accompanied by appropriate illustrations to make it easier for primary school students to understand. In addition, audio recordings of pronunciations by native speakers of the Acehnese language are provided to strengthen students' phonetic skills, so that they not only understand the meaning but are also able to imitate the correct pronunciation.

All multimedia content, such as images and audio, is optimized using efficient compression formats to maintain access speed. The user interface is programmed to support various devices, from computers to Android-based gadgets, to achieve flexibility of use. After the prototype was completed, internal testing was conducted to ensure that each component functioned properly. This testing included interface display consistency, vocabulary category navigation, page loading speed, and system stability when accessed by multiple users simultaneously. Next, the prototype was validated by language experts to review the accuracy of the vocabulary and its equivalents, and by information technology experts to assess system reliability and data security. The validation results formed the basis for revisions and refinements before the product was ready for wider testing at the dissemination stage.

Table 2. Results of the Linguistic Expert Validator Assessment

No	Aspects Assessed	Average
1	Clarity of the use of the Acehnese language in the digital dictionary	93
2	Clarity of Indonesian language usage in the digital dictionary	93
3	Accuracy of Aceh–Indonesian translations	73
4	Accuracy of Acehnese spelling in accordance with linguistic rules	80
5	The accuracy of Indonesian spelling is in accordance with EYD Edition 5.	93
6	Readability of text for primary school students	100
7	Appropriateness of vocabulary chosen in relation to the cultural context of Aceh	93
8	Accuracy of Aceh–Indonesian word equivalents in supporting language learning in primary schools	87
	Average	89

Based on Table 2. Results of the Language Expert Validator Assessment, it can be seen that the quality of the Aceh-Indonesian illustrated digital dictionary is considered very good, with an overall average score of 89%. In general, the linguistic aspects of both the Aceh and Indonesian languages are considered clear (93%), with the text readability score reaching the maximum (100%). This indicates that the dictionary can be used effectively by primary school students in accordance with their level of understanding.

However, there are several aspects that still need improvement, particularly in the accuracy of the Aceh-Indonesian translations, which received the lowest score (73%). This indicates the need to review the translations to ensure greater accuracy and consistency. Other aspects, such as the correctness of Aceh spelling (80%), also need to be strengthened by referring to standard linguistic rules. Meanwhile, the accuracy of word equivalents in supporting learning (87%) is already in the good category, although it can still be optimized. Overall, the results of expert validation show that the illustrated Aceh–Indonesian digital dictionary has a high level of linguistic feasibility,

but still requires limited revision in terms of translation and spelling to improve linguistic accuracy and suitability in the context of primary school learning.

Table 3. Results of IT Expert Validator Assessment (Media/Web Design)

No	Aspects Assessed	Average
	Alignment of the user interface (UI) design with the characteristics of primary school students	93
2	Ease of navigation when using the digital dictionary	80
3	System stability (loading, responsiveness, error handling)	93
4	Access speed and web display conciseness	80
5	Appropriateness of colour, icons, and typography for primary school children	73
6	Consistency of layout across pages (home, vocabulary list, search, etc.)	80
7	Word search function (search engine) works effectively and accurately	87
8	Application compatibility with various devices (PC, tablet, smartphone)	93
9	Media support for learning (accessibility, interactivity, integration)	67
Average		**83**

Based on Table 3. Results of the IT Expert Validator Assessment (Media/Web Design), the Aceh–Indonesian illustrated digital dictionary received an average score of 83%, which is classified as good. The assessment shows that the user interface (UI) design is in line with the characteristics of primary school students (93%) and the system is considered stable and responsive (93%). In addition, the application's compatibility with various devices (PCs, tablets, and smartphones) also received a high score (93%), indicating that the flexibility of media use is fairly guaranteed. The word search function was also considered effective with a score of 87%, which supports the ease of students in finding vocabulary. However, several aspects still require more attention. Ease of navigation (80%), consistency of layout between pages (80%), and access speed (80%) indicate that although functional, the user experience can still be improved to be more efficient. The lowest aspects are the appropriateness of colour and icon usage (73%) and the media's support for learning (67%). This emphasises the need for revisions to the visual aesthetics to make them more child-friendly and the development of interactive features that can strengthen the dictionary's role as a learning resource, not just a vocabulary repository.

