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E-BASA: A READING APPLICATION USING MACHINE LEARNING

[1]Mariz L. Graydo
[2]Richard G. Rabulan, MIT

Aemilianum College Inc. Piot, Sorsogon City, Sorsogon, Philippines

Abstract

Reading proficiency is a fundamental skill that significantly influences academic success and lifelong learning. This study aimed to design and develop E-BASA, a reading application utilizing machine learning to enhance reading engagement, motivation, and proficiency among developing readers. The application was designed with core functionalities, including machine learning for personalized learning, audio-visual aids for engagement, and progress tracking for performance monitoring. Additionally, it incorporated age-appropriate and culturally relevant content, such as phonics, syllabication, and basic reading exercises, to cater to various literacy levels. Other key features included audio guides for pronunciation accuracy, visual aids for enhanced comprehension, and user authentication for personalized progress tracking. The system was rigorously evaluated using the ISO 25010 industry standards to ensure high functional suitability, efficiency, usability, security, and reliability.

Findings from the system's development, testing, and evaluation demonstrated the successful integration of machine learning, audio-visual aids, and progress tracking, making E-BASA an effective tool for adaptive learning. The application's age-appropriate and culturally relevant content was well-received, supporting literacy development across different reading levels. The inclusion of audio guides significantly improved pronunciation and fluency, while visual aids enhanced user engagement and comprehension. The system's authentication features enabled secure tracking of individual performance, ensuring a personalized learning experience. Based on ISO 25010 standards, E-BASA achieved an overall rating of 4.42, indicating that the system is "Highly Applicable" in terms of functionality, efficiency, compatibility, usability, reliability, security, maintainability, and portability.

The study concluded that E-BASA effectively delivers an engaging and adaptive reading experience by incorporating machine learning, multimedia resources, and structured literacy content. Its ability to provide personalized reading support and track learner progress highlights its potential as a valuable educational tool. The successful adherence to ISO 25010 standards confirms the system's reliability, efficiency, and usability, making it a highly suitable platform for enhancing reading literacy among developing readers.

To further improve E-BASA, future research should focus on enhancing machine learning algorithms for deeper personalization, updating content to align with evolving literacy standards, and expanding the app's compatibility across multiple platforms. Additional features such as gamification, interactive storytelling, and multi-factor authentication could further enrich the learning experience. Regular system evaluations and updates based on user feedback should be conducted to ensure continued efficiency and relevance in literacy education.

Keywords. *Aemilianum College Inc. Artificial Intelligence (AI) in Education, Automated Reading Assessment, Data Analysis in Education, Digital Learning Tools, E-Basa, Educational Technology, Interactive Reading Platform, Language Learning Application, Machine Learning, Natural Language Processing (NLP), Personalized Learning, Reading Application, Reading Proficiency, Speech Recognition, Student Engagement, Text-to-Speech Technology*

Introduction

Reading is known to be one of the most noteworthy language skills since it is considered a fundamental tool of education, whether formal or informal (Alauya & Basmayor, 2023)**.** Reading is a powerful tool for personal growth and cultural understanding. Just as physical exercise strengthens the body, reading can stimulate the mind, improving critical thinking, problem-solving skills, vocabulary, and knowledge. Given the complexities of learning to read, it is essential to consider how reading develops broadly, the role of each component of reading throughout a reader's development, and the reality that not all readers develop in every area at the same rate (Kuhn & Stahl 2022). Some of the key contributing factors to pupils' poor reading abilities include: poor attention given to phonics instruction in class, pupils' laziness, lack of motivation to learn to read and the shifts away from phonics instruction to reading comprehension at the third grade (Mohammed & Amponsah, 2018). One of the key factors in students' participation in class is the lack of comprehension of what is being taught by the teacher. By not knowing how to read what is written on the board or flashed on the screen, the students' ability to comprehend the lesson is next to impossible.

According to Organization for Economic Cooperation and Development (OECD), the smartphone has transformed the ways in which people read and exchange information; and digitalisation has resulted in the emergence of new forms of text, ranging from the concise, to the lengthy and unwieldy. In the 2018 result of Program for International Student Assessment (PISA), Filipino students obtained an average score of 340 points in Overall Reading Literacy, which was significantly lower than the OECD average of 487 points. Furthermore, among the participating ASEAN countries, Filipino students performed closest to but significantly behind Indonesian students by 31 points in Overall Reading Literacy (PISA 2018 Philippine National Report).

