



Faculty of Computer Science and Information Technology

**BacaSama – A Literacy Learning App for Illiterate Adults in Malaysia**

Lee Su Fah

Bachelor of Software Engineering with Honours

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# **BacaSama – A Literacy Learning App for Illiterate Adults in Malaysia**

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This project is submitted in partial fulfilment of the  
requirement for the degree of  
Bachelor of Software Engineering with Honours

Faculty of Computer Science and Information Technology  
UNIVERSITI MALAYSIA SARAWAK

2025

# **BacaSama – A Literacy Learning App for Illiterate Adults in Malaysia**

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Projek ini merupakan salah satu keperluan untuk  
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## ABBREVIATIONS

AI	Artificial Intelligence
IDE	Integrated Development Environment
IT	Information Technology
JAKOA	Jabatan Kemajuan Orang Asli
KEMAS	Jabatan Kemajuan Masyarakat
LEADS	Literacy Education for Adult Skills
OCR	Optical Character Recognition
PLF	Program Literasi Fungsian
PLFOA	Program Literasi Fungsian Orang Asli
RAD	Rapid Application Development
SDG	Sustainable Development Goals
UI	User Interface
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations Children's Emergency Fund
UX	User Experience

## **ABSTRACT**

BacaSama is a mobile application designed to address the literacy challenges faced by illiterate adults in rural Sarawak. The app provides interactive lessons in the Malay language, focusing on reading and writing skills. Using a user-friendly interface, gamified features, and offline accessibility, the application ensures engagement and adaptability for users with limited digital experience. Developed using Flutter, Firebase, and Figma, BacaSama leverages advanced technologies such as speech recognition and real-time data storage to track progress and provide personalized learning experiences. By empowering adults with essential literacy skills, the app contributes to improving socio-economic opportunities, reducing inequalities, and aligning with Sustainable Development Goals, particularly SDG-4 (Quality Education). The project also emphasizes cultural relevance and usability for the target audience, ensuring it becomes an effective tool in bridging literacy gaps in rural communities.

## ABSTRAK

BacaSama ialah aplikasi mudah alih yang direka untuk menangani cabaran literasi yang dihadapi oleh golongan dewasa buta huruf di kawasan luar bandar Sarawak. Aplikasi ini menyediakan pelajaran interaktif dalam Bahasa Melayu dengan penekanan kepada kemahiran membaca dan menulis. Dengan antaramuka mesra pengguna, ciri gamifikasi, dan kebolehcapaian luar talian, aplikasi ini memastikan penglibatan dan kebolehsuaian bagi pengguna yang kurang pengalaman digital. Dibangunkan menggunakan *Flutter*, *Firestore* dan *Figma*, BacaSama memanfaatkan teknologi canggih seperti pengecaman suara dan penyimpanan data masa nyata untuk menjejaki kemajuan serta menyediakan pengalaman pembelajaran yang diperibadikan. Dengan memberi kuasa kepada golongan dewasa dengan kemahiran literasi asas, aplikasi ini menyumbang kepada peningkatan peluang sosio-ekonomi, mengurangkan ketidaksamaan, dan selaras dengan Matlamat Pembangunan Mampan, khususnya SDG-4 (Pendidikan Berkualiti). Projek ini juga menekankan kepentingan budaya dan kebolehgunaan untuk kumpulan sasaran, menjadikannya alat yang berkesan dalam merapatkan jurang literasi dalam komuniti luar bandar.

## CHAPTER 1: INTRODUCTION

### 1.1 Introduction

BacaSama is a mobile application designed to provide a lifeline to illiterate adults in Sarawak, enabling them to learn fundamental reading and writing skills in the Malay language. Literacy, as defined by UNESCO, encompasses the ability to identify, understand, interpret, create, and communicate using written and printed materials. In the Malaysian context, adults are generally defined as individuals aged 18 years and above, who are recognized by law as having full legal capacity and responsibility (Government of Malaysia, 1971). Many of these adults, especially in rural and remote areas of Sarawak, face significant barriers to accessing formal education due to the lack of infrastructure and resources, leaving them without the opportunity to acquire basic literacy skills.

BacaSama focuses specifically on teaching reading and writing because these skills form the foundation for functional literacy, enabling individuals to understand essential information, engage with educational content, and participate more fully in society. Literacy is a critical gateway to personal and professional development, and for many adults in rural Sarawak, it represents the first step toward breaking the cycle of poverty and improving quality of life. Unlike numerical or digital skills, which often require literacy as a prerequisite, reading and writing skills are fundamental and universally necessary for accessing broader learning opportunities and navigating everyday life.

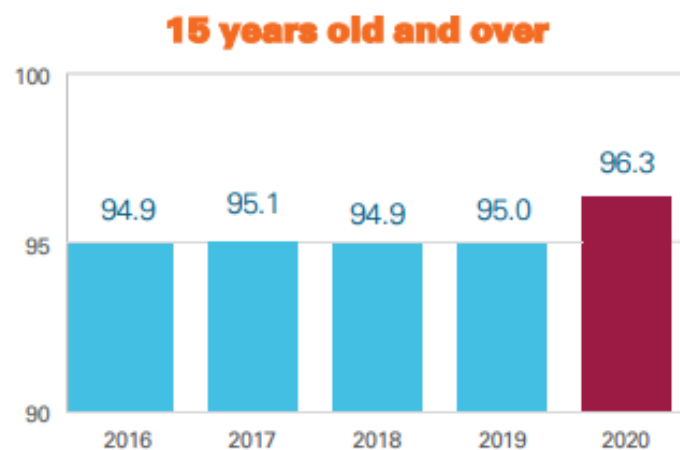
BacaSama aligns closely with the United Nations' Sustainable Development Goal 4 (SDG-4): Quality Education, which emphasises ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all. By targeting marginalised communities in

Sarawak, the app addresses SDG 4's call to eliminate disparities in access to education, particularly for vulnerable populations, such as rural and indigenous communities. Through its user-friendly, culturally relevant, and offline-capable platform, BacaSama empowers adult learners to overcome literacy challenges, fostering their ability to engage with societal opportunities and improve their socioeconomic status.

Ultimately, BacaSama is more than a tool for learning to read and write; it is a bridge to greater inclusion, independence, and self-reliance for the people of Sarawak. By focusing on literacy, the app lays a crucial foundation for lifelong learning and supports national and global efforts to achieve education for all.

## 1.2 Problem Statement

UNICEF Malaysia (2023) stated that the literacy rate in 2020 for youth and adults aged 15 years and above in Malaysia was 96.3%, as shown in Figure 1 below.



*Figure 1: Literacy and Numeracy rates in Malaysia between 2016 and 2020 for 15 years old and over (UNICEF Malaysia, 2023)*

Despite the high literacy rate over the year, a significant number of adults, particularly in rural areas and older demographics, still struggle with basic literacy skills. Many of these individuals missed out on formal schooling and have limited opportunities for "second chance" education, preventing them from fully participating in society. In Sarawak, rural areas face additional challenges, including limited infrastructure and access to trained educators, which further exacerbate low literacy rates (UNICEF Malaysia, 2023). To address this issue, programs like Literacy Education for Adult Skills (LEADS), under the Department of Community Development (KEMAS), have been introduced to provide adult literacy education in rural areas.



*Figure 2: Basmi buta huruf di Kawasan Pedalaman Negeri in – Harden (Harian Sarawak, 2024)*

These initiatives have seen some success in reducing illiteracy, Figure 2 above shows the recent graduation of participants from a LEADS program in Sri Aman. However, for the program to truly make a lasting impact, graduates must continue their learning journey beyond basic literacy. Continued access to education and opportunities for improvement will help them further develop literacy skills and enable them to better engage in daily tasks and interactions with government offices (Harian Sarawak, 2024). Programs like LEADS offer a valuable foundation, but ongoing support and resources are necessary to ensure long-term progress for adult learners.

In addition to these challenges, illiterate adults face significant barriers in adapting to modern communication and technological advancement. Many are confined to using voice chat on messaging platforms, as they are unable to utilise text-based communication tools due to their inability to read or write. They also struggled to navigate digital applications, as written instructions, icons, and features are incomprehensible to them. This disconnect limits their access to essential services, their ability to stay updated with news – which is predominantly written – and their engagement with digital society.

These challenges underscore the need for solutions like BacaSama, a mobile application designed to deliver continuous literacy education to adults in rural Sarawak. By equipping users with foundational reading and writing skills in Malay, BacaSama not only complements existing programs like LEADS but also addresses the pressing need for tools that bridge the gap between literacy and digital engagement. Such solutions are essential for empowering individuals to actively participate in their communities, access services, and adapt to an increasingly digital world.

### **1.3 Scope**

The proposed application for the BacaSama project has a focused scope, targeting adults in rural Sarawak who lack basic literacy skills. Its primary geographic reach will encompass underserved areas across Sarawak, particularly those with infrastructural challenges that hinder access to formal education. The app's design will cater specifically to the learning needs of non-literate adults, with localised content in the Malay language to ensure it resonates with the cultural and linguistic context of Sarawak.

The key features of BacaSama will include interactive, voice-guided lessons that can aid users in developing reading and writing skills, complemented by exercises that reinforce learning. The app will also offer AI-powered speech recognition to provide real-time feedback on their

pronunciation. A major part of the user interface will involve gamification elements, such as badges and rewards, to engage and motivate users. This will be further enhanced by offline functionality, allowing learning to continue even in areas with limited internet connectivity.

The primary users of the application will be adults in rural communities; however, secondary users may include family members who assist in the learning process. Initially, the app will be developed for Android, given the platform's wide accessibility. This scope ensures the app is a practical tool for adult literacy, helping to bridge educational gaps in Sarawak and improving users' socio-economic prospects.

#### **1.4 Aims and Objectives**

The project aims to develop a mobile application that enhances literacy among illiterate adults in rural Sarawak by focusing on tailored learning modules, offline accessibility, and user engagement through gamification.

##### **i. To study and analyse existing literacy applications**

The primary objective involves evaluating current mobile literacy applications to identify effective features, learning approaches, and limitations that can inform the design of BacaSama.

##### **ii. To design and develop a culturally relevant literacy application for adults in Sarawak**

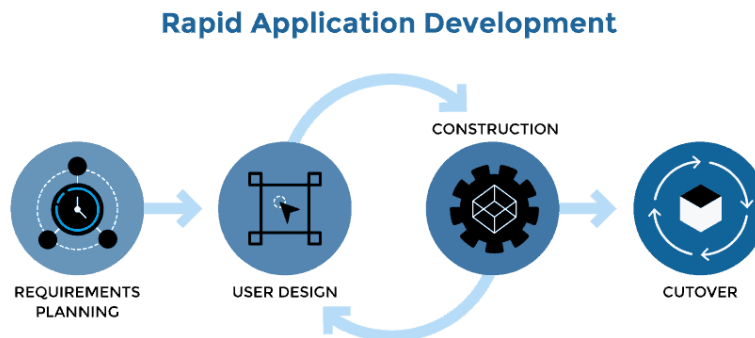
This objective focuses on creating a mobile app tailored to the literacy needs of adult learners, emphasising the Malay language, offline accessibility, and gamified engagement.

##### **iii. To test and evaluate the usability and functionality of BacaSama**

This objective ensures that the application is usable and effective through user testing with the target audience and functionality assessments to ensure it meets its educational goals.

## 1.5 Brief Methodology

For the development of BacaSama, the project will utilise Rapid Application Development (RAD). RAD is a fast-paced software development methodology focused on quick prototyping and iterative development.



*Figure 3: Rapid Application Development (Plutora, 2019)*

RAD's flexibility allows for adjustments based on user feedback throughout the development process, ensuring that the final product effectively addresses the literacy needs of its target audience. This method not only accelerates development but also encourages user engagement and satisfaction. The RAD approach involves several key steps:

1. Requirements Planning: Gather initial requirements by engaging with users to understand their literacy needs and challenges.
2. User Design: Involve users in the design process through feedback sessions, ensuring the app's interface and features are user-friendly and culturally appropriate.
3. Construction: Develop prototypes quickly, incorporating essential features like audio lessons and interactive elements based on user input.

4. Cutover: Deploy the app to users and gather ongoing feedback for continuous improvements, creating a cycle of enhancement based on real user experiences.

## **1.6 Significance of Project**

The BacaSama mobile application addresses the significant challenges faced by illiterate adults in rural Sarawak. BacaSama aims to bridge this gap by offering a user-friendly platform to teach basic reading and writing skills in Malay. By equipping users with the ability to read, write, and navigate digital tools, the app enables them to communicate effectively, understand instructions, and engage with written content, both online and offline.

By addressing these limitations, BacaSama promotes social inclusion and digital literacy, allowing users to actively participate in their communities and improve their quality of life. Furthermore, the BacaSama initiative contributes to SDG 4 (Quality Education) by providing an inclusive learning platform that addresses educational disparities, especially in rural areas with limited access to formal education. The project leverages technology to ensure that those who have missed out on formal schooling can still acquire literacy skills, foster empowerment and reduce inequalities.

Additionally, the project aligns with SDG 1 (No Poverty) by enabling illiterate adults to gain essential literacy skills, which are crucial for improving their livelihoods and breaking the cycle of poverty. By enhancing their ability to read, write, and utilise digital platforms, BacaSama enables users to access better job opportunities, financial resources, and social services, thereby contributing to poverty reduction in rural communities.

The app also contributes to SDG 8 (Decent Work and Economic Growth). Through improved literacy, users can engage more effectively in the workforce, acquire new skills, and enhance their economic productivity, ultimately contributing to the region's overall economic growth. In this way, BacaSama is not just an educational tool, but a key driver of social and economic

development, helping users gain independence, improve their livelihoods, and foster long-term community growth.

### **1.8 Expected Outcome**

The expected outcome for the proposed application, BacaSama, includes the development of a fully functional app that provides interactive lessons and assessments in Malay, targeting illiterate adults. The application aims to achieve measurable improvements in literacy, which will be assessed through in-app quizzes that evaluate reading fluency and writing accuracy. The app will offer both offline and online functionality, ensuring accessibility for users in rural areas with limited internet connectivity. To enhance user engagement, gamified features such as progress tracking, rewards, and badges will be integrated, motivating users to complete literacy lessons and maintain their learning journey. Overall, these outcomes aim to empower illiterate adults by providing them with essential literacy skills and fostering a greater sense of community involvement.

### **1.9 Report Outline**

This report is structured to provide a comprehensive overview and analysis of the development of the BacaSama mobile application, which aims to improve literacy among adults in rural Sarawak. The following chapters outline the key aspects of the project:

Chapter 1 introduces the background, problem statement, and objectives of the project, focusing on the barriers to literacy in remote areas and the application's potential to mitigate these issues.

Chapter 2 will cover a literature review, comparing relevant studies and previous projects related to adult literacy and mobile app design tailored for low-literacy adults. This review will guide the objectives and highlight unique aspects of BacaSama that address specific needs in Sarawak's rural communities.

Chapter 3 presents the methodology, detailing the design and requirement analysis process, including the selection of target user needs and the inclusion of accessible, culturally appropriate UI/UX features.

Chapter 4, the implementation phase will be discussed, including the development process, technology stack, and the core functionalities of the application, such as offline capabilities and voice assistance.

Chapter 5 outlines the testing methods, feedback collection from target users, and an evaluation of the app's effectiveness. The chapter also includes an evaluation of the application performance based on predefined success criteria, identifying areas for improvement and lessons learned during the testing process.