Overall, the results of the IT expert validation indicate that the Aceh-Indonesian Web dictionary has met the standards of digital media suitability for primary school students, but optimisation is still needed in terms of visual design, interactivity, and accessibility so that the digital dictionary truly supports the process of learning the Aceh language in primary schools.

3.1. Limited Trial

A limited trial was conducted on 30 students in grades IV, V, and VI at SDN 68 Banda Aceh and involved teachers from grades I to VI as observers and accompanying users. The purpose of this trial was to assess the usability, effectiveness, and supportiveness of the illustrated Aceh-Indonesian digital dictionary in real classroom learning. During the trial, students were instructed to use the dictionary's main features, ranging from searching for vocabulary to utilizing images and audio pronunciations. Class teachers observed student responses, ease of navigation, and technical

obstacles that arose, while also providing input regarding the integration of this media into daily lesson plans. The results of the observation showed that the majority of students were able to use the dictionary independently with enthusiasm, while teachers assessed this media as having the potential to strengthen Acehnese language learning, although improvements are still needed in terms of visuals and interactivity in order to optimize its sustainable use in schools.

Table 4. Results of Limited Trials with Grade IV, V, and VI Students

No	Aspects Assessed	Average
1	I can easily open the digital dictionary on my laptop/mobile phone/tablet.	95
2	The pictures in the dictionary help me understand the meaning of words.	94
3	I enjoy learning Acehnese using this digital dictionary.	93
4	I can find the words I'm looking for quickly.	89
5	This digital dictionary is more fun than learning with textbooks alone.	95
6	I can study on my own at home using this digital dictionary.	86
7	The text in the dictionary is easy to read and understand.	93
8	This digital dictionary has helped me learn more Acehnese words.	93
9	I have no difficulty using the features in this digital dictionary.	90
10	I would like to continue using this digital dictionary when learning Acehnese.	90
	Average	**92**

Based on Table 4. Limited Trial Results in grades IV, V, and VI, an average score of 92% was obtained, indicating that the Aceh–Indonesian illustrated digital dictionary has a very high level of usability and received positive responses from students. The most prominent aspects were the ease of opening the digital dictionary on various devices (95%) and the students' perception that learning with this dictionary was more interesting than using textbooks alone (95%). This confirms that web-based media can provide a more interactive learning experience that is in line with the learning style of the digital generation.

In addition, the images were considered very helpful for students in understanding the meaning of vocabulary (94%), while the level of enjoyment in learning with this medium was also high (93%). The easy-to-read text (93%) and the increase in Acehnese vocabulary knowledge (93%) show that the visual design and linguistic content of the dictionary are in line with the needs of primary school children. Students also found it easy to use the available features (90%) and were motivated to continue using this digital dictionary in learning the Acehnese language (90%).

However, despite the high overall score, the aspect of independent learning at home is still relatively lower than other aspects (86%). This shows that although the dictionary can be accessed independently, additional strategies are needed to encourage its use outside the classroom, for example by providing structured assignments based on the digital dictionary or parental support at home. Thus, the limited trial results prove that the illustrated Aceh–Indonesian digital dictionary is suitable for use as a learning medium and has great potential to support the revitalisation of the Aceh language at the primary school level.

