Indonesian Journal of Education Methods Development
Vol. 20 No. 4 (2025): November
DOI: 10.21070/ijemd.v20i4.955

Development of the "Yak Meureunoe Bahasa Aceh" Mobile Learning Application

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General Background: The preservation of regional languages in Indonesia faces serious challenges due to globalization and the declining interest of younger generations in using local languages. **Specific Background**: The Acehnese language, as a carrier of rich cultural and philosophical values, has experienced a reduction in daily use, necessitating innovative educational media that align with digital learning trends. **Knowledge Gap**: Current Acehnese language instruction still relies on conventional methods that lack interactivity and technological integration. **Aims**:This study aims to design and develop the "Yak Meureunoe Bahsa Aceh" mobile-based learning application using the 4D model (Define, Design, Develop, Disseminate) to enhance learning motivation and preserve the Acehnese language. **Results**: Validation results from linguists, media experts, and language teachers yielded an average feasibility score of 82.7% (highly feasible), while field trials showed a learning motivation increase with a mean score of 78.7%. **Novelty:** The application integrates linguistic accuracy, interactive design, and accessibility through mobile technology, making it the first comprehensive Acehnese language learning tool based on the 4D model. **Implications:** This innovation provides an effective medium for regional language revitalization, supports independent learning, and serves as a model for developing digital learning applications for other local languages.

Highlights:

- Promotes regional language preservation through digital learning
- Uses the 4D model to ensure systematic application development
- Increases student motivation and engagement in language learning

Keywords: Acehnese Language, Mobile Learning, 4D Model, Language Preservation, Educational Technology

Introduction

The Acehnese language is one of the regional languages that has a rich culture, history, and philosophy of life of the Acehnese people. As part of the Austronesian language family, the Acehnese language has a unique linguistic structure and vocabulary that is different from Indonesian and other regional languages in the archipelago. This uniqueness makes the Acehnese language not only a means of communication, but also a symbol of the identity and collective identity of the Acehnese people [1]. Through this language, philosophical, social, and religious values are preserved and passed down from generation to generation, making it a valuable intangible heritage. Thus, the Acehnese language has a

dual function: communicative and cognitive, because in addition to enabling speakers to interact, it also shapes the mindset, perspective, and cultural awareness of the local community [2].

In addition to its communicative and cognitive roles, the Acehnese language also functions as a medium for passing on traditions, social norms, and religious values. Through language, various classical literary works such as hikayat, pantun, syair, and folk poetry can be understood, interpreted, and preserved. The presence of the Acehnese language as a medium of traditional literacy confirms that this language is an integral part of the process of transmitting local culture and knowledge [3]. However, the reality of globalization poses a major challenge to the survival of the Acehnese language. The younger generation now prefers to use Indonesian or foreign languages in their daily interactions, resulting in a decline in the intensity of Acehnese language use in both domestic and public spheres [4].

This phenomenon raises serious concerns, because the loss of language also means the loss of the local knowledge contained within it. The loss of language will result in the loss of history, identity, and the worldview of the Acehnese people. Therefore, the preservation of the Acehnese language is an urgent necessity. One of the main strategies is through formal education, namely by including the Acehnese language in the school curriculum [5]. Through education, the younger generation can be introduced to, trained in, and encouraged to use the Acehnese language in various contexts. However, this strategy needs to be balanced with an innovative approach that utilizes technology to suit the learning style of the digital generation [6].

In addition to the curriculum, the development of innovative learning media is also an important instrument in preserving the Acehnese language. Learning media that are adaptive to the times, such as digital applications, online platforms, and interactive audiovisual content, will be more easily accepted by the younger generation [7]. The use of digital media allows the Acehnese language to be packaged in an attractive, enjoyable, and flexible form. Not only that, the revitalization of oral traditions and arts that contain elements of the Acehnese language is also an important strategy. In this way, the Acehnese language is not only taught, but also revived in everyday life so that it remains relevant in the modern era [8].