Finally, Chapter 6 concludes the report, summarizing findings, evaluating the project's success, and proposing potential future improvements. This section aims to set the stage for the ongoing development and scalability of BacaSama.

## **1.10 Summary**

Chapter 1 introduces the BacaSama mobile application, designed to tackle the persistent issue of low literacy rates among adults in rural Sarawak. By providing accessible and user-friendly literacy education in the Malay language, the application aims to address critical challenges such as limited educational infrastructure, lack of formal schooling opportunities, and barriers to digital literacy. This chapter outlines the background of the literacy problem, identifies its root causes through a detailed problem statement, and establishes clear objectives for the project.

Additionally, it highlights the broader significance of addressing literacy gaps, emphasizing how improved literacy can enhance individuals' socioeconomic opportunities, empower them to engage in digital society, and contribute to national goals and global Sustainable

Development Goals (SDGs), particularly SDG-1 (No Poverty), SDG-4 (Quality Education), and SDG-8 (Decent Work and Economic Growth).

By setting a strong foundation, Chapter 1 paves the way for the following chapters, which will explore the design, development, testing, and evaluation of a tailored solution aimed at empowering underserved communities and fostering lifelong learning.

## CHAPTER 2: LITERATURE REVIEW

### 2.1 Introduction

Literacy is a fundamental skill for social and economic participation, yet illiteracy persists among adults in many parts of Malaysia, particularly in rural areas of Sarawak and Sabah. While numerous educational applications have been developed globally to address literacy issues, most are designed for children or young learners, leaving a significant gap in resources for adult learners. This chapter reviews existing educational applications, including Citizen Literacy (United Kingdom), Duolingo ABC (United States), and Khan Academy Kids (United States) examining their features, processes, target users, and regional focus. In Malaysia, no prominent literacy application specifically targets adult learners. The reviewed applications cater to different demographics and serve both local and global audiences:

- Citizen Literacy: Designed for adult learners, this program offers functional literacy tools and multimedia lessons, primarily catering to English speakers worldwide.
- Duolingo ABC: Targeted at young learners, it gamifies foundational literacy skills. Although designed for children, it is widely accessible to global audiences.
- Khan Academy Kids: Designed for children, it offers comprehensive educational content, encompassing literacy, numeracy, and critical thinking, with a global reach.

This comparative analysis identifies strengths and limitations of these applications, which inform the development of BacaSama, a localized literacy app for adults in rural Sarawak. BacaSama seeks to bridge the gaps in existing efforts by offering culturally relevant, accessible, and offline-capable tools for underserved adult learners in Malaysia.

## **2.2 Existing Efforts / Initiatives**

Malaysia has implemented various policies and programs to eradicate illiteracy, with a particular focus on rural areas and marginalised communities. These initiatives have laid the groundwork for addressing literacy challenges.

### **2.2.1 Orang Asli Functional Literacy Programme (PLFOA)**

The Orang Asli Functional Literacy Programme (PLFOA) is a focused initiative aimed at eradicating illiteracy among the Orang Asli community, particularly in rural and remote areas of Peninsular Malaysia. Launched to improve the quality of life for the Orang Asli population, the program emphasises the "3M" approach—Membaca (Reading), Menulis (Writing), and Mengira (Arithmetic)—to equip participants with essential skills for daily life and self-sufficiency (Adninit, 2022). Targeting adults, youth, and school dropouts, PLFOA provides a culturally sensitive education model that aligns with the unique needs and traditions of the Orang Asli community. The program has made measurable progress in improving literacy rates among participants. Implemented by JAKOA and Kemas, PLFOA integrates culturally relevant teaching methods, enhancing the quality of life and promoting the importance of education. Since 2019, it has benefited 200 Orang Asli, with RM40,000 allocated annually for program expansion in Kelantan (Yahya, 2023).

## Seronok belajar membaca, mengira walaupun usia cecah 47 tahun

Oleh Paya Linda Yahya - November 29, 2023 @ 8:19am  
bhnews@bh.com.my



Figure 4: Collaboration JAKOA and KEMAS on Literacy Program (Ibrahim, 2020)

### 2.2.2 Literacy Education for Adult Skills (LEADS) and Functional Literacy Programme (PLF)

The Literacy Education for Adult Skills (LEADS) and Functional Literacy Programme (PLF), as shown in Figure 5 below, are initiatives by Jabatan Kemajuan Masyarakat (KEMAS) under Malaysia's Ministry of Rural and Regional Development. These programs aim to eradicate illiteracy and enhance the quality of life for rural and marginalized communities, particularly in the remote areas of Sabah and Sarawak (Portal Rasmi Jabatan Kemajuan Masyarakat, n.d). The program has expanded its scope by introducing Information Technology (IT) literacy, such as using communication tools like WhatsApp, to adapt to the growing digitalisation of society, said Abduraya, KEMAS Officer, Sibul Division (Utusan Borneo Online, 2020). The program aims to ensure that issues of illiteracy do not persist, even among those who are older adults or grandparents (Lambai, 2023). This highlights the transformative potential of these literacy

initiatives in promoting lifelong learning. Through these efforts, KEMAS continues to support Malaysia's national goal of improving literacy rates and fostering inclusive education for all.

## Peserta program PLF, LEADS diseru terus menambah ilmu

© November 7, 2020, Sabtu - 10:04am



Figure 5: LEADS Program (Utusan Borneo Online, 2020)

### 2.2.3 Kelas Dewasa Ibu Bapa Orang Asli dan Peribumi (KEDAP)

The KEDAP program targets indigenous adults, such as the Orang Asli, Penan communities in Sabah, providing literacy education while emphasizing cultural preservation as shown in the Figure 6 below is one of the programs held by KEDAP in Kota Kinabalu Sabah. According to Sabah Media (2023), the program not only aims to enhance literacy skills but also contributes to combating extreme poverty through education. KEDAP also fosters a heightened awareness of the importance of education among participants. As noted by Abidin Marjan, Deputy Director of the Sabah State Education Department, this initiative helps parents play a more active role in their children's academic journey, positively impacting both literacy and school attendance rates.



Figure 6: Graduation Ceremony for KEDAP in Kota Kinabalu, Sabah (Sabah Media, 2023)

## 2.3 Existing Literacy Applications

This section reviews existing mobile literacy applications that provide innovative solutions to literacy challenges. These apps offer flexibility, interactivity, and scalability to enhance literacy levels among diverse target audiences. Each subsection details the features, processes, advantages, and disadvantages of the applications and compares them to the proposed application, *BacaSama*, which targets adult learners in rural Sarawak.

### 2.3.1 Citizen Literacy

Citizen Literacy is an app designed for adults who struggle with reading and writing skills, particularly those at the lowest literacy levels. Developed by Citizen Literacy CIC in the UK, the app uses a phonics-based approach, helping users understand the relationships between sounds and letters, improving foundational literacy skills as shown in Figure 7. Recognizing the unique challenges faced by adult learners, Citizen Literacy also emphasizes contextual learning, incorporating real-world scenarios to make literacy skills immediately relevant to users' daily lives. This approach helps address barriers that low-literate adults often face in traditional learning environments, offering a more accessible and practical pathway to literacy

(Casey, 2023). However, the Citizen Literacy team has primarily emphasized the development of a web application that works like a native app but is hosted online.



Figure 7: Learning Unit Screen for Citizen Literacy

Source: <https://citizenliteracy.com/app/>

### 2.3.1.1 Features

Citizen Literacy offers features designed to support foundational literacy learning for adults. These features address the unique challenges faced by low-literate adults and include phonics-based lessons, speech recognition, interactive exercises, progress tracking, and offline functionality.

Table 1: Features Offered by Citizen Literacy

Features	Description
Phonics-based lessons	Introduces phonics to help users understand letter-sound relationships.

Speech recognition	Provides feedback on pronunciation, enabling users to self-correct.
Interactive exercises	Engages users with quizzes and hands-on activities to reinforce learning.
Progress tracking	Tracks user progress across lessons, helping learners monitor their growth.

### 2.3.1.2 Process

The app follows a structured process to help learners progress from basic to advanced literacy skills through interactive modules:

- i. Users sign up and complete an initial assessment to gauge their reading level.
- ii. They are guided through phonics-based lessons, focusing on sound-letter recognition.
- iii. Interactive exercises follow each lesson, enabling users to practice their reading and pronunciation skills.
- iv. Speech recognition gives real-time feedback on pronunciation accuracy.
- v. Progress is tracked, and users can revisit lessons as needed.

### 2.3.1.3 Advantages / Disadvantages

Citizen Literacy’s focus on phonics and real-world scenarios makes it effective for beginner readers. However, it has limitations in addressing advanced literacy needs and diverse cultural contexts.

*Table 2: Advantages and Disadvantages of Citizen Literacy*

Advantages	Disadvantages
------------	---------------

Phonics-based learning is effective for beginner readers.	Limited to basic literacy, lacks advanced topics.
Real-time feedback through speech recognition.	Not optimized for diverse dialects beyond UK English.
Offline access aids users in areas with low connectivity.	User interface may feel outdated or less engaging.

### 2.3.2 Duolingo ABC

Duolingo ABC is an educational app developed by Duolingo, specifically designed to teach children fundamental reading and writing skills in English (Lavigne, 2022). The app uses gamified learning techniques with a focus on phonics, vocabulary, and early literacy concepts as shown in Figure 8 below. With its child-friendly design, Duolingo ABC aims to make learning to read fun and accessible, providing interactive lessons that build foundational literacy skills step-by-step. Although Duolingo ABC is targeted primarily at children, the app is designed to be accessible to a global audience. It is available in multiple languages and can be used by learners worldwide, offering an inclusive educational experience. This global availability ensures that children from various cultural backgrounds and language environments can benefit from the app's resources.

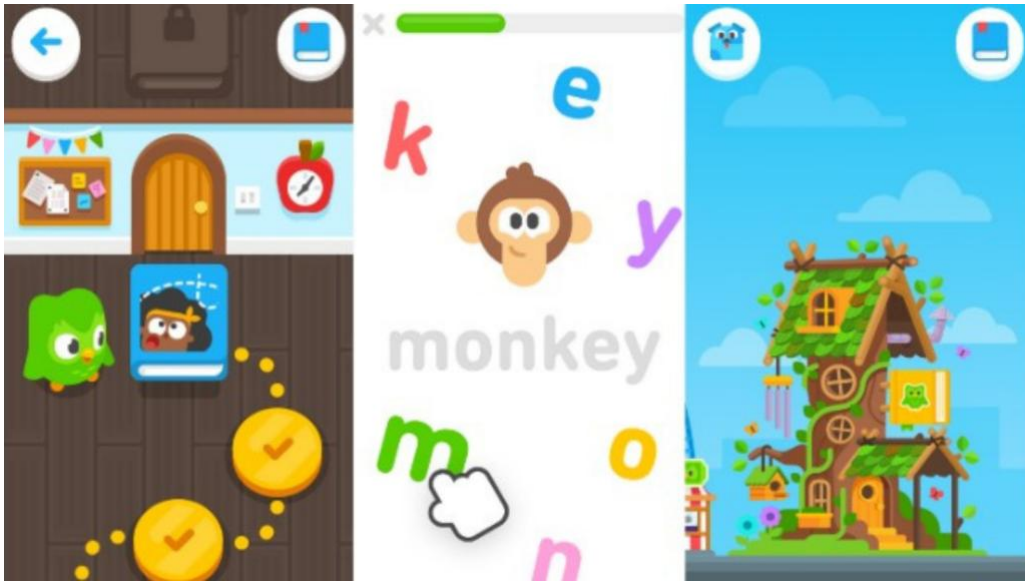


Figure 8: Learning Unit Screen for Duolingo ABC

Source: <https://play.google.com/store/search?q=duolingo+abc&c=apps>

### 2.3.2.1 Features

The app incorporates gamification to make learning enjoyable for children. Features include phonics-based games, interactive exercises, personalized feedback, offline functionality, and progress tracking.

Table 3: Features Offered by Duolingo ABC

Features	Description
Phonics and vocabulary	Builds early reading skills through phonics and vocabulary games.
Interactive games	Uses gamified exercises to maintain engagement and reinforce learning.
Personalized feedback	Provides hints and suggestions, helping users progress at their own pace.

Offline functionality	Offers offline access to most lessons, supporting continuous learning without internet.
Progress tracking	Monitors user progress, encouraging self-paced improvement.

### 2.3.2.2 Process

Duolingo ABC’s process is designed to create a fun, step-by-step learning experience:

- i. Users sign up and select their learning preferences.
- ii. They are introduced to phonics-based games and exercises.
- iii. Each lesson includes interactive games to reinforce phonics and vocabulary.
- iv. Feedback is provided in real time, assisting users in overcoming mistakes.
- v. Progress is tracked, and users can advance through increasingly challenging lessons.

### 2.3.2.3 Advantages/Disadvantages

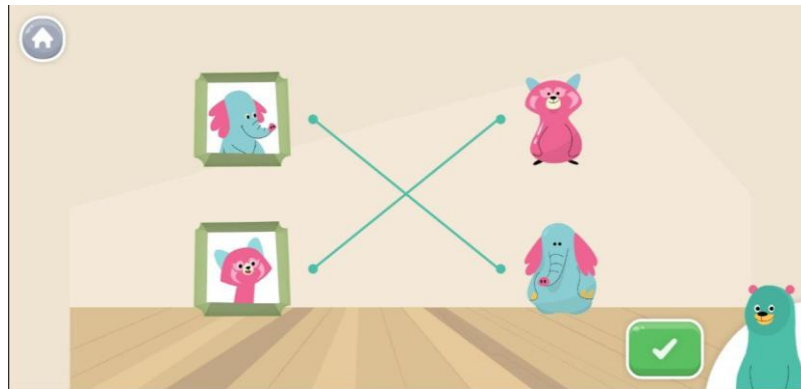
Duolingo ABC’s gamified approach appeals to children but may not address the needs of adult learners or non-English speakers.

*Table 4: Advantages and Disadvantages of Duolingo ABC*

<b>Advantages</b>	<b>Disadvantages</b>
Gamified approach keeps users engaged.	Targeted mainly toward children, not optimized for adults.
Interactive exercises enhance learning retention.	Limited language focus, only teaches basic English literacy.
Lessons accessible offline for remote learning.	Limited cultural adaptability, especially for non-English users.

### 2.3.3 Khan Academy Kids

Khan Academy Kids is an educational app designed for young children, focusing on foundational skills in reading, writing, math, and critical thinking. This app, which Khan Academy develops, incorporates interactive content, drawing tools, and creative activities, supporting a holistic approach to early learning. Figure 9 shows one of the activities in the learning unit of Khan Academy Kids. Khan Academy Kids is available for free and is accessible to a global audience. The app offers content in multiple languages, making it widely available to children from diverse linguistic backgrounds. By offering free, high-quality education, Khan Academy Kids is a valuable resource for early childhood education, providing essential learning tools that help children build a strong foundation in critical areas such as literacy, numeracy, and logical thinking (University of Massachusetts Amherst, 2020).



*Figure 9: Learning Unit Screen for Khan Academy Kids*

Source: <https://play.google.com/store/search?q=khan+academy+kids&c=apps>

#### 2.3.3.1 Features

Khan Academy Kids integrates creative and interactive features to make learning enjoyable. Key features include multimedia content, creative activities, progress tracking, and comprehensive subject coverage.