Table 5. Limited Trial Results for Teachers of Grades I, II, III, IV, V, VI

No	Aspects Assessed	Average
1	Digital dictionary is easily accessible through devices available at school	93
2	The digital dictionary's display and navigation are simple and easy to understand.	93
3	The dictionary content aligns with the Aceh language curriculum in primary schools.	90
4	Illustrations in the dictionary help students understand the meaning of vocabulary.	97
5	Digital dictionaries accelerate the process of learning Acehnese vocabulary.	93
6	Integrating the digital dictionary with teaching methods is easy to do.	93
7	Students are more active when using digital dictionaries compared to printed media.	93
8	Digital dictionaries can be used effectively.	93
9	The search feature on digital dictionaries makes it easy to find vocabulary.	100
10	I plan to use this digital dictionary continuously in my learning.	93
	Average	94

Based on the data in Table 4, it can generally be seen that the level of acceptance of the Aceh–Indonesian digital picture dictionary by teachers is very high, with an average score of 94%. The majority of aspects assessed received a percentage above 90%, indicating that this product is considered very suitable and effective for use in learning. The aspects of accessibility (93%), simplicity of display and navigation (93%), and suitability of content with the Acehnese language curriculum (90%) confirm that this digital dictionary has been designed in accordance with the needs of the primary school context. These results also reflect the designers' success in ensuring that the digital devices used do not become technical barriers for teachers.

Furthermore, aspects directly related to learning effectiveness and student engagement also showed positive results. The illustrations included in the dictionary received the second highest score (97%), indicating the contribution of visualisation in clarifying the meaning of vocabulary for primary school students. Teachers also assessed that this digital dictionary is able to accelerate the process of learning Acehnese vocabulary (93%) and trigger higher student activity compared to print media (93%). This fact indicates that the integration of digital media can optimise local vocabulary-based learning, while supporting a multimodal learning approach that is in line with the characteristics of the digital native generation.

Advanced technical aspects such as ease of integration into teaching methods (93%), ease of use (93%), and superior search features (100%) further reinforce the advantages of this digital dictionary as a practical and efficient learning medium. The high percentage of teachers who plan to use this dictionary on an ongoing basis (93%) is a good indicator of sustainability, signifying the potential for long-term adoption in schools. Thus, it can be concluded that this digital dictionary not only meets technical and pedagogical standards but also has great potential for widespread implementation as a medium to support the revitalization of the Acehnese language at the primary school level.

Discussion

The research findings show that the web-based Acehnese–Indonesian digital dictionary with images received a very high level of acceptance from primary school teachers, with an average rating of 94%. The aspects of accessibility, simplicity of display, content suitability, and learning effectiveness were all above 90%, indicating high feasibility from a pedagogical and technological perspective. These findings are in line with the views of [17], who assert that digital-based media, especially those that include interactive visualisation, can increase the interest and understanding of primary school students because they support their multimodal learning styles. Thus, the success of this digital dictionary reinforces the theoretical assumption of that the integration of visual-based technology is one effective approach in language learning for primary school-aged children [32], [33], [34].

In terms of content, the suitability of the vocabulary in the dictionary with the Aceh Language curriculum in primary schools (90%) indicates that the development of the material has taken into account the Learning Outcomes (CP) and Basic Competencies (KD). This supports the findings of which states that local culture-based learning materials will be effective if they are integrated into the formal curriculum and systematically mapped to national education standards. The effort to map the dictionary content to the curriculum is important because it makes the dictionary not only a linguistic reference but also a primary teaching medium that helps achieve regional language literacy [12], [35], [36]. In practical terms, this also addresses the challenge raised by [4], [37] regarding the lack of local content in Acehnese language teaching in primary schools, which has been one of the main obstacles to the revitalisation of regional languages in Aceh.

The visualisation aspect in the form of illustrated images received the second highest rating (97%) from teachers, reinforcing the evidence that visual elements play an important role in improving students' vocabulary comprehension. [19] previously emphasised that image-based media can stimulate motivation and memory retention in early childhood for local vocabulary. In addition, audio recordings accompanying vocabulary entries are also considered to help improve students' phonological skills, in line with the findings of [18] that the integration of audiovisual elements in web-based learning media can increase student engagement and support listening skills simultaneously. These findings confirm that the multimodal (visual and audio) approach applied in this digital dictionary is in line with the visual-aural and concrete cognitive characteristics of primary school children.

