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Multilingual Web-Based Application to Supplement Language Instruction Among Indigenous Schools in Dingalan, Aurora

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Abstract. This project aims to develop a Multilingual Web-Based Application to support language instruction in indigenous schools in Dingalan, Aurora. Language is not only a tool for communication but also a vessel of culture and identity. However, many indigenous languages in the Philippines—such as Bulos, the native language of some communities in Dingalan—are at risk due to the dominance of Filipino and English in formal education. This creates barriers for indigenous students who struggle to understand lessons in unfamiliar languages, resulting in low comprehension, reduced participation, and cultural disconnection. Teachers also face challenges due to the lack of multilingual teaching resources. To address these issues, the application enables users to translate learning materials—such as activities, quizzes, exams, and modules—into Bulos, Filipino, or English. It also features an audio function that allows users to hear the correct pronunciation of selected words, enhancing both comprehension and oral language skills. This supports inclusive learning, language development, and cultural preservation within the classroom. The system is designed to be accessible on multiple devices, includes offline functionality, and features a user-friendly interface suited for varying levels of digital literacy. These features ensure that both students and teachers, even in remote or underserved areas, can effectively use the application regardless of connectivity or technical familiarity.

Ultimately, this project promotes educational equity, indigenous language revitalization, and cultural continuity. It empowers teachers with practical tools and motivates students to engage in meaningful learning experiences. Most importantly, it aids in preserving the Bulos language by embedding it into a modern educational platform. This initiative serves as a model for integrating indigenous languages into digital learning environments and can inspire similar efforts in other regions of the Philippines.

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1. Introduction

The integration of multilingual education and digital technology has become increasingly important in addressing the educational and cultural needs of indigenous communities. While the Philippine government promotes Mother Tongue-Based Multilingual Education (MTB-MLE), several challenges hinder its effective implementation in indigenous schools. Dela Cruz et al. (2018) point out a critical gap between national policy and actual classroom practice due to the lack of localized instructional materials, insufficient teacher training, and limited technological infrastructure. These issues are especially pronounced in remote communities, where indigenous learners often face language barriers that affect their understanding, participation, and overall academic performance.

Studies by Johnson (2019) and Miller & Santos (2020) demonstrate the potential of web-based and mobile learning platforms to address these challenges. Their findings show that features like pronunciation guides, interactive content, and offline accessibility significantly improve vocabulary retention, motivation, and language proficiency among indigenous students. However, these tools are often generalized and not tailored to specific local languages or contexts, reducing their effectiveness in preserving endangered indigenous languages.

Research by Brown & Lopez (2021) and Williams et al. (2022) emphasizes the importance of community-based approaches and culturally responsive content in language preservation. Participatory development, especially involving native speakers and elders, contributes to more meaningful and sustainable learning experiences. Yet, many existing platforms still lack this level of community engagement and localization.

In the case of Dingalan, Aurora, the Bulos language remains underrepresented in educational content and digital tools. Without deliberate efforts to integrate it into the learning process, students risk losing a critical part of their identity and heritage. There is a clear need for an inclusive, technology-driven solution that supports instruction in Bulos while bridging digital literacy gaps and enhancing accessibility in marginalized areas.

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2. Methodology

This study employed a Developmental Research Design, a method well-suited for creating and refining educational technologies, particularly in localized and underserved contexts (Alqahtani & Rajab, 2020). The project followed the Software Development Life Cycle (SDLC) model, integrating Agile principles for iterative refinement based on user feedback. Software quality was evaluated using the ISO/IEC 25010:2011 framework, which considers key attributes such as functionality, usability, reliability, and efficiency.

Requirements Analysis. Surveys and interviews with teachers, students, and language experts identified the needs, challenges, and content requirements for multilingual instruction in Bulos, Filipino, and English.

Design. The system architecture and interface were designed using Figma, with planned support for translation, audio playback, and a MySQL database to store words, user data, and materials.

Development. The application was built using PHP, MySQL, HTML, CSS, and JavaScript. DOCX translation was handled using PHPWord, and PDF rendering with TCPDF. Audio playback featured native recordings for Bulos and Filipino and browser TTS for English. Offline access was enabled via caching.

Testing and Evaluation. Alpha and beta testing were conducted with developers and users. Usability was measured using a modified SUS, and software quality was evaluated using ISO/IEC 25010:2011: functionality (performs intended tasks), usability (user-friendly), reliability (consistent performance), efficiency (optimized resource use), and maintainability (easy to update). Feedback guided iterative improvements.

2.1. Sampling Procedure

The evaluation of the developed Multilingual Web-Based Application was based on the ISO/IEC 25010 Software Product Quality Model, using a 4-point Likert scale to measure how well the system met specific quality attributes: functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, portability, and overall effectiveness.