*Table 5: Features Offered by Khan Academy Kids*

<b>Features</b>	<b>Description</b>
Comprehensive subjects	It covers a range of subjects, including reading, writing, math, and social-emotional skills.
Interactive lessons	Use animated characters and engaging lessons to keep users interested.
Creative activities	Includes drawing and storytelling activities to foster creativity.
Progress tracking	Monitors user progress and adjusts content based on individual learning speed.
Multimedia content	Offers video and audio content to support diverse learning styles.

### **2.3.3.2 Process**

The app process encourages holistic learning:

- i. Users create a profile to personalize the app experience.
- ii. The app introduces basic literacy concepts using animations and characters.
- iii. Each lesson involves interactive exercises with activities like drawing and storytelling.
- iv. Users receive feedback on tasks, adjusting based on their progress and comprehension.
- v. Progress tracking is used to adjust lesson difficulty to match the user's learning pace.

### **2.3.3.3 Advantages/Disadvantages**

Khan Academy Kids' broad educational scope may appeal to young learners but lacks the targeted literacy focus needed by adult users.

Table 6: Advantages and Disadvantages of Khan Academy Kids

<b>Advantages</b>	<b>Disadvantages</b>
Covers multiple subjects beyond literacy.	Content may feel too child-oriented for adult users.
Encourages creativity and critical thinking.	Limited phonics emphasis, less focus on adult learning needs.
Multimedia resources support various learning styles.	Requires consistent internet access for certain features.

### 2.3.4 Comparison Study

There are currently no widely recognized mobile literacy applications targeting adult learners in Malaysia. Most initiatives rely on classroom-based programs like PLFOA and LEADS. This has resulted in an underestimated demand for mobile literacy applications tailored for adults, especially in rural areas. Preference for traditional methods due to cultural and generational factors. Limited investment in educational technology for adult learners.

Table 7: Comparison on Citizen Literacy App, Duolingo ABC and Khan Academy Kids

<b>Features</b>	<b>Citizen Literacy App</b>	<b>Duolingo ABC</b>	<b>Khan Academy Kids</b>	<b>BacaSama</b>
Target Audience	Adult learners, primarily those with low literacy in the UK.	Young children, typically ages 3-6, learning English literacy basics.	Young children, typically aged 2-8, with a broader educational	Adults in rural Sarawak.

			focus beyond literacy.	
Language Focus	English phonics and basic literacy.	English literacy, focusing on phonics, vocabulary, and letter recognition.	English literacy, math, and social-emotional learning; limited focus on phonics.	Malay-focused, culturally relevant.
Learning Approach	Phonics-based lessons with speech recognition and interactive exercises.	Gamified learning with interactive exercises, hints, and real-time feedback.	Multi-subject approach with creative activities like drawing and storytelling.	Phonics-based, gamified.
Engagement Strategy	Progress tracking and real-time feedback via speech recognition.	Highly gamified, using rewards, levels, and badges to motivate young users.	Progress tracking, interactive lessons, multimedia, and creative activities.	Gamified quizzes, rewards
Offline Accessibility	Not available offline for the web app	Many lessons are accessible offline, useful for uninterrupted	Limited offline access: some features, like multimedia,	Most features available offline, which aids users

		learning for children in low-connectivity areas.	require internet connectivity.	with low connectivity.
Cultural Relevance	Limited to English and UK-based literacy standards.	Primarily U.S.-focused English curriculum, not tailored to diverse cultural contexts.	U.S.-based curriculum, with limited adaptability for non-Western cultural contexts.	Adapted to Sarawak context.
Visual and Interface Design	Simplistic UI, which can feel outdated but is straightforward for adult learners.	Highly colourful and engaging, designed for children's cognitive needs.	Animated characters and vibrant UI, appealing to young children.	Clear icons, local imagery

BacaSama is an app designed to help adults in rural Sarawak, Malaysia, learn basic reading and writing in Malay. It targets adult learners who have limited or no formal education, particularly in areas with limited educational resources. The app focuses on the Malay language, making the lessons culturally relevant and easy for users to relate to in their daily lives (Ministry of Education Malaysia, 2019). The app employs a phonics-based approach to teach literacy and incorporates Malay speech recognition to assist users in practising pronunciation. This is important for non-literate users who may struggle with phonetic accuracy. To keep learners motivated, BacaSama incorporates gamified features such as quizzes, rewards, and

progress tracking, making learning enjoyable and encouraging consistent progress. Ryan (2022) states that gamification uses game-like mechanics to increase interest in learning among participants, and this concept has shown high effectiveness.

Since many areas in Sarawak have limited internet access, BacaSama allows users to access lessons offline. This makes the app accessible even in remote areas, aligning with best practices for educational apps designed for low-connectivity environments. The app has a simple, easy-to-use interface with clear icons and local imagery, so adult learners can navigate it without difficulty. BacaSama also includes examples and scenarios based on daily life in Sarawak, such as market interactions and public transport, making learning more relevant to the users' experiences. By combining these features, BacaSama aims to provide an effective and accessible way for adults in rural Sarawak to improve their literacy skills and improve their quality of life.

## **2.4 Software and Hardware**

The development of the proposed use requires several technologies and tools to ensure its performance, dependability, and usage. Every tool is essential to making sure the application is effective, scalable, and user focused.

### **2.4.1 Android Studio**



*Figure 10: Android Studio Logo*

Android Studio will be the primary Integrated Development Environment (IDE) for building the application. It provides a comprehensive environment that includes code completion, robust debugging tools, and an emulator for testing the app across various Android devices. Android Studio is the best option for developing cross-platform apps because of its compatibility with Flutter. Additionally, its built-in features facilitate the testing procedure, ensuring that the application meets quality and performance requirements prior to deployment.

### 2.4.2 Flutter



*Figure 11: Flutter Logo*

The primary framework for developing the mobile application will be Flutter. It enables programmers to create a single codebase and publish the application across several operating systems, such as iOS and Android. Flutter may be used to create visually appealing and intuitive user interfaces because of its wide widget library and support for dynamic UI development. Additionally, the framework's hot reload capability speeds up development by allowing developers to view changes instantly.

### 2.4.3 Firebase



*Figure 12: Firebase Logo*

The backend solution will be Firebase, which offers crucial features like analytics, real-time database capabilities, and authentication. Firebase Realtime Database facilitates real-time data synchronization, guaranteeing smooth user interactions, while Firebase Authentication will safely handle user login and registration. Furthermore, Firebase Analytics will track user activity and provide insightful data on user performance and engagement.

#### **2.4.4 Figma**



*Figure 13: Figma Logo*

Figma will be used to design the user interface and create prototypes for the application. It enables collaborative UI/UX design, ensuring that the final product meets the requirements of the intended audience, which consists of illiterate individuals living in rural areas. Users with low levels of digital literacy can benefit from layouts that are both aesthetically pleasing and easy to use through Figma's user-friendly design tools.

#### **2.5 Summary**

This chapter reviewed three literacy-focused educational applications—Citizen Literacy, Duolingo ABC, and Khan Academy Kids—to explore how different strategies and features address literacy development. Each app offers unique strengths, such as Citizen Literacy's phonics-based lessons and speech recognition tailored for adult learners, Duolingo ABC's engaging gamification for young users, and Khan Academy Kids' holistic, multi-subject

approach. However, certain limitations, such as limited cultural adaptability, offline accessibility, and primary focus on young learners rather than adult learners.

The proposed BacaSama application aims to bridge these gaps by delivering a culturally relevant Malay-language literacy tool specifically designed for non-literate adults in rural Sarawak. BacaSama will incorporate a phonics-based approach with Malay speech recognition, tailored offline functionality, and gamification elements to foster motivation and engagement. Its user-friendly interface and culturally resonant content will further enhance accessibility, ensuring that literacy learning is not only achievable but directly applicable to users' daily lives. By addressing the unique needs of adult learners in underserved areas, BacaSama aspires to make a significant impact on literacy rates and socioeconomic inclusion in Sarawak.

## CHAPTER 3: REQUIREMENT ANALYSIS AND DESIGN

### 3.1 Introduction

This chapter outlines the requirements analysis and system design for the *BacaSama* literacy learning application. It begins with methods used to gather system requirements, lists the functional and non-functional requirements derived from the analysis, and provides a detailed design of the proposed application. The chapter also includes system diagrams and interface design elements to visualise the system architecture and functionality. This ensures that the design aligns with the objectives and addresses the identified challenges.

### 3.2 Rapid Application Development (RAD)

The BacaSama literacy learning application is being developed using the Rapid Application Development (RAD) methodology. To guarantee that the finished application meets the needs and expectations of the user, RAD places a strong emphasis on iterative development, quick prototyping, and active user interaction. The methodology's emphasis on user feedback, design flexibility, and capacity to produce outcomes more quickly make it ideal for this project. The use of RAD ensures that any changes to the requirements can be quickly integrated into the development process.

#### 3.2.1 Requirements Planning

The RAD methodology's requirements planning phase collects and evaluates system requirements to make sure they are clear and aligned with the project's goals. For the BacaSama project, this phase concentrated on understanding the needs of the target audience, which is adults from rural Sarawak, especially those living in longhouse communities in Niah, Subis.

### **3.2.1.1 Survey-Based Data Collection**

A survey-based method was used to determine the needs and preferences of the users. To collect qualitative data, this required distributing questionnaires to possible users and holding casual interviews. The questionnaire is as shown in Appendix C. Key aspects covered in the survey are as follows:

- i. Common literacy challenges faced by the community.
- ii. User preferences for app features such as offline access and gamification.
- iii. Feedback on usability and cultural relevance of content.

### **3.2.1.2 Survey Findings**

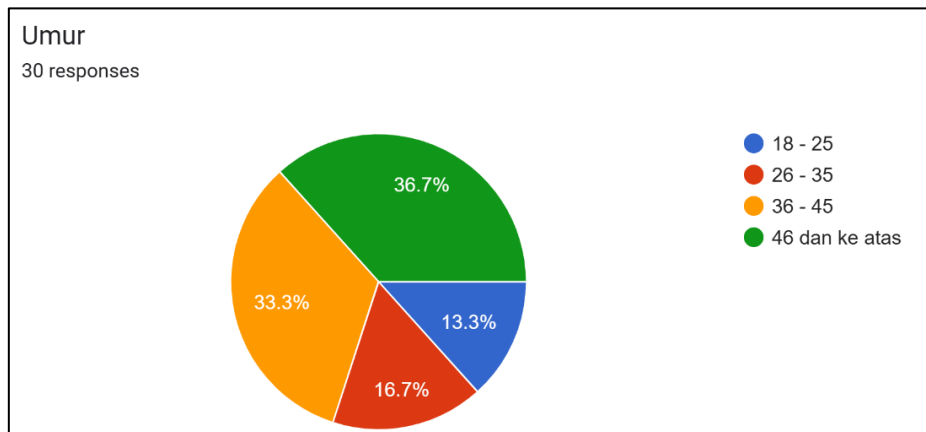
The survey conducted targeted potential users of the BacaSama literacy learning application, focusing on rural communities, particularly adults in longhouses in Niah, Sarawak. The goal of this effort was to get essential details about the target user group's digital requirements, preferences, and literacy challenges. A total of 30 responses were collected, providing an essential foundation for understanding the user requirements and guiding the app's design and features. Various topics were covered in the questionnaire, such as demographic data (age, educational attainment), reading difficulties, competence with technology, and requested app features.

Key obstacles to literacy were identified by the findings, including language preferences, insufficient digital literacy, and restricted access to educational materials. User preferences for features like offline accessibility, gamification elements, and culturally relevant information were also emphasized by the responses. The results are visualized through a series of charts and graphs, which are explained in detail below to provide an in-depth understanding of the data collected.

Figure 14 illustrates the age distribution of respondents in the survey. Among 30 respondents:

- 46 years and above: Represent the largest group, accounting for 36.7% of the total respondents. This indicates a significant number of older adults who may require specialized attention in app design to ensure accessibility and usability.
- 36 to 45 years: Form the second-largest group at 33.3%, highlighting middle-aged adults as another primary user group.
- 26 to 35 years: Make up 16.7% of respondents, representing younger adults who may be slightly more familiar with technology.
- 18 to 25 years: The smallest group at 13.3%, showing limited interest or need for the application among younger individuals.

This distribution suggests that the app should cater primarily to the older age group (36 years and above), incorporating features that are easy to use for individuals with minimal digital experience.

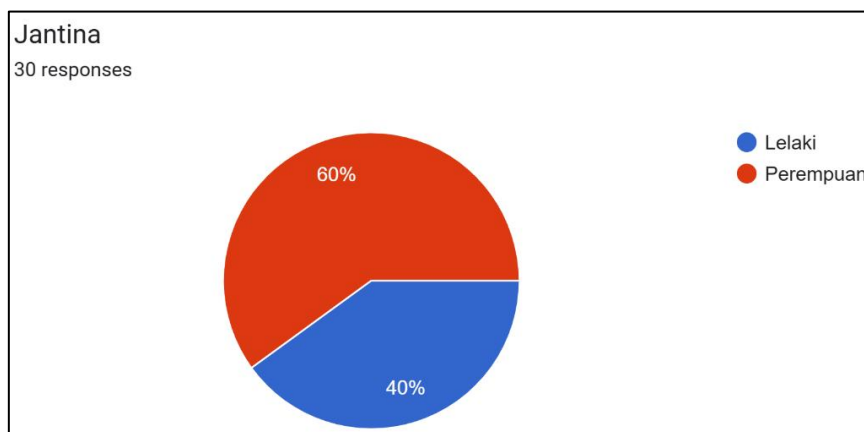


*Figure 14: Pie Chart of Respondents' Age Group*

The gender distribution of the survey participants is depicted in the Figure 15. Among the 30 respondents:

- Female: Represent 60% of the respondents, indicating that a majority of the target users are women. This suggests that the app's design and content should consider female perspectives, particularly in addressing their specific literacy challenges and preferences.
- Male: Account for the remaining 40%, highlighting a smaller yet significant male user base.

The higher proportion of female respondents reflects their potential interest or need for the application, likely driven by their role in family education or community settings. Gender considerations in content presentation and cultural relevance could enhance the application appeal and usability.