In this context, practical language learning mobile applications can be an effective solution. Mobile devices, which are now owned by almost every individual, especially millennials and Generation Z, provide ample space to access learning materials anytime and anywhere [1]. Mobile applications also enable interactive features, gamification, and audio-visual integration that enrich the language learning experience. Thus, the process of learning the Acehnese language can be independent, enjoyable, and continuous. This strategy is expected to revive the interest of the younger generation in using and preserving the Acehnese language in their daily lives [9].

Modern education today is required to continuously adapt to technological developments. Various innovations are being made to improve the quality and quantity of learning, both in terms of curriculum and methods. The use of information technology in learning, including regional language learning, is a strategic response to the needs of the times [10]. Technology provides opportunities to create more effective, efficient, and meaningful learning experiences. Therefore, the integration of technology in Acehnese language learning is no longer an option, but a necessity in order for learning to be more relevant and able to respond to the challenges of the digital age [11].

Until now, Acehnese language learning in schools has still been carried out conventionally using lecture or memorization methods, which tend to be boring. Such learning patterns often make students less interested and even feel bored. In fact, for language learning to be successful, students must be actively involved, motivated, and feel that the material being studied is relevant to their lives. Therefore, innovation is needed in the form of packaging Acehnese language learning with the help of technology, especially mobile applications, which are able to present material in a more interesting, interactive, and relevant way to the needs of the current generation [12].

Smartphones as mobile devices have now become an integral part of people's daily lives. These devices are not only used for communication, but also as an effective learning tool. With the support of Android-based mobile applications, learning can be flexible and easily accessible. Android-based learning applications have been proven to assist in the learning process of various other regional languages. The advantages of the open Android platform allow developers to design applications according to user needs, from the interface display to the presentation of interactive content [13].

The availability of Android-based learning applications opens up great opportunities for the development of more modern Acehnese language learning media. Mobile applications offer flexibility in terms of time, space, and learning methods that can be tailored to the user's learning style [14]. With a user-friendly interface design and systematically presented phonological material, this application can be an effective alternative medium. Therefore, the development of mobile-based Aceh language learning applications can be seen as a strategic strategy in responding to the challenge of declining use of regional languages amid the tide of globalization [15].

To produce a high-quality learning application, development needs to be carried out systematically using a proven model. One relevant model is the 4D model (Define, Design, Develop, Disseminate). This model emphasizes the importance of the process of needs analysis, design, development, and dissemination of products. By following the stages of the 4D model, the resulting application will be suitable for user needs, have high-quality content, and be effective in learning implementation [16].

The application of the 4D model in the development of the “Yak Meureunoe Bahasa Aceh” application allows for structured design, starting from the identification of user needs, the preparation of interface and content design, to testing and dissemination. Thus, the resulting application is not only functional but also attractive and easy to use by students at various levels. This process also ensures that the application can address the challenges of regional language learning, which has traditionally been conventional, limited by space and time, and less suitable for the digital generation [17].

Furthermore, the digitization of Acehnese language learning through mobile applications is in line with the vision of 21st-century education. Modern education emphasizes creativity, collaboration, critical thinking, and technological literacy skills as key competencies. By presenting the Acehnese language in a digital medium, students not only learn the language but also engage in mastering 21st-century skills. This will make Acehnese language learning relevant to the needs of the younger generation while contributing to the preservation of regional languages in the digital age [18].

With this background, this study aims to design and develop a mobile-based Acehnese language learning application using the 4D model approach. The developed application is expected to be an effective alternative medium for preserving the Acehnese language while supporting independent learning for the younger generation. Through the “Yak Meureunoe Bahasa Aceh” application, it is hoped that students' interest and ability in the Aceh language will increase, so that the Aceh language remains alive as a cultural heritage that is highly valued and relevant to the times.