The implementation of the K–12 Basic Education Program is tied to the significance of raising students' competitive reading skills (Roque, Javillonar, Pascua & Cruzat 2023). The Department of Education issued the DepEd Order No. 13, s. 2023 also known as the *Adoption of the National Learning Recovery Program***,** to address the learning loss heightened by school closures and disruption during COVID-19 Pandemic and the low performance of its learners in International Large-Scale Assessments (ILSAs) and national assessments. DepEd Order No. 70, s. 2011 also known as "Guidelines on the Utilization of Funds for Every Child A Reader Program (ECARP)" allotted funds to be utilized to support the implementation of Reading Recovery (RR) and the administration of Philippine Informal Reading Inventory (Phil-IRI) together with the development of the Philippine World Lists in English (PWLE) for Grade I – III Pupils. Initial data from national assessments confirm, indeed, that the results of many students who experienced school closures (particularly those from disadvantaged backgrounds) lag behind those of similar students in previous school years (Avvisati, 2021).

The Department of Education - Division of Sorsogon Province, through the Curriculum Implementation Division, spearheaded the conduct of the Division Workshop on Learning Recovery Plan to *assess of learning needs by determining skills and knowledge gaps and analysis of assessment results in literacy* under Division Memorandum No. 110, s. 2022. With this implementation, a significant need for improvement in reading literacy arises based on the Comprehensive Rapid Literacy Assessment (CRLA) of grades 7 - 10 of Beguin High School.

In the school level, a reading intervention program titled *Pagbasa at Pag-unawa Ko'y Umunlad* (PaPaKu) was crafted and implemented this school year 2024 – 2025 in Beguin High School by reading coordinators in English and Filipino, ma'am Melinda G. Fulgar and Melba R. Quintanar, to improve literacy and school performance of the learners specifically in grades 7 and 8 who are in Coping and Deficit levels. The reading intervention program aims to improve phonological and phonemic awareness, phonics, vocabulary, fluency, as well as the learners' comprehension skills.

In the context of the project, the implementation of the E-BASA: A Reading Application using Machine Learning is an initiative to leverage technology in providing support to developing readers and to create a collaborative and immersive learning environment. By leveling up the traditional reading strategies with innovative digital tools, the study aims to foster a love of reading and enhance the learners' literacy skills. The E-Basa reading mobile application will be developed to provide a one-on-one tutorial to the learners.

Specific Objectives

Specifically, the study aimed to:

1. Develop features and functionalities of the app, focusing on:
   1.1. Machine Learning
   1.2. Audio-visual aids
   1.3. Progress tracking
2. Design age-appropriate, culturally relevant content for each literacy level, incorporating:
   2.1. Phonics
   2.2. Syllabication
   2.3. Basic reading exercises
3. Develop and record audio guides for correct pronunciation and reading patterns aligned with reading literacy levels.
4. Incorporate visual aids such as images and animations to enhance engagement and comprehension.
5. Implement user authentication features for tracking individual progress and performance.
6. Evaluate the system using ISO 25010 industry standards in terms of:
   6.1 Functional Suitability
   6.2 Performance Efficiency
   6.3 Compatibility
   6.4 Usability
   6.5 Reliability
   6.6 Security
   6.7 Maintainability
   6.8 Portability

Scope and Delimitations

The study aimed to develop an educational tool that enhanced reading proficiency through innovative features and functionalities. The study focused on creating

an application with key components such as machine learning, which provided adaptive learning based on user performance. The app included audio-visual aids, such as images, animations, and audio guides, to support reading comprehension and pronunciation. It featured a progress tracking system to monitor individual learning achievements. The application offered age-appropriate and culturally relevant content, focusing on basic literacy skills like phonics, syllabication, and reading exercises. The app also included an authentication feature for personalized progress tracking. The system's evaluation followed the ISO 25010 industry standards, assessing aspects such as functional suitability, performance efficiency, compatibility, usability, reliability, security, and maintainability. The evaluation process involved 10 IT experts to assess technical performance and 10 teachers specializing in reading to review the educational content and user experience.

This study was limited to the development and testing of the E-BASA application within a controlled environment and did not include large-scale deployment or long-term effectiveness studies across different regions. The target users of the application were elementary school students, and the scope of literacy content was designed for beginner to intermediate reading levels only, excluding advanced or specialized reading skills. The machine learning model relied on a predefined dataset of reading exercises and pronunciation patterns, and as such, it did not fully adapt to variations in regional dialects or accents. The evaluation was conducted solely by the selected group of IT experts and reading teachers, and the feedback was limited to this specific sample. Additionally, the system's performance was not tested on older or low-specification devices which may have affected its compatibility outside the specified hardware requirements. The system is specifically for Android devices only.