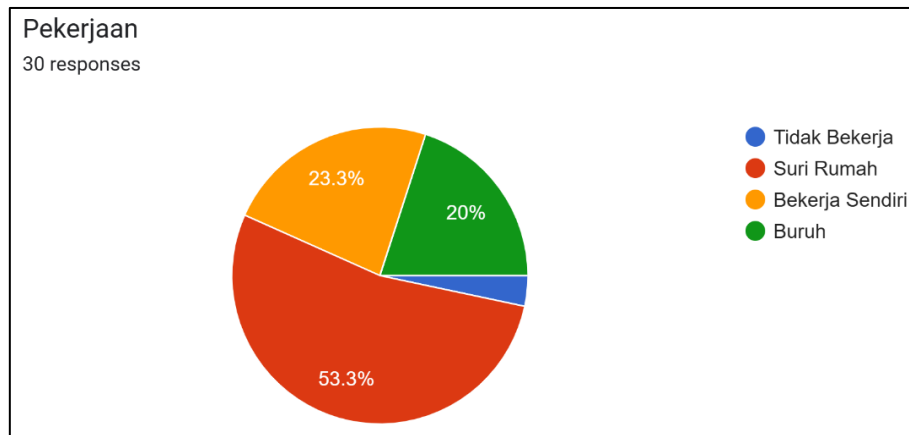


*Figure 15: Pie Chart of Respondents' Gender*

The occupation distribution of the survey participants is shown in Figure 16. Among the 30 respondents:

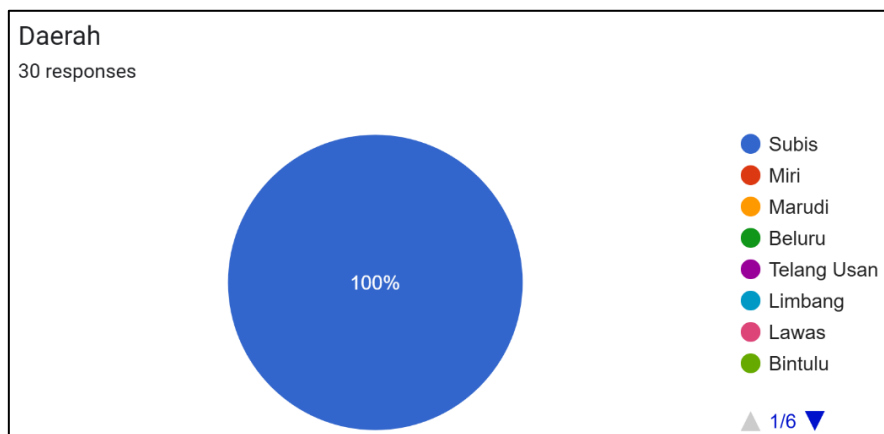
- Housewife 53.3% dominate the respondent group, suggesting that the app should cater to those who may have limited mobility and education time at home.
- Self-employed (23.3%) and Labourers (20%) imply users may have demanding schedules, necessitating quick, flexible literacy lessons.

- Not working (3.3%) indicates potential opportunities for more engagement with users who have more available time.



*Figure 16: Pie Chart of Respondents' Occupation*

Figure 17 displays the survey respondents' location. Since all responders (100%) are from the Subis district, it is imperative that the app be customized to fit the unique linguistic and cultural context of this region.



*Figure 17: Pie Chart of Respondents' Location*

The primary language spoken by the survey participants is shown in Figure 18. All respondents primarily speak the Iban language, highlighting the importance of incorporating Iban language support and culturally relevant content in the app to enhance user engagement and effectiveness.



Figure 18: Pie Chart of Respondents' Primary Language Spoken

The highest education of the survey participants is shown in Figure 19. The education levels of respondents show that 43.3% have no formal education, 46.7% have completed UPSR, 3.3% have PMR/PT3, and 6.7% have SPM. This indicates a need for the app to provide basic literacy support and cater to users with varying educational backgrounds.

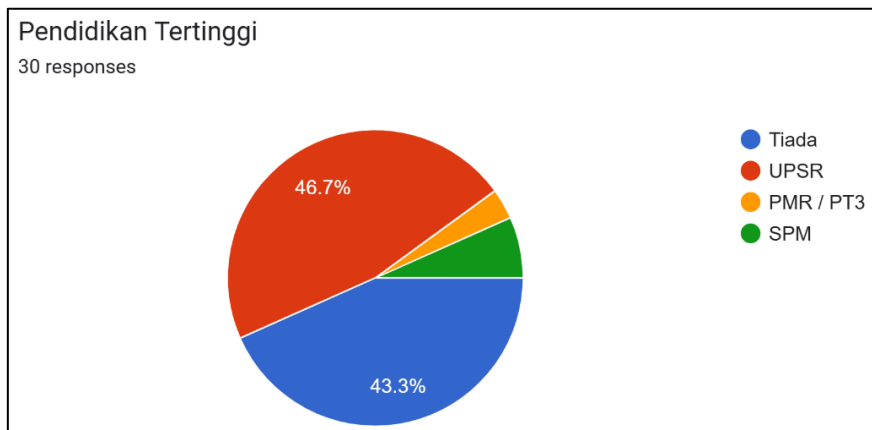
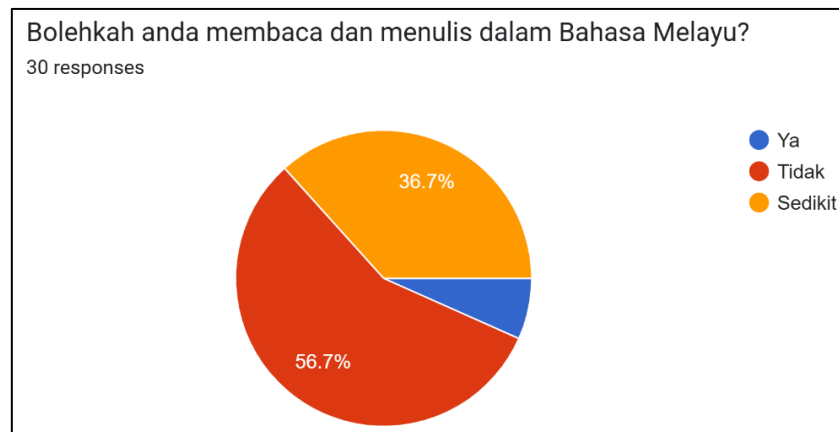


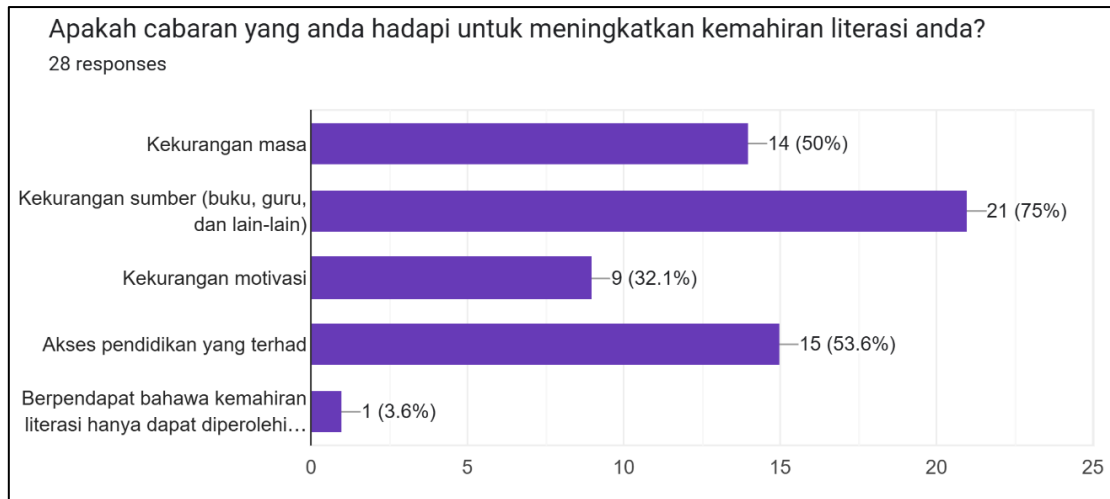
Figure 19: Pie Chart of Respondents' Highest Education

Figure 20 below displays the survey respondents' Malay literacy level. 56.7% of respondents are unable to read and write in Malay, 36.7% have limited skills, and only 6.7% can. This emphasizes how important it is that the app provide thorough Malay literacy instruction at all skill levels.



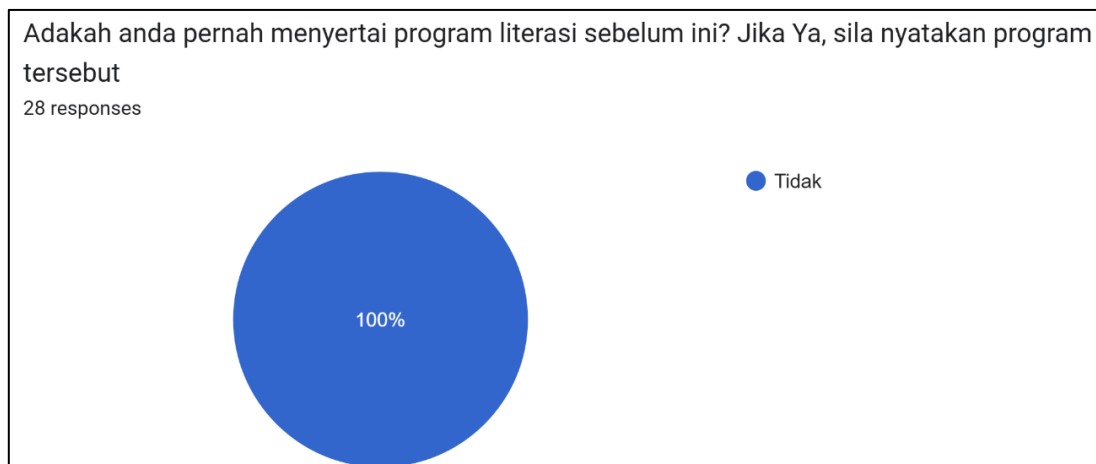
*Figure 20: Pie Chart of Respondents' Malay Literacy*

Figure 21 illustrates the difficulties survey respondents had in enhancing their literacy. The main challenges faced by respondents include a lack of resources (75%), limited access to education (53.6%), lack of time (50%), and lack of motivation (32.1%). Addressing these challenges through the app's features, such as providing offline resources, flexible learning schedules, and motivational elements, will be crucial.



*Figure 21: Bar Chart of Respondents' Challenges in Improving Literacy*

Figure 22 shows the respondents' involvement in educational programs. Among the 30 respondents: None of the respondents have participated in literacy programs before, indicating a significant gap that the app can fill by providing accessible and engaging literacy education.



*Figure 22: Pie Chart of Respondents' Participation in Literacy Program*

Figure 23 reveals the survey respondents' smartphone ownership. All respondents own a smartphone, which is a positive indicator for the app's potential reach and usability, as it can leverage the widespread availability of smartphones among the target users.

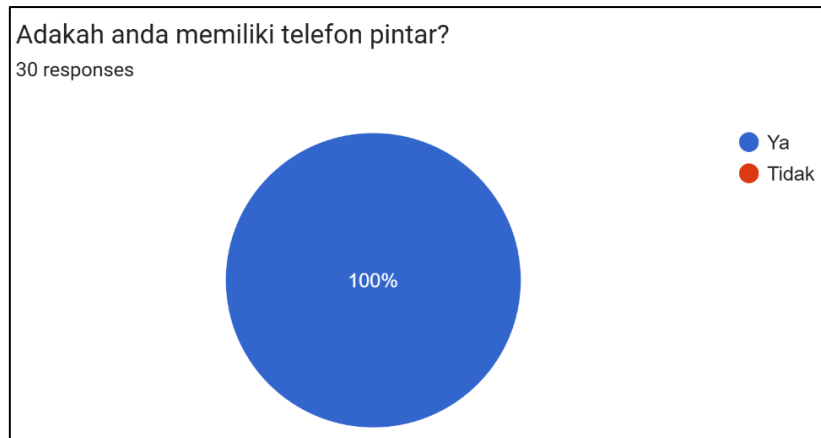


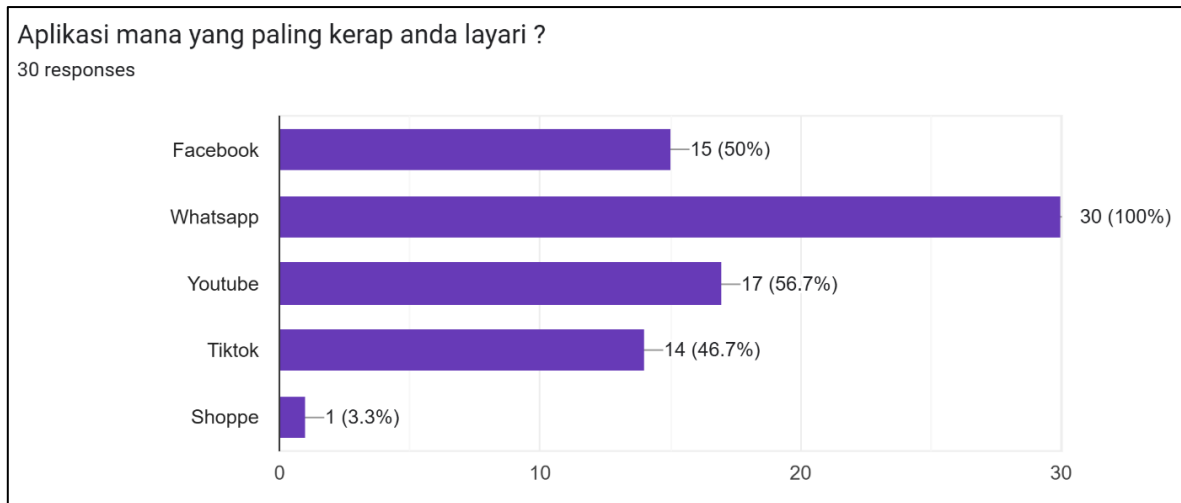
Figure 23: Pie Chart of Respondents' Smartphone Ownership

Figure 24 highlights the survey respondents' smartphone usage frequency. Among the 30 respondents, 63.3% of respondents use their smartphones daily, 30% occasionally, and 6.7% rarely. This suggests that the app should be designed for frequent use, with features that encourage daily engagement.



Figure 24: Pie Chart of Respondents' Frequency of Smartphone Usage

Figure 25 displays the survey respondents' level of familiarity with mobile applications. The most used apps among respondents are WhatsApp (100%), YouTube (56.7%), Facebook (50%), and TikTok (46.7%). This indicates that the app should incorporate familiar elements and user interfaces from these popular apps to enhance user comfort and adoption.



*Figure 25: Bar Chart of Respondents' Familiarity with Mobile Apps*

The experience of the survey participants with educational applications is shown in Figure 26. None of the respondents have experience using educational apps or websites, highlighting the need for the app to provide an intuitive and user-friendly introduction to digital literacy tools.



*Figure 26: Pie Chart of Respondents' Experience with Educational Apps*

The preferred learning methods of the survey participants is shown in Figure 27. Respondents prefer watching videos (93.3%), interactive exercises (80%), reading and writing practice

(80%), and listening to audio lessons (76.7%). The app should incorporate these preferred learning methods to maximize engagement and effectiveness.

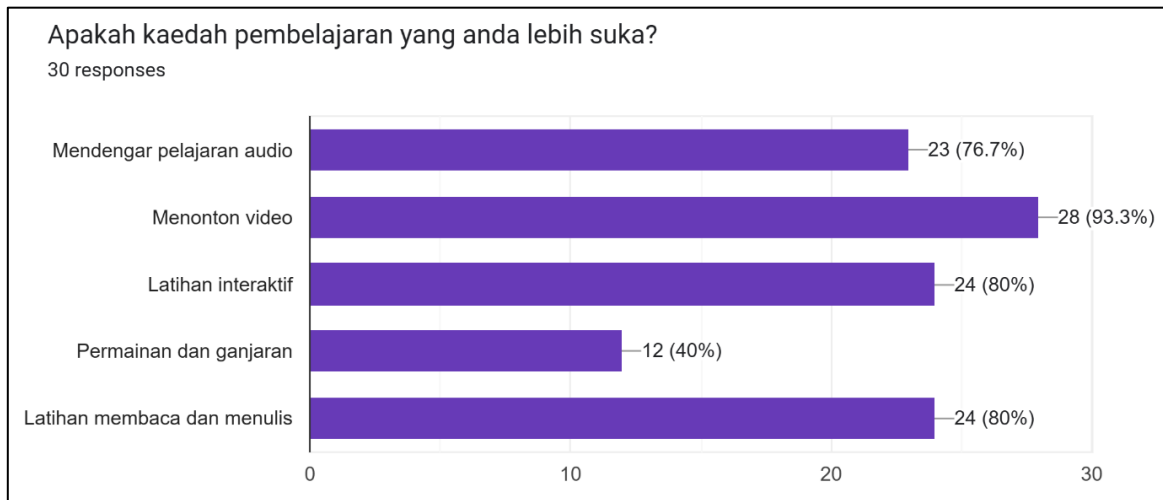


Figure 27: Bar Chart of Respondents' Preferred Learning Methods

Most respondents are motivated by self-motivation (90%), family (70%), and community leaders (33.3%). The app should leverage these sources of encouragement by including features that support self-motivation, family involvement, and community engagement.