Method

This study uses a Research and Development (R&D) research method with a quantitative approach [19]. R&D is a systematic research method that aims to produce a specific product and test its effectiveness in practice. Through this approach, researchers not only focus on product creation but also ensure that the resulting product truly meets user needs and can be effectively implemented in an educational context. R&D is considered appropriate for use in this study because it produces a practical, interactive, and mobile-based Acehnese language learning application. The research design refers to the 4D (Define, Design, Development, and Dissemination) development model developed by Thiagarajan, Semmel, and Semmel, with a focus on creating mobile-based digital learning service products while testing their feasibility [20].

The first stage, Define, was carried out by analyzing the needs through Focus Group Discussions (FGD) involving linguists, language teachers, and education practitioners. At this stage, the researchers identified the main problem faced, namely the limited availability of digital-based Acehnese language learning media that can effectively support phonology learning. From this analysis, it was determined that there was a need for a mobile application that could be accessed anytime and anywhere and was able to provide a more engaging learning experience for students. The second stage, Design, focused on creating a design for the "Yak Meureunoe Bahasa Aceh" application, featuring a main menu, phonology material sub-menu, and interactive features. The initial design of the application was consulted with media and language experts to obtain input and revisions so that the application would be in accordance with instructional design principles and the rules of the Acehnese language [21].

The third stage is Development, where the application design that has been compiled is then developed into an Android-based digital product. The development process includes creating a user interface, integrating Acehnese phonological content, and adding interactive features. Next, the application is tested for validity by linguists, media experts, and language teachers to ensure the quality of the content, the suitability of the design, and its usefulness in learning. Revisions are made based on input from the validators so that the application becomes more optimal. In addition, the instrument is tested to ensure its validity and reliability. Reliability is tested using the Cronbach's Alpha technique to ensure that the instrument is consistent in measuring the quality aspects of the application. With this step, a product is produced that is not only feasible in terms of content but also valid in terms of the instrument [22].

The fourth stage is Dissemination, which is carried out by socializing the application through workshops for language teachers, students, and education practitioners in Bireuen Regency. This dissemination aims to introduce the product to potential users while testing its effectiveness directly in learning. Through limited field trials, the application was used by teachers and students to assess its ease of use, usefulness, and impact on motivation to learn the Acehnese language. The results of these trials form the basis for assessing the suitability of the application, whether it falls into the "suitable" or "highly suitable" category. Thus, the 4D stage ensures that the development process runs systematically and that the resulting product can be implemented in the context of Acehnese language education [23].

Sampling in this study used purposive sampling, a non-probability sampling technique conducted by considering certain criteria. The criteria for research subjects were parties who had direct competence and relevance to Acehnese language learning, namely linguists and language teachers in Bireuen Regency. This method was chosen because the research subjects had to thoroughly understand the context of Acehnese language learning so that their assessments could accurately reflect the quality and suitability of the product. The instrument used was a closed questionnaire with pre-determined answer choices, so that respondents could simply select the answer that matched their perception. The results of this questionnaire were then analyzed using a suitability percentage formula to determine the suitability level of the application [24].

Before the instrument is used, a validity test is conducted to ensure that the instrument actually measures the intended aspect, as well as a reliability test to test the consistency of the measurement results. The criteria used by language experts and language teachers in determining the suitability of the application are explained in Table 1, while the conversion of scores into suitability percentage categories is presented in Table 2. These two tables serve as a reference for assessing the extent to which the developed application meets the suitability standards for learning products. Based on these criteria, a product is declared eligible if it falls into at least the "Eligible" category with a percentage score of 61%–80%, and highly eligible if it obtains a score above 81%.