Gap-Bridged by the Study

The reviewed systems, including Phil-IRI, READTECH 1.0, Aral Muna, E-*Tulay, Pagsasanay sa Pagbasa* System, Read-Aloud System, MyReadingPal, Read Right, iRead, and The Literacy Enrichment App, primarily focused on enhancing reading skills through interactive exercises, phonics-based activities, and gamified learning approaches. These applications were effective in addressing issues related to reading comprehension, fluency, and literacy development among elementary students. Most of these systems incorporated adaptive features, progress tracking, and personalized interventions tailored to meet individual learner needs. However, many relied heavily on either mobile-based platforms or web-based tools, with limited integration of advanced technologies like speech recognition or real-time feedback mechanisms, particularly for the context of Filipino learners.

The present study bridges the identified gaps by introducing an enhanced, comprehensive reading platform that integrates speech recognition, adaptive learning algorithms, and real-time feedback, all tailored to the cultural and linguistic context of the Philippines. Unlike previous studies, which often segmented literacy skills into isolated components, the proposed system adopts a holistic approach that combines phonemic awareness, word recognition, reading fluency, and comprehension in a unified framework. The unique feature of real-time adaptive content based on learner input and progress offers a significant improvement over existing

systems, providing a more immersive and engaging experience for struggling readers. This innovative approach not only addresses the gaps in current digital reading tools but also offers a scalable and accessible solution for improving reading proficiency in diverse learning environments.

Requirements Gathering and Analysis

In the study titled E-Basa: A Reading Application Using Machine Learning, the project researcher conducted a meticulous research and analysis to assess the effectivity of the proposed reading mobile application. This involved a collaborative effort between key stakeholders: reading coordinators, the researcher and school administration. The core concept was to leverage machine learning to create a personalized reading companion. By analyzing a user's reading history, preferences, and comprehension level, E-Basa would be able to recommend suitable reading materials, adjust the difficulty level, and provide real-time feedback.

System Design

The system design phase of E-Basa is a critical step in translating the requirements gathered during the analysis phase into a concrete system architecture. This phase involves creating a detailed blueprint of the application, defining its components, their interactions, and how they will work together to deliver a seamless reading experience.

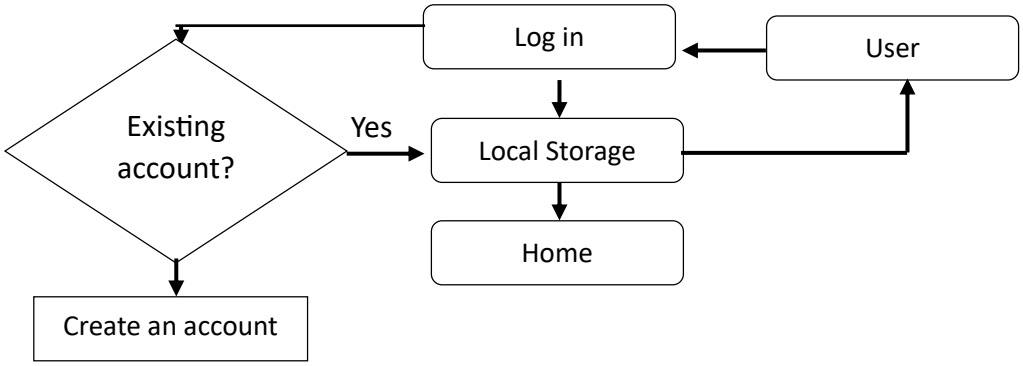

Figure 4.4 Log-In Module

Figure 4.4 illustrates the Log-In Module of the E-Basa system, which serves as the primary access point for students to securely enter the platform. The module facilitates user interaction by requiring students to enter their username and password into the login form. Once the credentials are provided, the system performs credential verification by saving the entered data in local storage and sending a request to the database to validate the username and password. Based on the verification results, the system enforces access control by either granting or denying access. If the credentials are valid, the module displays a welcome message and allows the student to proceed within the E-Basa system. However, if the credentials are invalid, the system presents two options: prompting

the user to create an account or displaying an error message indicating a failed login attempt due to an incorrect password. This structured authentication process ensures security, prevents unauthorized access, and enhances user convenience within the system.

Implementation

During the implementation phase of the study on E-Basa: A Reading Application Using Machine Learning, the researcher transformed the conceptual framework into a tangible product, paying close attention to technical details and user experience. It details the development process, including the system architecture, the selection and integration of relevant libraries and frameworks, and the deployment of the application. Explanation of how the machine learning models (e.g., for text analysis, personalized recommendations, progress tracking) were implemented and integrated into the application.