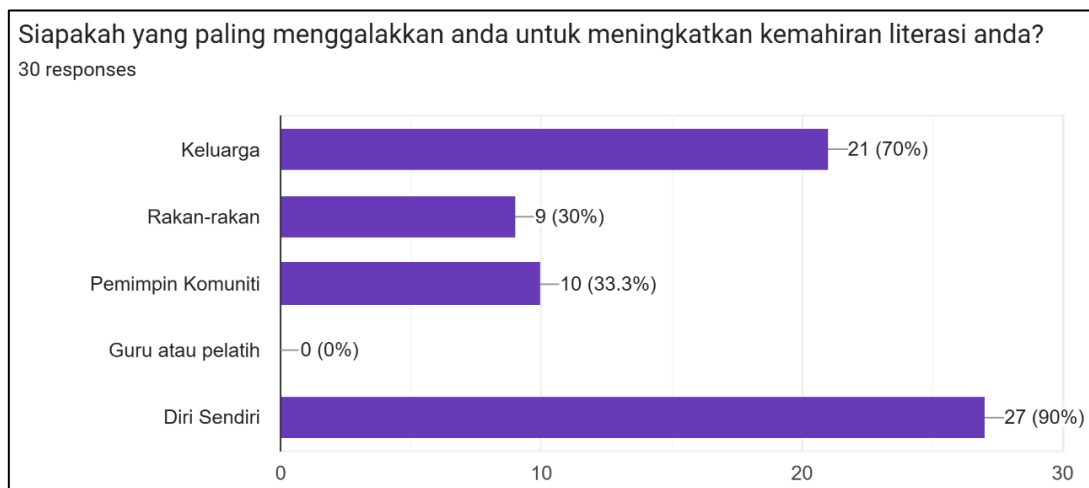


Figure 28: Bar Chart of Respondents' Encouragement Sources

The motivational factors of the survey participants are shown in Figure 29. Respondents are motivated by clear results (83.3%), fun content (80%), rewards (50%), and family support (50%). Incorporating these motivational factors into the app's design, such as progress tracking, gamified content, rewards, and family support features, will enhance user motivation and retention.

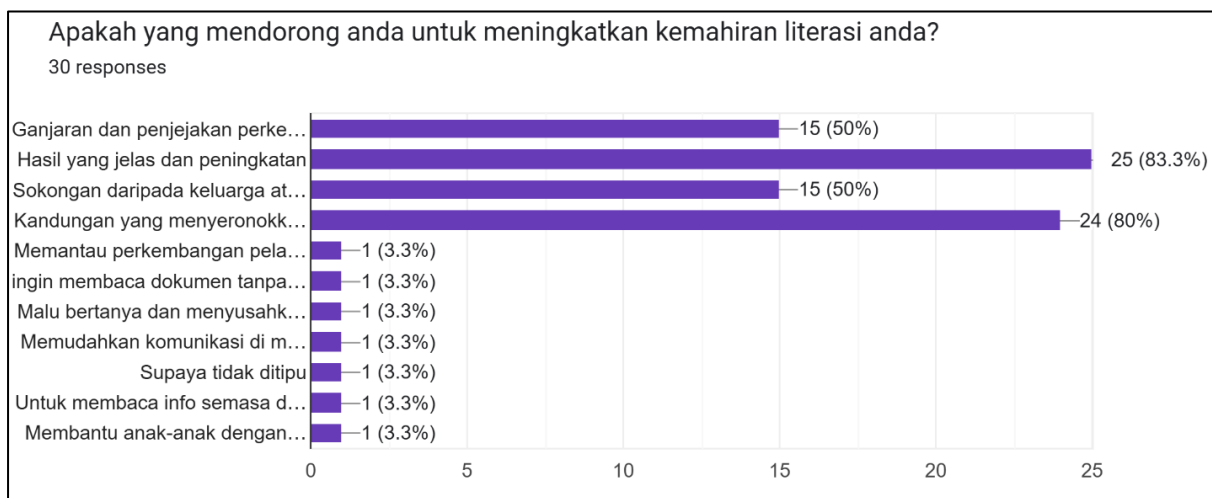


Figure 29: Bar Chart of Respondents' Motivational Factors

The preferred application interface of the survey participants is shown in Figure 30. 70% of respondents prefer a combination of text and icons, while 30% prefer simple icon-based interfaces. The app should offer a balanced interface that combines text and icons to cater to user preferences.



Figure 30: Pie Chart of Respondents' Preferred App Interface

The navigation preference of the survey participants is shown in Figure 31. Most respondents (76.7%) prefer tapping on icons for navigation. The app should prioritize icon-based navigation to ensure ease of use and accessibility.



Figure 31: Pie Chart of Respondents' Navigation Preference

The language preference of the survey participants is shown in Figure 32. 70% of respondents prefer audio instructions in Malay, while 23.3% prefer Malay text. The app should provide audio instructions in Malay to cater to the majority preference and support users with limited reading skills.

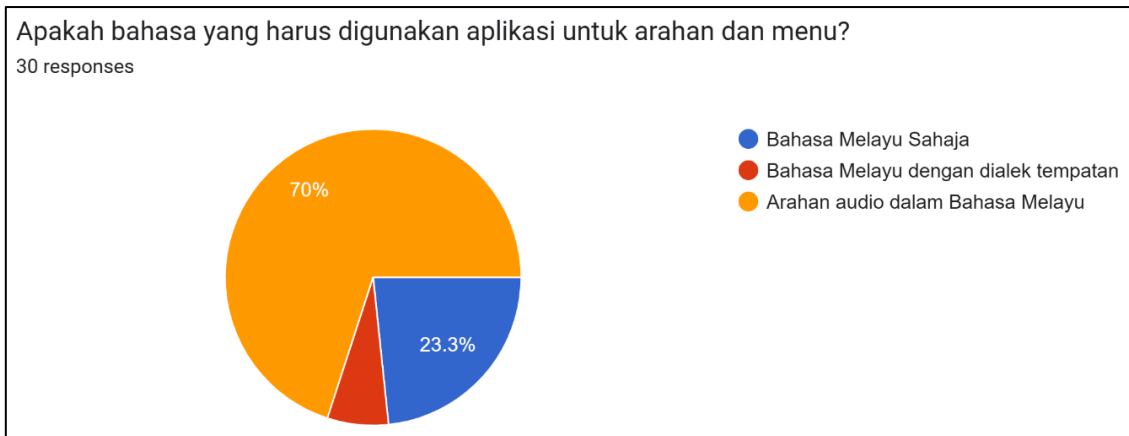


Figure 32: Pie Chart of Respondents' Language Preference

The visual style preference of the survey participants is shown in Figure 33. 70% of respondents prefer a simple and clean visual design, 20% prefer bright and colorful styles, and 10% prefer traditional themes. The app should adopt a simple and clean visual design to appeal to the majority of users.



Figure 33: Pie Chart of Respondents' Visual Style Preference

The importance of voice guidance for the survey participants is shown in Figure 34. 83.3% of respondents rate voice guidance as very important, with a score of 5 out of 5. The app should include comprehensive voice guidance to support users in navigating and using the app effectively.

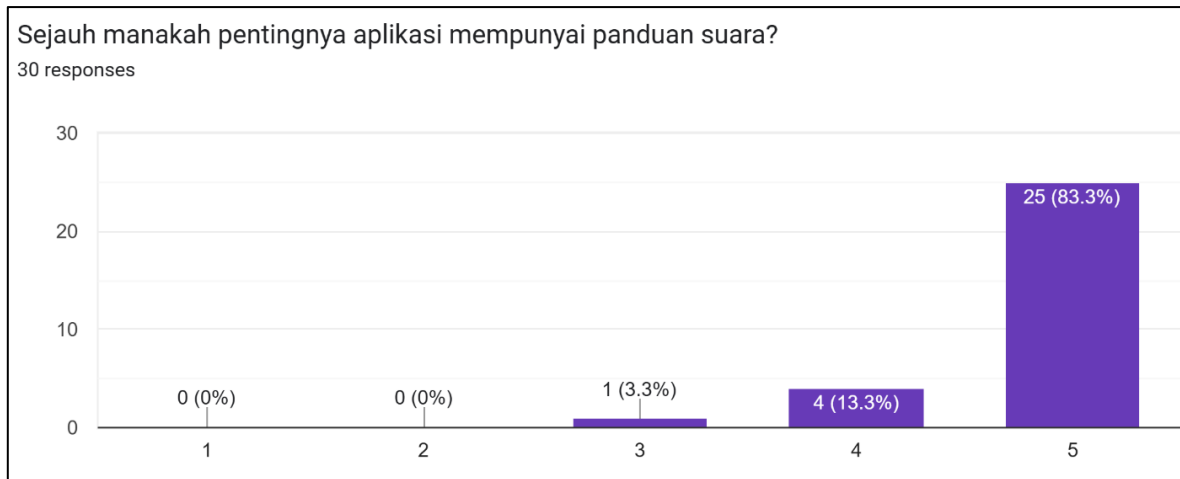


Figure 34: Bar Chart of Importance of Voice Guidance for Respondents

### 3.2.2 System Requirements

The project relies on several essential software tools to ensure efficient development and functionality.

#### 3.2.2.1 Hardware Requirement

The hardware requirement that are suitable for this proposed platform and its development journey are as stated below in Table 8. The laptop is required to install and access all the required software to develop the project.

Table 8: Device Specification and Description

Device Specification	Description
Processor	11th Gen Intel(R) Core (TM) i5-11400H @ 2.70GHz 2.69 GHz
Installed RAM	8GB DDR4
Storage	512 SSD
Operating System	64-Bit operating system, x64-based processor

Windows Version	Windows 11 Home Single Language
Graphic Card	GeForce RTX 2050

### 3.2.2.2 Software Requirement

Software requirements are also important to ensure complete execution of the project. The software requirements for the proposed online learning platform are stated below in Table 9.

*Table 9: Software and Description*

Software	Description
Figma	For prototyping and interface design.
Android Studio	The primary IDE for developing, testing, and debugging the app.
Flutter	Framework for app development.
Firebase	To store the data.

### 3.2.3 Functional Requirements

The proposed application must meet several functional requirements to ensure it effectively serves its intended purpose. Below is the list of functional requirements of this proposed application:

- i. Users must be able to access phonics-based lessons in Malay.
- ii. The app should provide speech recognition feedback for pronunciation practice.
- iii. Gamified features, such as quizzes, progress tracking, and rewards, must be integrated.
- iv. Offline access must allow users to access lessons and use them without internet connectivity.
- v. The app should support user registration and login for personalized progress tracking.

### **3.2.4 Non- Functional Requirements**

The application must also adhere to several non-functional requirements to ensure a positive user experience and reliable performance. Below is the list of non-functional requirements of this proposed application:

- i. The app must have a user-friendly interface with clear icons and local imagery.
- ii. It should function on low-end Android devices to ensure accessibility.
- iii. The system must maintain data privacy and security for user information.
- iv. The app should support offline functionality with minimal storage requirements.

### **3.2.5 Accessibility Features**

To address the diverse needs of users, the following accessibility features are included:

- i. **Font Size and Readability:** Adjustable font sizes and high-contrast themes for users with vision impairments.
- ii. **Voice Guidance:** Audio navigation to assist users with low digital literacy.
- iii. **Simplified Navigation:** Minimalistic interface to reduce cognitive load.

### **3.2.6 Culture Considerations**

Cultural considerations are integral to the app's design and functionality.

- i. Including culturally relevant imagery and examples.
- ii. Ensuring feedback from the community leaders to enhance culture appropriateness.

## **3.3 System Design**

This section provides a detailed explanation of the BacaSama system's design, including its architectural components and various UML diagrams that represent system behaviour and interactions.

### **3.3.1 Overview**

The BacaSama system design incorporates modular architecture, ensuring scalability and maintainability. The primary components include:

- i. Frontend Module: Developed using Flutter for dynamic, interactive user interfaces.
- ii. Backend Module: Powered by Firebase, managing authentication, user data, and lesson content.
- iii. Speech Recognition API: Integrated for phonics feedback and pronunciation assessment.
- iv. Gamification Engine: Tracks progress, generates rewards, and enhances user engagement.

### **3.3.2 Use Case Diagram**

The Use Case Diagram visually represents the interactions between the user and various system functionalities. It includes the primary user actions and their dependencies.

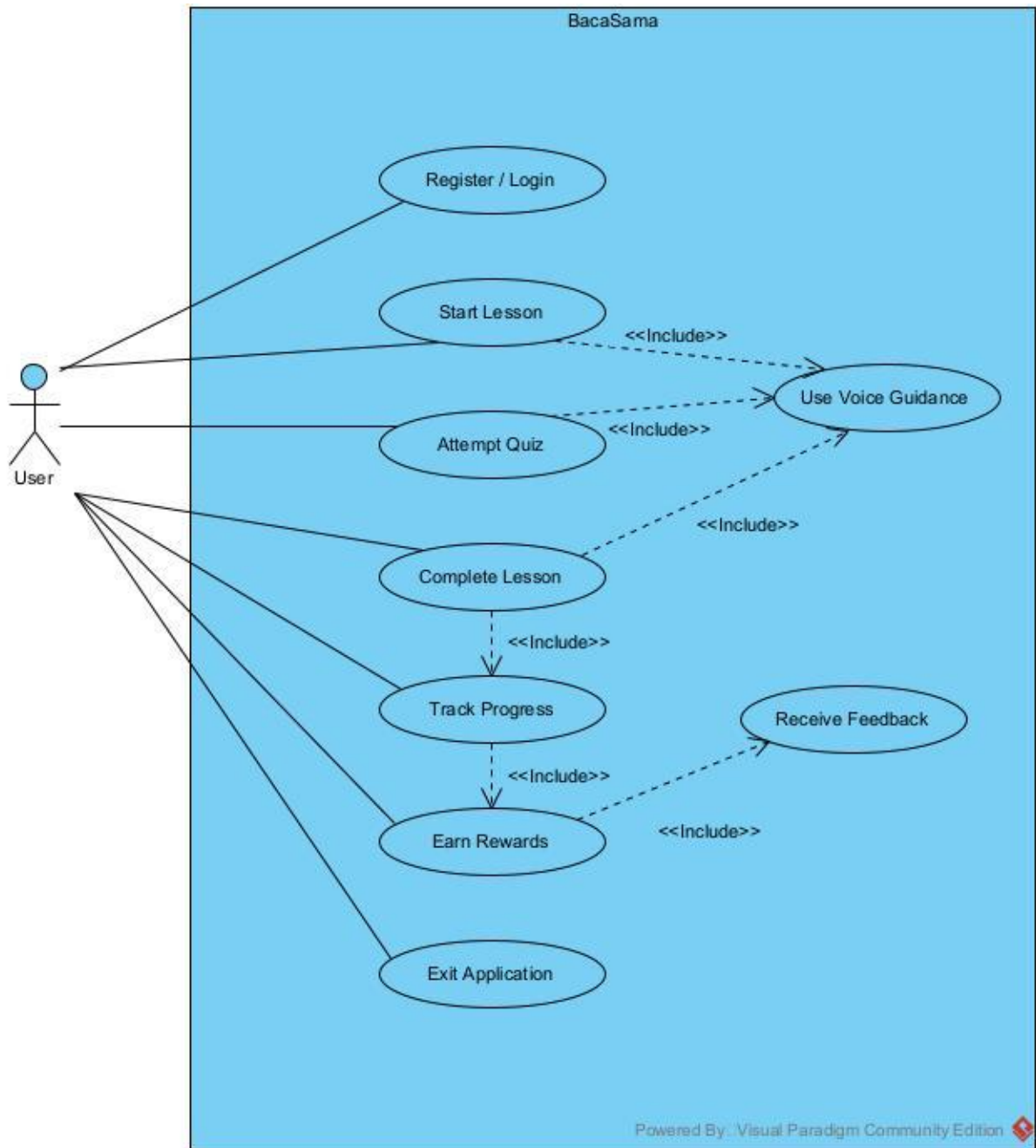


Figure 35: Use Case Diagram for BacaSama

Figure 35 above shows the Use Case Diagram for BacaSama illustrates how a User interacts with the system's various functionalities. The user can perform actions such as Register/Login, Start Lesson, Attempt Quiz, Complete Lesson, Track Progress, Earn Rewards, and Exit Application. Some of these actions include additional functionalities through the "<<include>>" relationships. For instance, both "Start Lesson" and "Attempt Quiz" include

"Use Voice Guidance", which suggests that voice assistance is available during these activities. Similarly, "Complete Lesson" leads to "Track Progress", which then connects to "Earn Rewards" if progress milestones are achieved. Additionally, "Track Progress" includes "Receive Feedback", ensuring users receive necessary learning insights. The diagram effectively showcases the structured interaction between the user and the system, emphasizing voice support, feedback, and gamification elements.