Table 1. Expert Assessment and Trial Criteria

No	Criteria	Score Formula
1	Highly Suitable	X > Xi + 1,80 Sbi
2	Suitable	Xi + 0,60 Sbi < X ≤ Xi + 1,80 Sbi
3	Sufficiently Suitable	Xi – 0,60 Sbi < X ≤ Xi + 0,60 Sbi
4	Less Suitable	Xi – 1,80 Sbi < X ≤ Xi – 0,60 Sbi
5	Very Less Suitable	X ≤ Xi – 1,80 Sbi

Explanation:
X = Actual score (achieved score)
Sbi = 1/6 (ideal maximum score – ideal minimum score)

Table 2. Feasibility Score Qualifications

No	Percentage	Feasibility
1	81 – 100%	Highly Suitable
2	61 – 80%	Suitable
3	41 – 60%	Sufficiently Suitable
4	21 – 40%	Less Suitable
5	0 – 20%	Very Less Suitable

Results and Discussion

A. Results

This research produced a mobile-based service product in the form of an Acehnese language learning application called “Yak Meureunoe Bahsa Aceh”. This application was developed using the 4D research and development model (Define, Design, Development, Dissemination). This model was chosen because it provides a systematic flow in producing quality learning products, from the needs analysis stage to the dissemination stage. The application development process not only produced a prototype but also underwent a series of validations by language experts, media experts, and language teachers to ensure its feasibility and effectiveness in supporting learning. In general, the research results show that the “Yak Meureunoe Bahsa Aceh” application is “highly feasible” for use as a learning medium, both to support teaching and learning activities in schools and for independent student learning.

1. Define Stage

The first stage is Define, which is needs analysis. At this stage, researchers identify problems encountered in learning the Acehnese language. Based on the results of Focus Group Discussions (FGD) involving linguists, language teachers, and education practitioners in Bireuen Regency, it was found that digital technology-based learning media to support Acehnese phonology learning is still very limited. FGD participants emphasized that phonology learning is often difficult for students to understand because conventional methods are still predominantly used. Therefore, practitioners believe that mobile-based applications can be an innovative solution to overcome the limitations of existing learning media. This needs analysis became the main basis for designing the “Yak Meureunoe Bahsa Aceh” application to suit the needs of students and teachers.

2. Design Stage

The second stage is Design, which focuses on creating an application prototype. At this stage, researchers developed the main menu, sub-menu for Acehnese phonology material, and interactive features that can help students understand the material. The application interface was designed to be

simple yet attractive, so that it is easy to use for students of various educational levels. The initial prototype is then consulted with media and language experts. Based on their input, the application design is revised, for example, by improving the menu layout, selecting more user-friendly colors, and reorganizing the material to be more systematic. This process ensures that the application is not only technologically feasible but also complies with the linguistic rules of the Acehnese language.

3. Development Stage

The third stage is Development, which involves developing the prototype into an application product that is ready for testing. The development process includes integrating phonological material, refining the interface, and adding audio features to assist users in pronouncing the Acehnese language. After the application was developed, expert validation was carried out involving three parties: language experts, media experts, and language teachers.

The validation test results are shown in Table 3 below:

Table 3. Validation Test Results for the "Yak Meureunoe Bahsa Aceh" Application

No	Validator	Score (%)	Criteria
1	Language Expert	86	Highly Suitable
2	Media Expert	82	Highly Suitable
3	Language Teacher	80	Suitable

Descriptive Statistics of Validation Results
Mean = 82.7
Standard Deviation (SD) = 3.05
Highest Score = 86 (Language Expert)
Lowest Score = 80 (Language Teacher)

Overall, the average application feasibility score is 82.7%, which falls into the "Highly Feasible" category. These results show that the application has a high level of feasibility in terms of content, media design, and learning implementation.