Figure 4.5 Login Screen

Figure 4.5 displays the Login Screen for E-Basa: A Reading Application Using Machine Learning, featuring a minimalist design with *Username* and *Password*, *Create an Account* and *Forgot Password*, and *Log in* fields. The username field is for users to enter their desired username to be used every time the user opens the application. The password field is for users to enter their password. The Log In button is a prominent button to initiate the login process. The *Forgot Password* field directs users to a password recovery or reset

page. The "Create Account" field is an option for new users to create an account within the application.

Deployment and Maintenance

The final phase of the development of E-BASA: A Reading Application Using Machine Learning focused on ensuring that the system was fully optimized, stable, and ready for deployment. This stage involved extensive testing, final refinements, and user training to guarantee a seamless transition from development to real-world use.

Prior to deployment, the system underwent comprehensive validation through functional, performance, usability, and reliability testing. Evaluations conducted by IT experts, reading coordinators, and developing readers confirmed that the application met industry standards, particularly in areas assessed using ISO 25010 criteria—including functional suitability, performance efficiency, usability, and reliability. The testing results indicated high user acceptance and effectiveness, affirming the system's readiness for implementation.

In preparation for deployment, user documentation, training materials, and technical support guidelines were developed to assist users in navigating the application effectively. The system was also optimized for cloud-based deployment, ensuring scalability, data security, and real-time updates. This approach allowed continuous monitoring and maintenance without disrupting user access.

With all necessary refinements and optimizations completed, the E-BASA application was deemed ready for full deployment. The final stage ensured that students, educators, and parents could seamlessly access and utilize the system, ultimately achieving the project's goal of enhancing reading proficiency through machine learning technology.

Findings

During the development and after testing and evaluation of the developed system the following findings have been established:

1. The E-BASA application successfully integrated machine learning, audio-visual aids, and progress tracking to enhance personalized learning, engagement, and user performance monitoring.
2. The application effectively incorporated age-appropriate and culturally relevant content, including phonics, syllabication, and basic reading exercises, to support literacy development at various levels.
3. The application successfully developed and integrated audio guides that provide correct pronunciation and reading patterns, ensuring alignment with different literacy levels.

4. The application effectively incorporated visual aids, including images and animations, to enhance user engagement and improve reading comprehension.
5. The application successfully implemented user authentication features, enabling the system to track individual progress and performance effectively.
6. The application was evaluated using ISO 25010 industry standards, achieving an overall rating of 4.42, which indicates that the system is "Highly Applicable" in terms of functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability.

Conclusions

Based on the findings of this study the following conclusions were formulated:

1. The successful integration of machine learning, audio-visual aids, and progress tracking in E-BASA demonstrates its effectiveness in providing an adaptive and engaging learning experience.
2. The inclusion of age-appropriate and culturally relevant content ensures that the application caters to diverse literacy levels, making it a valuable tool for early reading development.
3. The incorporation of audio guides enhances pronunciation accuracy and reading fluency, reinforcing proper reading patterns aligned with literacy standards.
4. The use of visual aids such as images and animations significantly improves user engagement and comprehension, making learning more interactive and effective.
5. The implementation of user authentication features ensures secure and personalized learning by tracking individual progress and performance.
6. The E-BASA application met ISO 25010 standards with a "Highly Applicable" rating, confirming its reliability, efficiency, and overall effectiveness in enhancing reading literacy.

Recommendations

Based on the conclusions drawn from this study, the following recommendations were formulated:

1. To further enhance the effectiveness of E-BASA, future improvements should focus on refining its machine learning algorithms to provide more personalized learning experiences based on user performance and progress.
2. Continuous content updates should be implemented to ensure that age-appropriate and culturally relevant materials remain engaging and aligned with evolving literacy standards.
3. Additional audio guides with varying speech tones and speeds should be incorporated to accommodate diverse learning preferences and reinforce pronunciation skills.
4. More interactive visual elements, such as gamification features and animated storytelling, should be introduced to further enhance engagement and comprehension.
5. Strengthening the security of user authentication features by integrating multi-factor authentication and encrypted data storage will improve user data protection and privacy.
6. Regular system evaluations using ISO 25010 standards should be conducted to maintain and further improve the app’s functional suitability, efficiency, and

overall usability for a better reading experience.

7. Expanding the app's compatibility across multiple platforms, including iOS and web versions, can increase accessibility and reach a broader audience. Ensuring cross-platform synchronization will allow users to seamlessly transition between devices while maintaining their progress.

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