### 3.3.3 Use Case Description

Below are the detailed use case specifications for the BacaSama application. Each table provides a breakdown of the use case ID, description, actor, preconditions, postconditions, main flow, alternative flows, and any relationships such as Include or Extend.

*Table 10: Use Case Description for Register/Login*

Use Case ID	1
Use Case	Register/Login
Description	User registers a new account or logs into an existing one.
Actor	User
Precondition	User has the app installed.
Postcondition	User is authenticated and directed to the dashboard.
Main Flow	<ol style="list-style-type: none"> <li>1. User opens the app.</li> <li>2. User selects "Register" or "Login."</li> <li>3. If registering, enters details (email, password).</li> <li>4. If logging in, enters existing credentials.</li> <li>5. System authenticates and redirects to Home Screen.</li> </ol>

Alternative Flow	If authentication fails, the system prompts users to re-enter credentials or reset password.
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*Table 11: Use Case Description for Starting a Lesson*

Use Case ID	2
Use Case	Start Lesson
Description	The user selects and begins a lesson, and the system automatically stores it for offline access.
Actor	User
Precondition	User is logged in.
Postcondition	Lesson content is displayed.
Main Flow	<ol style="list-style-type: none"> <li>1. User selects a lesson.</li> <li>2. System loads lesson content.</li> <li>3. System automatically saves the lesson for offline use.</li> </ol>
Include	Use Voice Guidance – System reads instructions aloud for users.
Alternative Flow	If the lesson was previously cached, it loads from offline storage instead of the internet.

*Table 12: Use Case Description for Completing a Lesson*

Use Case ID	3
Use Case	Complete Lesson
Description	Users progress through lesson content.
Actor	User

Precondition	User has selected a lesson.
Postcondition	Lesson completion is recorded in progress tracking.
Main Flow	<ol style="list-style-type: none"> <li>1. User reads/listens to lesson materials.</li> <li>2. Completes interactive exercises.</li> <li>3. System marks lesson as completed.</li> </ol>
Include	<p>Use Voice Guidance – Assists user in navigating lesson content.</p> <p>Track Progress – Updates user's learning record.</p>

*Table 13: Use Case Description for Attempting Quiz*

Use Case ID	4
Use Case	Attempt Quiz
Description	Users answer quiz questions at the end of each lesson.
Actor	User
Precondition	User has completed a lesson.
Postcondition	Quiz results are recorded, and feedback is given.
Main Flow	<ol style="list-style-type: none"> <li>1. User selects quiz after lesson.</li> <li>2. Answers multiple-choice or interactive questions.</li> <li>3. System records responses and evaluates performance.</li> </ol>
Extend	Receive Feedback – Provides corrections if wrong answers are given.
Alternative Flow	If the quiz fails, the system suggests retrying the lesson.

*Table 14: Use Case Description for Receiving Feedback*

Use Case ID	5
Use Case	Receive Feedback
Description	The system provides feedback on quiz performance.
Actor	System
Precondition	User has attempted a quiz.
Postcondition	User understands their mistakes and can improve.
Main Flow	<ol style="list-style-type: none"> <li>1. System evaluates quiz answers.</li> <li>2. Provides explanations for incorrect answers.</li> <li>3. Displays the final score.</li> </ol>
Include	Use Voice Guidance – Reads out the correct answers and explanations.

*Table 15: Use Case Description for Tracking Progress*

Use Case ID	6
Use Case	Track Progress
Description	User can view completed lessons and scores.
Actor	User
Precondition	User has completed at least one lesson or quiz.
Postcondition	Progress is saved for future reference.
Main Flow	<ol style="list-style-type: none"> <li>1. User navigates to "Progress" section.</li> <li>2. System displays completed lessons and quiz scores.</li> <li>3. User can see achievements and next steps.</li> </ol>
Include	Earn Rewards – If milestones are reached.

*Table 16: Use Case Description for Earning Rewards*

Use Case ID	7
Use Case	Earn Rewards
Description	User unlocks badges as they progress.
Actor	System
Precondition	User has completed specific milestones.
Postcondition	Motivation is increased through gamification.
Main Flow	<ol style="list-style-type: none"> <li>1. System tracks milestones (e.g., completing 5 lessons).</li> <li>2. User unlocks achievements (badges, stars).</li> <li>3. Rewards are displayed in the Progress section.</li> </ol>
Extend	Track Progress – Links to user's learning record.

*Table 17: Use Case Description for Using Voice Guidance*

Use Case ID	8
Use Case	Use Voice Guidance
Description	Provides spoken instructions for illiterate users.
Actor	System
Precondition	User is navigating the app.
Postcondition	User can interact with the app without reading text.
Main Flow	<ol style="list-style-type: none"> <li>1. System detects user actions (e.g., selecting a button).</li> <li>2. Reads out instructions or lesson content.</li> <li>3. Assists user in completing tasks.</li> </ol>

Include	Start Lesson, Complete Lesson, Receive Feedback – Voice guidance is available in all learning stages.
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*Table 18: Use Case Description for Exiting Application*

Use Case ID	9
Use Case	Exit Application
Description	User logs out or closes the app.
Actor	User
Precondition	User is logged in.
Postcondition	Session ends.
Main Flow	<ol style="list-style-type: none"> <li>1. User selects "Log Out" or closes the app.</li> <li>2. System saves progress.</li> <li>3. User exits safely.</li> </ol>
Alternative Flow	If progress is unsaved, the system prompts user to sync data.

### **3.3.3 Sequence Diagram**

The Sequence Diagram illustrates the step-by-step interactions between system components for various user actions.

#### **3.3.3.1 User Registration / Login**

Figure 36 depicts the authentication activity for the users.

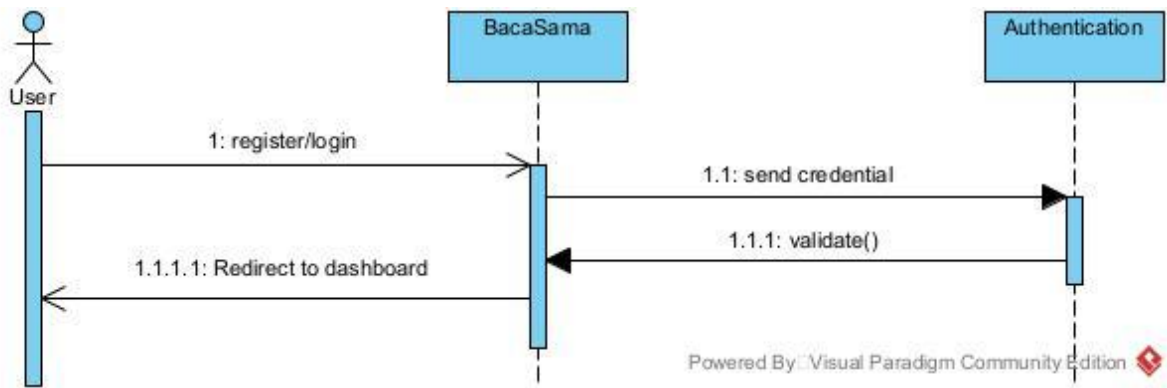


Figure 36: Sequence Diagram for User Registration/ Login

### 3.3.3.2 Start Lesson & Complete Lesson

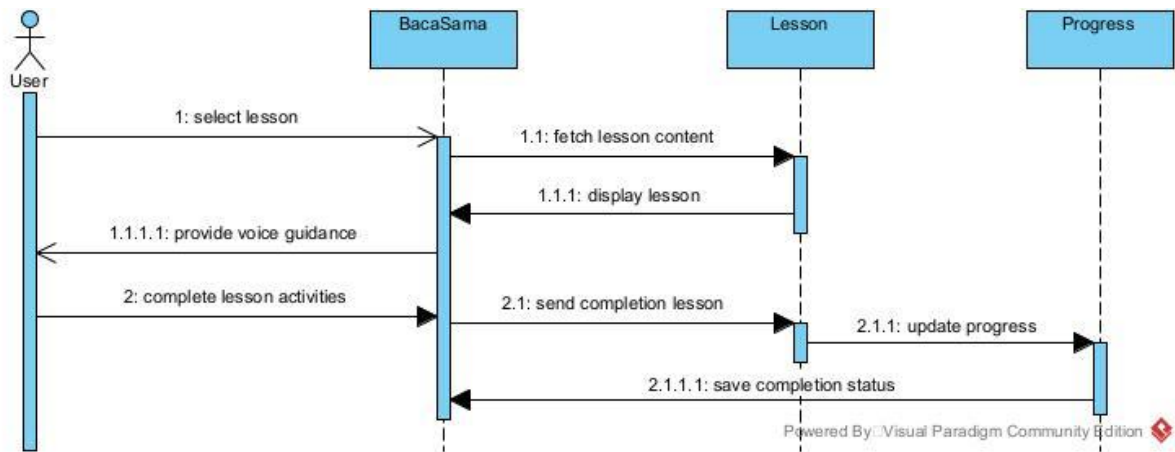


Figure 37: Sequence Diagram for Starting and Completing Lesson

### 3.3.3.3 Attempt Quiz & Receive Feedback

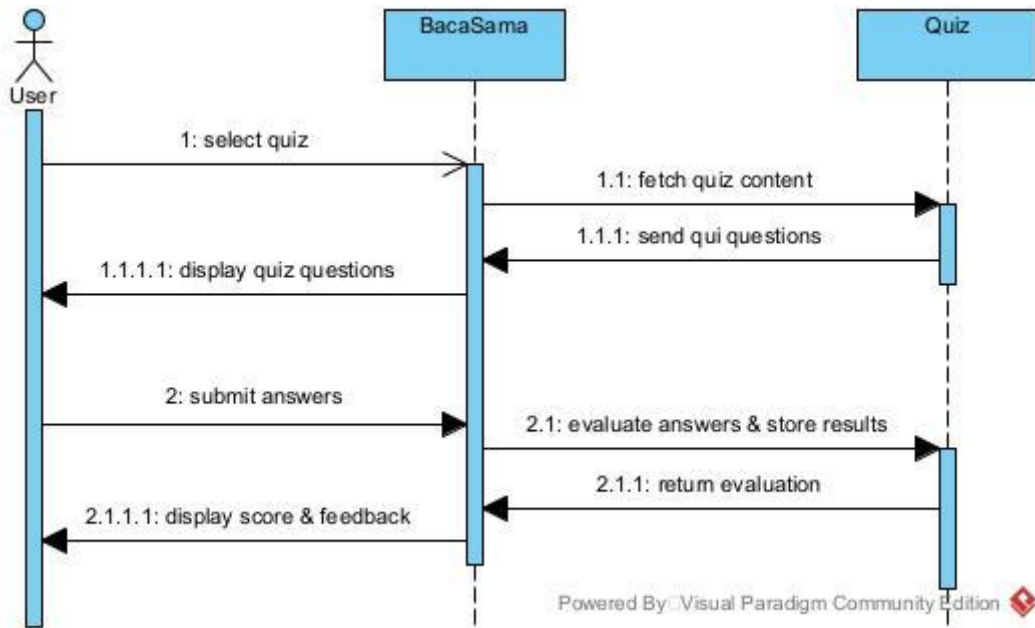


Figure 38: Sequence Diagram for Attempting Quiz and Receiving Feedback

### 3.3.3.1 View Progress and Earn Reward

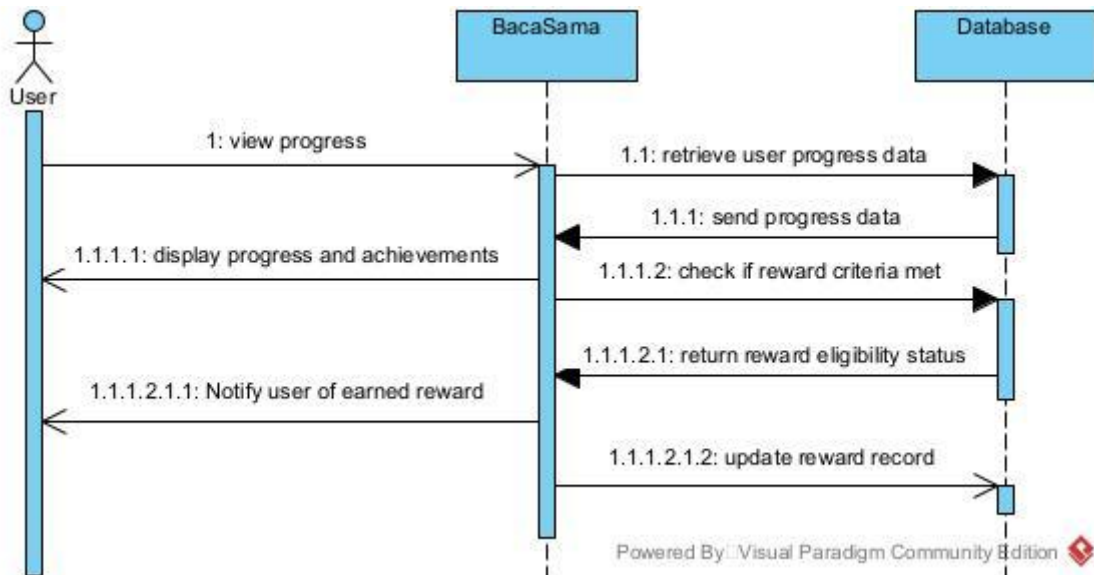


Figure 39: Sequence Diagram for Viewing Progress and Earning Reward

### 3.3.4 Class Diagram

The Class Diagram in Figure 40 represents a learning system where users can access lessons, attempt quizzes, track their progress, and earn rewards. Each User has a unique profile with details like name, email, and literacy level. They can start lessons, which contain educational content and quizzes to test their knowledge. After attempting a Quiz, users receive scores and feedback. Their learning journey is tracked through the Progress class, which records completed lessons, quiz scores, and achievements. To keep users motivated, the system grants Rewards based on their progress. This structured approach helps users improve their literacy skills while keeping them engaged with interactive learning experiences.