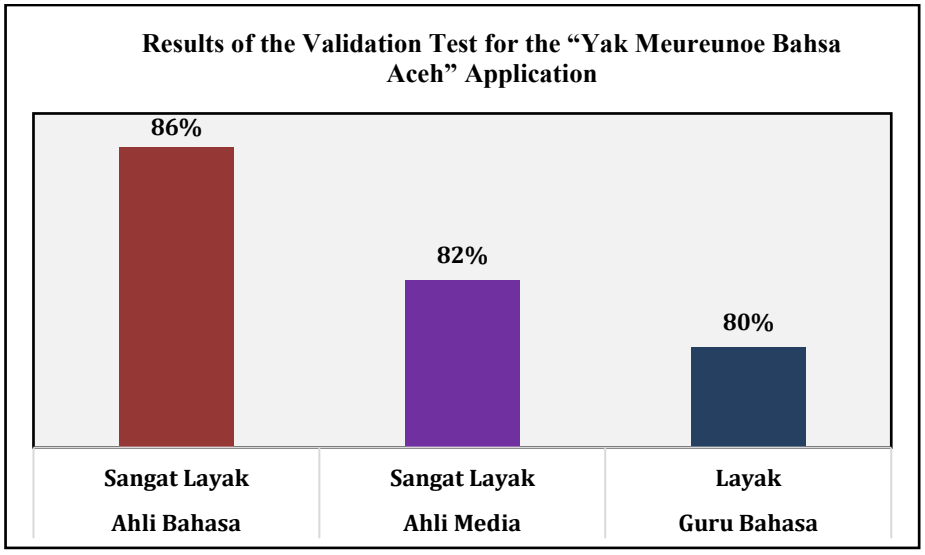

Figure 1. Application Feasibility Assessment Results

The graph above shows a comparison of validation scores given by linguists, media experts, and language teachers. The highest score was given by linguists (86%), while the lowest score was given by language teachers (80%). These results indicate that the application is quite strong in terms of

linguistics and media, although there is still room for improvement in terms of classroom implementation.

In addition, the reliability of the instrument was tested using the Cronbach's Alpha technique. The calculation results showed a value of α = 0.87, which means that the reliability of the instrument is in the "very high" category. Thus, the assessment instrument can be ensured to be consistent and suitable for use in measuring the quality of the application.

4. Dissemination Stage

The fourth stage is Dissemination, which is the distribution of the product to users. The "Yak Meureunoe Bahsa Aceh" application was introduced through a workshop involving language teachers, students, and education practitioners. This workshop aimed to provide training on the use of the application while testing its effectiveness in real learning.

The application product was also tested on a limited basis with teachers and students in Bireuen Regency. The test results are presented in Table 4 below:

Table 4. Test Results for the "Yak Meureunoe Bahsa Aceh" Application

No	Assessment Aspect	Score (%)	Criteria
1	Ease of use of the application (Students)	76	Suitable
2	Benefits of the application in learning (Teachers)	82	Highly Suitable
3	Increased motivation to learn the Aceh language	78	Suitable

Descriptive Statistics of Test Results
Mean = 78.7
Standard Deviation (SD) = 3.06
Highest Score = 82 (Teacher)
Lowest Score = 76 (Student)