Furthermore, the ease of integrating the dictionary into teaching methods (93%) and the existence of a very helpful search feature (100%) indicate that this digital dictionary is practical for use in classroom settings and independent learning. The high intention of teachers to use the dictionary continuously (93%) indicates the potential sustainability of the media in supporting Acehnese language teaching. This is relevant to the ideas of [13] and [14], who state that the success of digital media for regional languages is largely determined by the level of adoption and sustainability of its use in the field. The active participation of teachers as the main users is a crucial factor in ensuring that this digital dictionary does not become a short-lived innovation, but can develop into a learning ecosystem that supports the long-term preservation of the Acehnese language.

Limitation and Future Work

This study acknowledges several limitations that frame the scope of its findings. The digital illustrated dictionary was tested only in a single elementary school and involved 30 students, which limits the generalizability of the results to broader school contexts in Aceh. The learning

environment, student characteristics, and technological readiness of other schools may differ significantly, meaning that the usability, practicality, and learning impact of the dictionary may vary in diverse settings. Additionally, the limited sample size restricts the depth of statistical comparability across user groups, thereby positioning the findings as preliminary rather than conclusive. Future studies should expand implementation across multiple schools with larger and more varied participant groups to strengthen the robustness and representativeness of the results.

Beyond sampling constraints, this study also identifies three key areas requiring further development. First, the inconsistent quality of internet connectivity in many rural or remote Acehnese schools poses challenges for the stable use of web-based learning tools; therefore, optimization for offline or low-bandwidth environments is a crucial direction for improvement. Second, effective integration of the dictionary into classroom practice depends on adequate teacher training; thus, structured professional development programs are recommended to enhance teachers' digital literacy and pedagogical application skills. Third, sustaining the relevance of the dictionary requires a continuous content-update strategy, including expansion of vocabulary entries, integration of culturally rich examples, and regular technical maintenance. Addressing these aspects will ensure that the digital illustrated dictionary evolves into a scalable, sustainable, and pedagogically impactful learning resource for Acehnese language education.

CONCLUSION AND IMPLICATIONS

The results of the study indicate that the web-based illustrated Aceh–Indonesian digital dictionary has a very high level of feasibility for use in teaching the Aceh language in primary schools. Teachers' assessments of the ten aspects tested, such as accessibility, appearance and navigation, content suitability with the curriculum, and ease of integration into teaching, ranged from 90–100% with an overall average of 94%. These findings indicate that the developed product has met the technical and pedagogical standards required to effectively support the process of learning Acehnese vocabulary. In addition, the use of illustrations in the dictionary has been proven to improve students' understanding of vocabulary meanings, as reflected in the second highest score obtained for this aspect (97%). Teachers also assessed that the presence of a digital dictionary was able to accelerate the learning process and encourage higher student activity compared to the use of conventional print media. This shows that the multimodal approach applied in the development of the dictionary through a combination of visuals, text, and digital search features is effective in attracting interest in learning and facilitating student access to local vocabulary material.

Overall, the results of this study confirm that the illustrated Aceh-Indonesian digital dictionary is suitable for widespread implementation in Aceh language learning in primary schools. The high intention of teachers to use the dictionary on an ongoing basis indicates the potential for long-term adoption in the school environment. Thus, this dictionary has the opportunity to become one of the strategic media in supporting efforts to revitalise and preserve the Acehnese language through formal education, while also responding to the need for contextual and engaging digital learning resources for students

As a follow-up to the findings of this study, it is recommended that the development of the Aceh-Indonesian illustrated digital dictionary be continued through the expansion of vocabulary, the addition of interactive features such as quizzes or vocabulary-based games, and the integration of audio material to support students' listening skills. Local governments and educational institutions in Aceh are expected to support the use of this dictionary by providing training for teachers and strengthening technology in primary schools so that the implementation of this media

can run optimally, sustainably, and contribute significantly to the preservation of the Acehnese language through formal education.

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