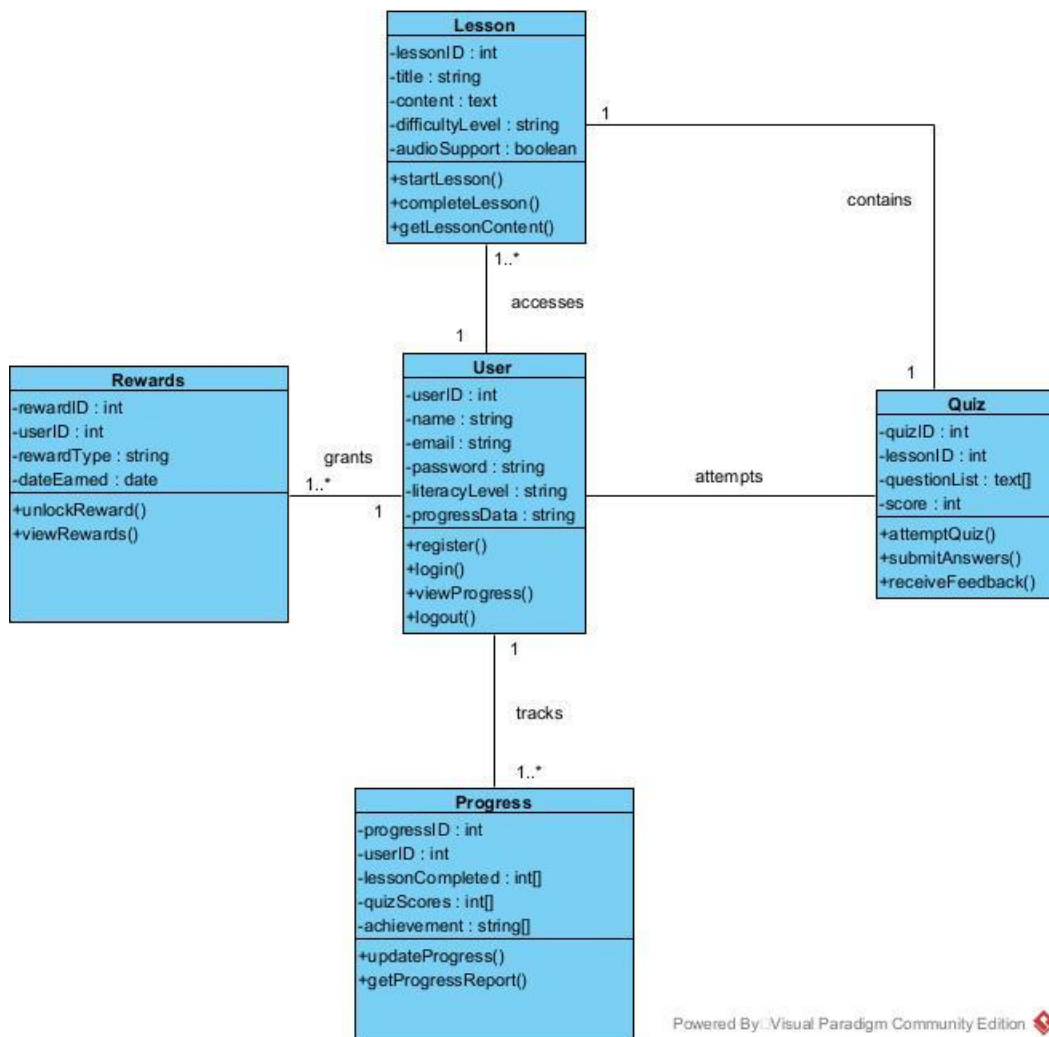


Figure 40: Class Diagram for BacaSama

### 3.3.5 State Diagram

The state diagram in Figure 41 illustrates the various states a user can experience while interacting with BacaSama, an educational application designed to facilitate learning through structured lessons. The process begins with the user registering or logging in. Upon a successful login, the user is directed to the Dashboard, where they can choose a lesson. Once a lesson is selected, the user enters the Lesson-In state, where they can navigate through the content, track their progress, and submit answers to quizzes. After completing a lesson, the user can either continue learning or finish the lesson, which may result in earning rewards or unlocking achievements. The user can also view their scores and receive feedback. The interaction concludes when the user logs out or exits the application.

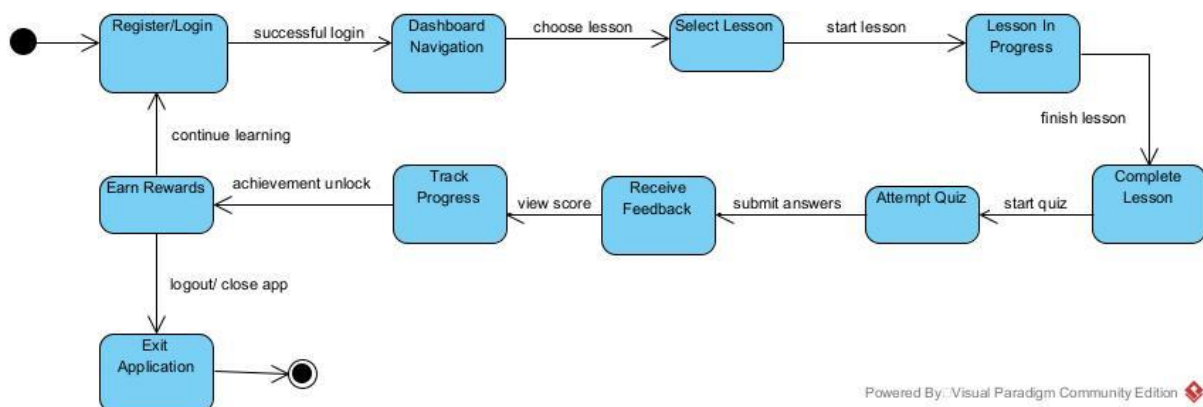


Figure 41: State Diagram for BacaSama

### 3.3.6 Component Diagram

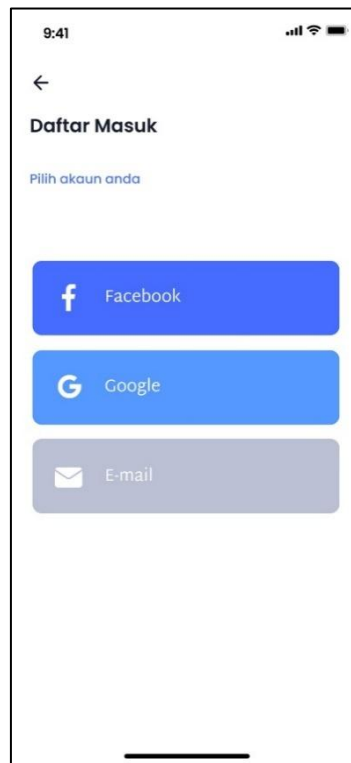
The Component Diagram depicts the high-level system architecture and how different modules interact which can be refer in Appendix D.

### 3.3.7 Interface Design

This section provides mockups and descriptions of key app screens, including:

- i. Login/Registration Screen:

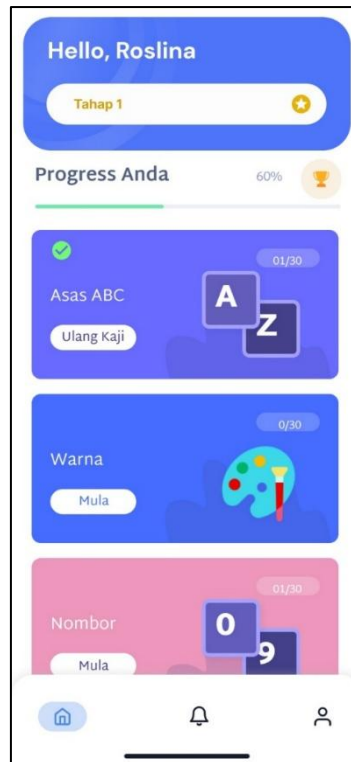
Figure 42 below shows the Login/Registration Screen, which offers users three options to sign in: Facebook, Google, or email. The interface is user-friendly and straightforward, with clear instructions to guide users through the process. This screen ensures a smooth and quick login experience, allowing users to access the app effortlessly.



*Figure 42: Login Screen for BacaSama*

ii. Home Screen:

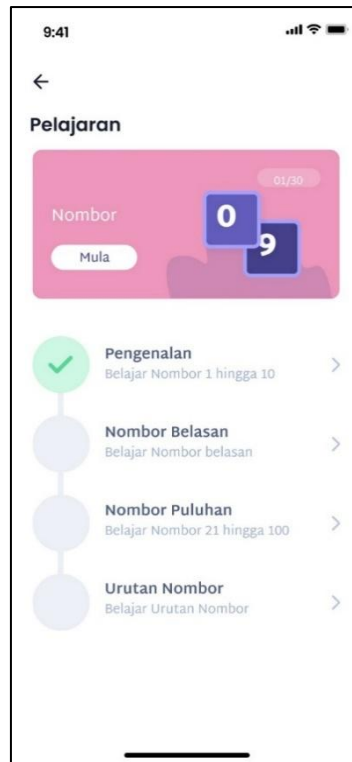
The Dashboard as shown in Figure 43 displays the user's lessons, progress, and achievements. It provides an overview of the user's learning journey, highlighting completed lessons, ongoing activities, and achievements. This screen helps users stay motivated and track their progress effectively.



*Figure 43: Home Screen for BacaSama*

iii. Lesson Preview Screen:

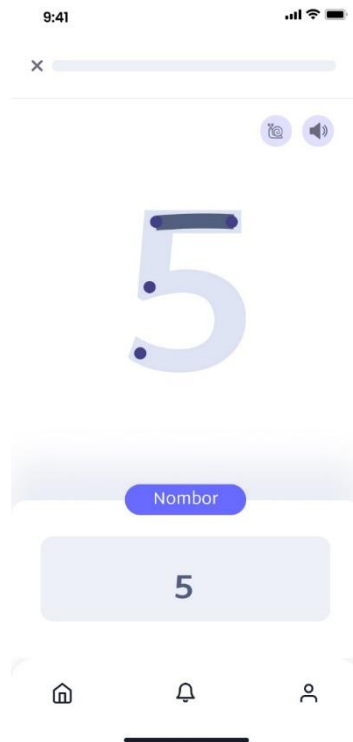
The Lesson Preview Screen, shown in Figure 44 below, provides a sneak peek into the upcoming lessons. It gives users an overview of the content they will be learning, helping them prepare for the lessons ahead. This screen is designed to build anticipation and keep users engaged with the learning material.



*Figure 44: Lesson Preview Screen for BacaSama*

iv. Lesson Screen:

Figure 45 illustrates the Lesson Screen features, which incorporate an interactive design featuring phonics exercises and speech recognition. It engages users with interactive activities that enhance their learning experience. The screen is designed to be intuitive and user-friendly, allowing users to easily navigate through exercises and practice their phonics skills.



*Figure 45: Lesson with Exercise for BacaSama*

### **3.3.8 Technical Architecture**

The application architecture includes:

- i. Cloud Infrastructure: Firebase for hosting user data and real-time updates.
- ii. APIs: Integration of third-party APIs for speech recognition and gamification
- iii. Scalability Considerations: Ensuring the app handles increased user load efficiently.

### **3.3.9 Security Features**

To protect user data:

- i. Authentication Mechanisms: Firebase ensures secure login and data access.
- ii. Data Encryption: User data is encrypted during transmission and storage.
- iii. Privacy Compliance: The app complies with data protection laws

### **3.4 Summary**

This chapter detailed the requirements analysis and design for the BacaSama literacy application. Through a systematic approach to gathering requirements and a detailed system design, the proposed application is expected to address literacy challenges among adults in rural Sarawak. By integrating phonics-based lessons, speech recognition, and gamification, the app not only aims to improve literacy but also ensures an engaging and accessible user experience.

## **CHAPTER 4: DEVELOPMENT AND IMPLEMENTATION**

### **4.1 Introduction**

This chapter discusses the implementation phase of the BacaSama mobile application, highlighting the overall development environment, tools and frameworks used, installation procedures, and development progress. It presents the step-by-step execution of features aligned with the system design and user requirements gathered earlier. The goal is to demonstrate how the application was built to support literacy learning for illiterate adults in rural Malaysia.

### **4.2 Implementation Overview**

The implementation phase of the BacaSama application focused on transforming the planned design and requirements into a functional mobile literacy learning tool. Developed using Flutter and integrated with Firebase services, the application was built to support key features, including phonics-based lessons, gamified quizzes, a rewards system, voice guidance, and Optical Character Recognition (OCR) for real-world text interaction. The implementation followed the RAD methodology, enabling quick prototyping and iterative feedback throughout the development process. The user interface was designed with simplicity and accessibility in mind, incorporating clear visuals and audio support to assist users with minimal or no literacy. Each module was implemented incrementally, tested individually and integrated into the system for comprehensive evaluation.

### **4.3 Implementations and Development Logs**

The implementation of the BacaSama application was carried out incrementally using the RAD methodology. Each feature was developed and tested individually to ensure proper functionality. As each component was completed, it was immediately tested to identify any

bugs, logic errors, or interface inconsistencies. The development process focused heavily on user accessibility and voice-enabled features to accommodate illiterate users. A development log was maintained throughout the process to document progress, note encountered issues, and record decisions made during development. This log serves as a valuable reference for future improvements and troubleshooting. Once all components were implemented, the application underwent final integration and functional testing to prepare it for user evaluation and deployment.

#### 4.4 Software Installation and Configuration

This section outlines the software tools and configurations used throughout the development of the BacaSama mobile application. The development environment was carefully selected to support cross-platform mobile development with a focus on simplicity, scalability, and offline-first functionality. BacaSama was developed using Flutter, with Android Studio as the main integrated development environment (IDE). Firebase handled backend services such as authentication and cloud data storage, while Figma and Canva were used for designing user interfaces and presentation materials. Additionally, assets like icons, images, and audio were sourced from Freepik.com and Freesound.org to enhance the visual and auditory engagement of the app.

Table 19: List of Resources

Software/ Website	Description
Android Studio	The official IDE for Android development. Used to write, run, and debug the Flutter app. Includes built-in Android emulator for testing.

Flutter SDK	The main framework used to build the cross-platform BacaSama app. Enables one codebase for Android and iOS deployment.
Dart	The programming language used with Flutter to implement logic, navigation, and animations.
Firebase Console	Cloud platform used for user authentication, Firestore database storage, and real-time updates.
Figma	UI/UX design and prototyping tool used to develop mock-ups and wireframes of the app.
Canva	Design tool used for logo.
Freepik.com	Source for royalty-free images, icons, and visual assets used in lesson materials and interface design.
Freesound.org	Provides free and open audio files for voice prompts, phonics, and sound effects.
Google Drive	Used to store courses.json and release.json.
Google ML Kit	Used for AI integrated real-time text detection through computer vision and provide speech feedback.