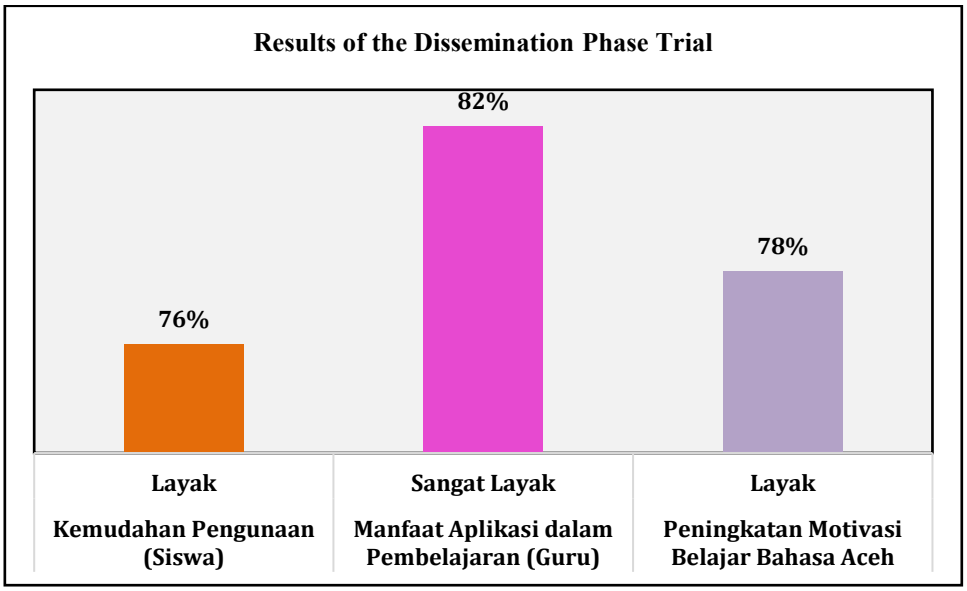

Figure 2. Dissemination Phase Trial Results

The trial results show that the application scored highly in all aspects. Teachers gave the highest rating of 82% (very good), mainly because the application helped them teach Acehnese phonology more effectively. Meanwhile, students gave a score of 76% for ease of use, indicating that the application is fairly easy to use, although there is still a need to improve its features to make it more user-friendly. The

aspect of increasing learning motivation also showed positive results with a score of 78%, meaning that the application succeeded in fostering interest in learning the Acehnese language among students.

In general, the average test score of 78.7% falls into the “Suitable” category. The low standard deviation (3.06) indicates that the respondents' answers were relatively consistent. These results show that the “Yak Meureunoe Bahsa Aceh” application is not only feasible in theory based on expert assessment, but also well-received by users in the field. Thus, this application has great potential to be implemented more widely in Acehnese language learning, both in schools and for students' independent learning.

B. Discussion

Based on the results of the study, the “Yak Meureunoe Bahsa Aceh” application has been proven to meet the eligibility criteria from various aspects, including content, media, and implementation in learning. Expert assessments show that this application is designed in accordance with the linguistic rules of the Acehnese language and technology-based instructional design principles. The validation confirms that the application is able to meet the needs of regional language learning, especially in the digital era which demands innovation in the presentation of material.

The results of the language expert validation obtained the highest score of 86%, which falls into the “Highly Eligible” category. This figure shows that the phonological content presented is in accordance with the rules of the Aceh language, both in terms of pronunciation, structure, and the systematic presentation of material. This is crucial because linguistic accuracy is fundamental to the development of language learning media. If the content presented does not adhere to linguistic rules, the learning objectives will not be optimally achieved. Therefore, validation by language experts provides legitimacy that this application truly meets the academic standards of the Acehnese language.

The media expert assessment scored 82% in the “Highly Recommended” category. This score reflects that the application design is in line with technology-based instructional design principles, such as ease of navigation, text readability, color selection, and a user-friendly interface. In digital learning, visual aspects and design play an important role in attracting users' interest. Applications designed with learning media principles in mind can increase student engagement and make the learning process more enjoyable. Thus, media expert input ensures that the application is not only linguistically sound, but also technically and visually effective.

Meanwhile, the assessment from language teachers showed a score of 80%, which falls into the “Suitable” category. This assessment indicates that the application is relevant to classroom learning practices and useful in helping teachers deliver material. However, teachers also emphasized the need for additional features to make the application more attractive to students. For example, the addition of gamification elements, interactive quizzes, or audio-visual-based exercises that can enrich the learning experience. These findings are important because teachers are the direct users of the application in formal learning, so their input can be the basis for further application development.

Expert validation and field test results are in line with the 4D model concept proposed by Thiagarajan, Semmel, and Semmel. This model emphasizes the importance of systematic educational product development through the stages of define, design, development, and dissemination. The results of this study show that each stage has been completed successfully, resulting in a product that is suitable for use in real learning situations. This also proves that the 4D model is relevant and effective in the development of mobile-based learning media.

In terms of usefulness, this application is able to support technology-based learning in line with the needs of the digital age. The younger generation, who have grown up in a digital environment, are in great need of learning media that is interactive, flexible, and accessible at any time. Mobile applications provide this solution because they can be used independently outside of school hours. With this application, students can learn the Acehnese language wherever they are, without being tied to a

classroom or specific time. This is very much in line with the principles of mobile learning, which emphasize flexibility and independence in learning.