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Each quality criterion was assessed using a specific response mode (Tables 2 to 10), with verbal descriptions and detailed descriptors to guide evaluators. The evaluation instruments were divided for two respondent groups: IT professionals, who rated technical qualities (e.g., maintainability and performance), and end-users, who focused on usability, instructional value, and accessibility in a multilingual context.

The acceptability level of the developed system was likewise assessed using the same weighted mean formula (see Equation 1), applied to the scores gathered from the acceptability questionnaire (Table 12). This provides a numerical indicator of how well the system met user expectations during implementation and reflects the degree to which it was accepted by stakeholders in real-use settings.

Formula for Data Analysis

To interpret the responses, Mean was used to summarize the level of agreement across all items per criterion.

Scale for Interpretation:

To interpret the evaluation results of the Multilingual Web-Based Application, a weighted mean scale was used in accordance with ISO/IEC 25010 quality standards. A mean score ranging from 3.25 to 4.00 indicates that the system is highly functional, efficient, compatible, usable, reliable, secured, maintainable, or portable, depending on the criterion being assessed. Scores from 2.50 to 3.24 signify that the system meets the standard level of quality and is considered functional or acceptable in performance. A rating between 1.75 and 2.49 suggests the system needs improvement, as it only partially meets the expected requirements. Lastly, scores between 1.00 and 1.74 reflect a poor rating, indicating major weaknesses that significantly affect the system's effectiveness and may require redesign or restructuring.

2.2. Respondents

The study involved 30 participants divided into two groups: 10 IT professionals and 20 end-users. The IT group consisted of 5 IT instructors and 5 system developers, selected for their expertise in system development and

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evaluation. The end-users included 15 teachers, 3 language experts, and 2 school administrators from DepEd-recognized indigenous schools in Dingalan, Aurora. These individuals were chosen based on their direct involvement in implementing Mother Tongue-Based Multilingual Education (MTB-MLE), in accordance with DepEd Order No. 74, s. 2009 and RA 10533. Their combined expertise and experience ensured relevant, informed feedback on the system's technical quality, usability, and instructional effectiveness.

Table 1 System Evaluation and Acceptability

Scale	Verbal Description	General Descriptor
4	**Highly Functional / Efficient / Compatible / Usable / Reliable / Secured / Maintainable / Portable / Very Acceptable**	Outstandingly meets all stated and implied needs; no weaknesses found; performs efficiently under all conditions.
3	**Functional / Efficient / Compatible / Usable / Reliable / Secured / Maintainable / Portable / Acceptable**	Satisfactorily meets all requirements with minor, tolerable flaws; does not affect overall performance or usability.
2	**Needs Improvement**	Meets only some requirements; minor or moderate weaknesses that slightly affect functionality or performance.
1	**Poor**	Fails to meet most requirements; major flaws are present and severely impact function, usability, or acceptability.

The table provides a scale to evaluate the developed Multilingual Web-Based Application based on ISO/IEC 25010 software quality standards, as well as its overall effectiveness and acceptability. It summarizes how participants rated the system's performance across various quality attributes—such as functionality, usability, and reliability—using a 4-point Likert scale. The table is significant because it allows for a clear and standardized interpretation of evaluation results, helping determine whether the system meets user needs and performs efficiently in a multilingual educational setting.

3. Results and Discussion

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The Multilingual Web-Based Application for indigenous schools in Dingalan, Aurora was developed following the Software Development Life Cycle (SDLC), ensuring a structured and user-centered process. Evaluated using ISO/IEC 25010 standards, the system was rated highly by IT professionals for its functionality, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability. Key features such as document translation (English, Filipino, Bulos), audio playback, file upload, and download operated smoothly across devices and browsers with minimal issues.

End-users—teachers, language experts, and school administrators—also assessed the application positively. They found it user-friendly, relevant to the MTB-MLE curriculum, and effective in supporting multilingual instruction. Despite minor compatibility concerns, the system was deemed acceptable, efficient, and suitable for classroom use. Overall, the application successfully addressed the needs of its users and proved to be a practical tool for enhancing language education in indigenous settings.

4. Conclusions

The study concludes that the Multilingual Web-Based Application developed to support language instruction in indigenous schools in Dingalan, Aurora was successfully designed and implemented through a structured SDLC approach, ensuring alignment with user needs and cultural relevance. The system demonstrated high technical quality, as validated by IT experts using ISO/IEC 25010 standards, particularly in its core functions—document upload, translation, audio playback, and download—across various devices and environments.

End-users, including teachers and school administrators, affirmed the system's usability, responsiveness, and effectiveness in enhancing multilingual instruction, especially in English, Filipino, and Bulos. The tool not only supported classroom teaching but also promoted the inclusion and revitalization of the Bulos language in education. Its high level of acceptability among stakeholders highlights its practicality, cultural significance, and

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potential for broader application in other multilingual and indigenous educational settings.

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