In addition to supporting digital learning, this application also serves as an effort to preserve regional languages. The Acehnese language is currently facing a major challenge in the form of declining use among the younger generation. Through a mobile-based learning application, the Acehnese language is presented in a digital format that is closer to the daily lives of Generation Z. Thus, this application is not only a learning medium, but also a means of revitalizing regional languages so that they continue to exist amid the tide of globalization.

The aspect of learning motivation is also an important finding. Based on the results of trials, this application scored 78% in terms of increasing student learning motivation. This shows that the use of digital applications can encourage student engagement in the learning process. Learning motivation is a key factor in educational success. If students are motivated, they will be more active, diligent, and consistent in their learning. With this application, the process of learning the Acehnese language becomes more interesting, thereby increasing students' intrinsic motivation to learn their regional language.

In addition to providing direct benefits to students, this application also helps teachers in teaching. Teachers consider this application to be very helpful in delivering material, especially phonology material, which has been difficult for students to understand. The application provides audio and visual features that can clarify the material, so that teachers do not only rely on lecture methods. With the help of this application, teachers can play more of a role as facilitators who accompany students in independent learning.

From a character development perspective, this application also contributes to the internalization of local values through language. According to Faiz and Soleh (2021), character education based on local wisdom can strengthen students' cultural identity while instilling positive values. By learning the Acehnese language through the application, students not only acquire language skills but also understand the cultural values contained within it. This is important for shaping a young generation with character, identity, and a love for local culture amid global challenges.

The academic implications of this study are that the development of mobile-based applications using the 4D model can serve as a reference in the development of learning media for other regional languages. The success of the “Yak Meureunoe Bahsa Aceh” application shows that a systematic and user-need-based approach can produce effective, feasible, and useful products. Meanwhile, the practical implications are that this application can be immediately used in learning the Acehnese language in schools or independently by the general public.

Thus, it can be concluded that the “Yak Meureunoe Bahsa Aceh” application falls into the “Highly Feasible” category. This application not only functions as an effective learning medium but also as an instrument for preserving regional languages and strengthening cultural identity. The results of this study open up great opportunities for the development of other innovative learning media oriented towards the preservation of local languages and cultures in the digital era.

Conclusion

This study successfully designed and developed a mobile-based Acehnese language learning application called “Yak Meureunoe Bahsa Aceh” using the 4D development model (Define, Design, Development, Dissemination). Validation results from linguists, media experts, and language teachers showed that this application falls into the “Highly Suitable” category with an average score of 82.7%. Limited field trials also showed that the application effectively increased student learning motivation with an average score of 78.7%. This proves that the developed application is not only linguistically and technically appropriate, but also capable of having a positive impact on the Aceh language learning process.

The findings of this study contribute both academically and practically. Academically, this study reinforces the relevance of using the 4D model in the development of technology-based learning media, especially for regional languages. Practically, the "Yak Meureunoe Bahsa Aceh" application can be used by teachers as a learning support medium and by students as a flexible and interesting means of independent learning. Furthermore, this application can be one of the strategies for revitalizing the Acehnese language, which is increasingly marginalized in the era of globalization, as well as a means of instilling local cultural values in the younger generation.

For further development, it is recommended that this application be equipped with additional features, such as gamification, an interactive question bank, and more varied multimedia integration to make it more attractive to users. In addition, the application also needs to be expanded by involving more schools in various regions of Aceh so that its benefits are more widespread. Further research can focus on measuring the long-term effectiveness of the application in improving students' language skills, so that this application not only serves as a learning medium, but also as an important instrument in the preservation of the Acehnese language and culture.

Acknowledgements

The author would like to express his deepest gratitude to the Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia for its support and funding through the 2025 Bima Grant, which has enabled this research to be carried out successfully. The assistance and trust provided have been instrumental in supporting the success of this research.

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