#### 4.5 Application User Interface (UI)

The UI of BacaSama was designed with accessibility and simplicity in mind to accommodate illiterate adult users in rural areas. The app uses icons, large buttons, audio guidance and minimal text where possible. Each screen was designed in Figma and implemented in Flutter. The flow ensures users can navigate easily from login to lessons, complete interactive exercises, attempt quizzes and track their progress with rewards. Below is an explanation of each screen and how users move through the app. The app launches with the Home Screen (not

login/register), where a unique ID is auto generated and progress is tracked anonymously unless the user registers later.

#### 4.5.1 Register Screen

The Register Screen allows users to create an account to save their learning progress permanently. The form includes minimal fields such as Email and Password. Upon registration, the system will link their unique session ID (created at launch) to the registered account. The screen uses clear visuals and simple buttons to accommodate users with low literacy.

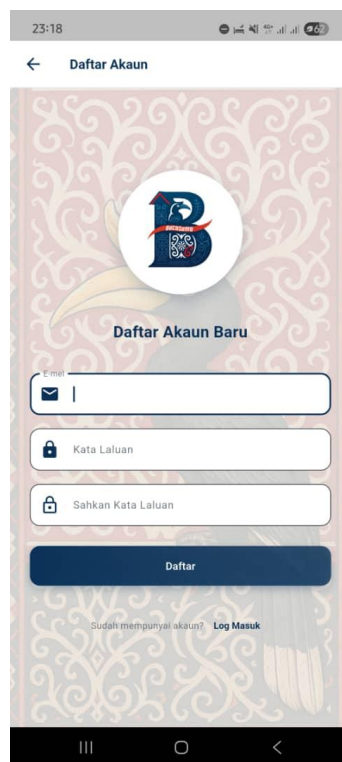
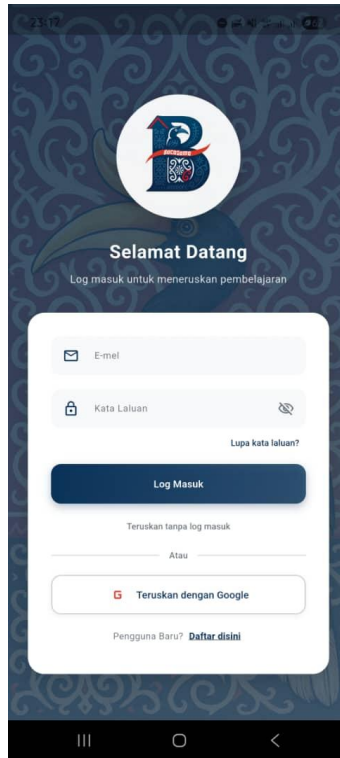


Figure 46: Register Screen

#### 4.5.2 Login Screen

This screen enables returning users to log in using previously created credentials. Once logged in, the app links them back to their earlier progress and rewards. Like the Register Screen, this page uses large buttons and clear icons to ease interaction.



*Figure 47: Login Screen*

### 4.5.3 Home Screen

The Home Screen is the first screen users see upon launching the app. Features include:

- Lesson Cards: Display current available lessons. When clicked, the app reads aloud the lesson title to guide the user.
- Progress Bar: Shows the user's learning journey briefly.
- Navigation Bar:
  - Home – Brings users back to this screen.
  - OCR – Opens a feature where users can take a picture of any printed text for the app to read it aloud.
  - Profile – Shows login/register options and app settings.

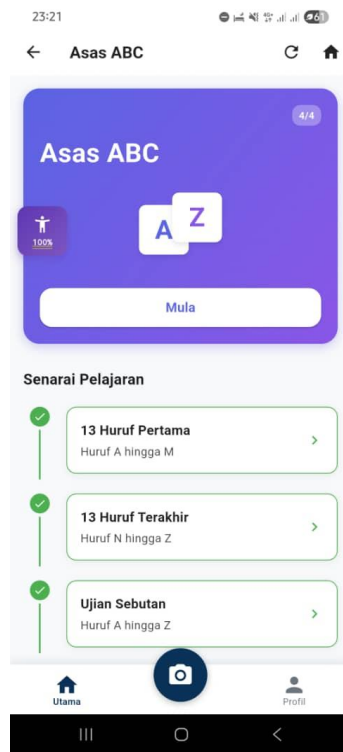
A unique anonymous ID is assigned on first use. If the user registers later, the ID is synced to their account for continued progress tracking.



*Figure 48: Home Screen*

#### **4.5.4 Lesson Preview Screen**

Upon selecting a lesson from the Home Screen, users are taken to the Lesson Preview Screen, which displays the list of sub-lessons in sequence under the chosen topic. Only the first lesson is available by default, while the others will be unlocked sequentially. Each sub-lesson is navigated to lesson page with audio prompt when selected.



*Figure 49: Lesson Preview Screen*

#### **4.5.5 Lesson Screen**

The Lesson Screen is where the core literacy learning takes place. Voice prompt is available on each lesson to guide users through the exercises. This interactive page combines visual, audio and kinesthetics learning to support multi-sensory engagement. It includes:

- i. Phonics Playback: Users hear the correct pronunciation of the letter or word (e.g., “A – Ayam”). Each letter or word is paired with an image.

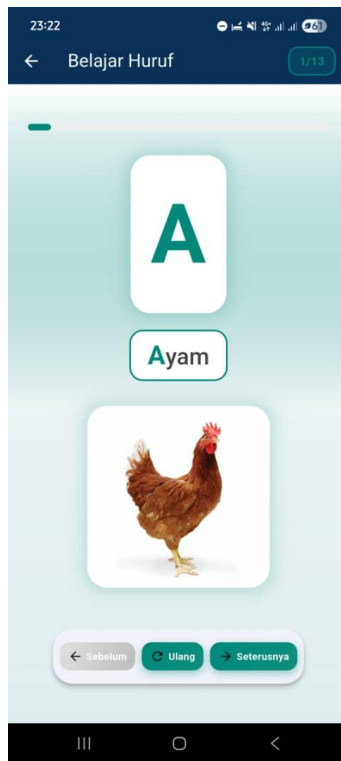


Figure 50: Lesson Screen (Phonics Playback)

- ii. Writing Practice: Users trace letters on the screen with finger gestures.

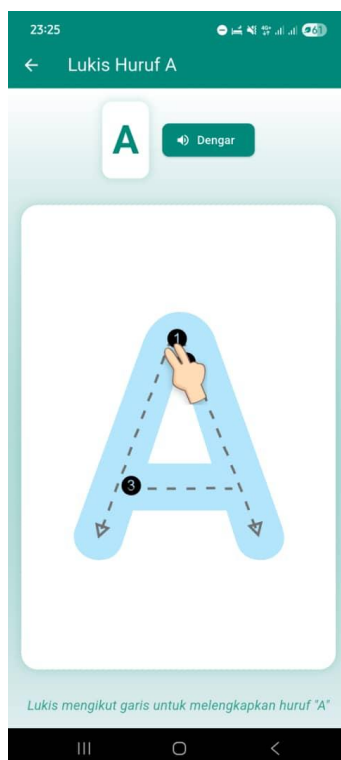


Figure 51: Lesson Screen (Writing Practice)

- iii. Speaking Practice: User click on voice button to try the speaking test.



*Figure 52: Lesson Screen (Speaking Practice)*

#### **4.5.6 Quiz Result Screen**

At the end of every lesson, users need to take a quiz to test their understanding of the lesson. The quiz is combined with each lesson which are randomly chosen from the lesson module. Figure 53 below shows the sample for result of quiz taken by the user. Mark is displayed with all the questions and answers.

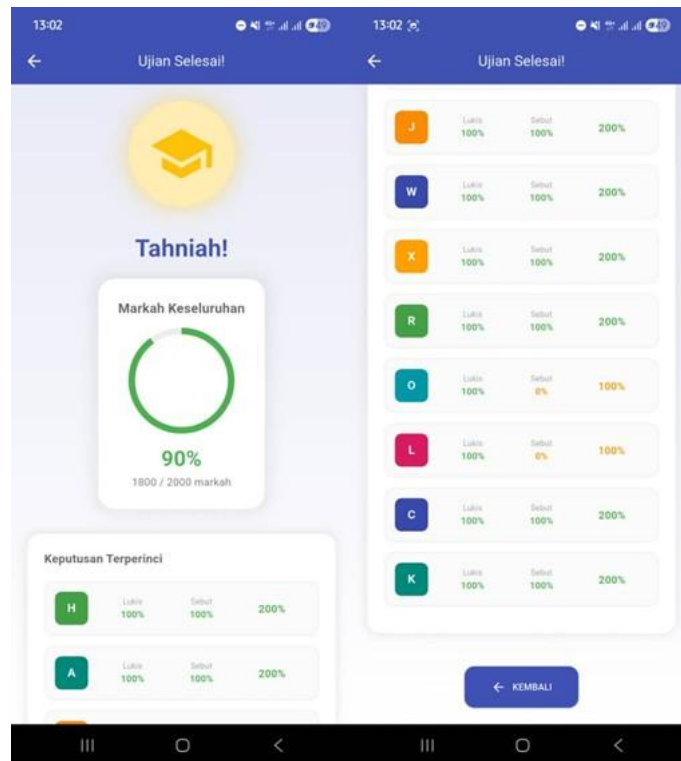


Figure 53: Quiz Result Screen

#### 4.5.7 Progress Screen

The Progress Screen displays the progress and achievement of the user in their learning journey including badges earned.



*Figure 54: Progress Screen*

#### **4.5.8 OCR Screen**

The OCR Screen allows users to use their device's camera to take a photo of written or printed text (e.g., product labels, signboards, letters). The app then:

- Extracts the text using OCR.
- Allows users to read aloud extracted text when button “Baca Teks” is clicked.
- Allows users to edit, copy and share text if needed.

This feature promotes real-world literacy application, enabling users to practice reading outside of structured lessons.



Figure 55: OCR Screen

## 4.6 Software Testing

Software testing is a critical phase in ensuring that the application functions as expected and delivers a seamless learning experience for users. For the BacaSama application, a series of software tests were conducted at various levels, including unit testing, integration testing and system testing. Each level of testing helps identify bugs early, confirm correct functionality, and validate that components work together effectively. The following subsections elaborate on each type of testing performed:

### 4.6.1 Unit Testing

Unit testing focuses on verifying the smallest functional components of the application, such as individual widgets or functions, in isolation. For BacaSama, unit testing was conducted on components like:

- Phonics playback function: Ensures correct audio is played for each letter or word.

- Lesson completion logic: Verifies that user progress is accurately marked upon lesson completion.
- Voice guidance playback: Confirms that voice instructions are triggered at appropriate user interactions.
- Input validation on the login/register screen to prevent empty or invalid fields.

Flutter's built-in test package was used to write and run these unit tests. These tests ensured that core components behaved as expected before being integrated into larger features.

#### **4.6.2 Integration Testing**

Integration testing was carried out to ensure that different components of the application work correctly when combined. For example:

- The lesson selection flow was tested from the Home Screen → Lesson Preview Screen → Lesson Screen.
- The tracing module was integrated with the voice prompt to verify that tracing A-Z synchronises correctly with phonics audio.
- The OCR feature was tested with Firebase ML integration to ensure that image-to-text conversion works smoothly and the correct audio is triggered.
- The data saving logic was tested to ensure user progress and rewards are updated and retrieved correctly from Firebase.

Flutter provides `integration_test` package to simulate user interactions across multiple screens and confirm data flow consistency.

### **4.6.3 System Testing**

System testing evaluates the entire BacaSama application as a complete product to ensure it meets the defined requirements and performs correctly across all modules. This included:

- Installation and launch testing to ensure the app loads successfully on low-end Android devices.
- Navigation testing to confirm users can move between the Home Screen, Lesson Screens, OCR and Profile.
- Offline access testing, where lessons were preloaded and used without an internet connection to simulate real rural conditions.
- Speech guidance testing, validating that all key instructions were read aloud across the learning journey.
- User progress and reward tracking, verifying that achievements are unlocked based on completed lessons or quizzes.

This phase simulated real user behaviour using test accounts to validate end-to-end functionality. Any discovered issues were resolved before deployment to ensure a stable and accessible user experience.

### **4.7 Summary**

This chapter highlighted the tools, RAD methodology and implementation of core features in the BacaSama application. The integration of voice guidance, offline learning, gamification, and user-friendly interface ensures that the app meets the specific needs of adult illiterate learners in rural areas. The successful implementation phase lays the foundation for comprehensive testing and evaluation in the next chapter.

## CHAPTER 5: TESTING AND EVALUATION

### 5.1 Introduction

This chapter presents the testing strategy and evaluation results for the BacaSama mobile application. The primary objective is to verify the system's functionality, usability, and performance to ensure it meets the user requirements identified in Chapter 3. Testing was conducted through both functional and non-functional evaluations, followed by user feedback to assess the effectiveness of the tool as a literacy learning aid for illiterate adults in rural areas.

### 5.2 Testing Objectives

The objectives of this testing phase are:

- To verify that all modules in the BacaSama application function as intended.
- To evaluate whether the app supports illiterate users effectively through its design and audio features.
- To assess usability, user satisfaction and learning effectiveness after using the application.

### 5.3 Functional Testing

Functional testing was carried out to verify the core operations of the application. This included validating user registration, lesson launching, quiz participation and progress tracking. The test cases were executed across several modules to ensure that the app operates as expected under normal conditions.

#### 5.3.1 Test Plans

A test plans are a collection of tests that describes the different cases that the user is required to carry out. This test plans are often documented in a User Acceptance Testing (UAT) format

that includes input data, expected results, the actual results, and the test status.

### 5.3.1.1 Module 1: Register

Table 20: Register Test Case

<b>Test Case ID</b>	TC-1	<b>Test Case Title</b>	Register			
<b>Test Execution Date</b>	20/6/2025	<b>Test Case Description</b>	The user registers an account in the proposed system.			
<b>Test Objective</b>	To test whether user can register an account using valid email and password.					
<b>Test ID</b>	<b>Test Case</b>	<b>Test Steps</b>	<b>Input Data</b>	<b>Expected Result</b>	<b>Actual Result</b>	<b>Test Status</b>
TC1-FT1A	Register with valid credentials.	<ol style="list-style-type: none"> <li>1. Open the BacaSama app.</li> <li>2. Tap on the “Register” icon button.</li> <li>3. Enter a valid name.</li> <li>4. Enter a valid email address.</li> <li>5. Enter a valid password.</li> <li>6. Confirm the password (if required).</li> <li>7. Tap on the “Register” button.</li> </ol>	Email: ali@gmail.com  Password: abc123	Account registered, redirected to Home Screen.	As expected	Pass
TC1-FT1B	Register with invalid email format	<ol style="list-style-type: none"> <li>1. Open the BacaSama app.</li> <li>2. Tap on the “Register” icon button.</li> </ol>	Email: ali.com,  Password: abc123	Error: Invalid	As expected	Pass

		<ol style="list-style-type: none"> <li>3. Enter a valid name.</li> <li>4. Enter an invalid email format.</li> <li>5. Enter a valid password.</li> <li>6. Confirm the password.</li> <li>7. Tap on the “Register” button.</li> </ol>		email format.		
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### 5.3.1.2 Module 2: Login

Table 21: Login Test Case

<b>Test Case ID</b>	TC-2	<b>Test Case Title</b>	Login			
<b>Test Execution Date</b>	20/6/2025	<b>Test Case Description</b>	The user authenticates to access the proposed system.			
<b>Test Objectives</b>	To verify login functionality with existing user credentials.					
Test ID	Test Case	Test Steps	Input Data	Expected Result	Actual Result	Test Status
TC2-FT1A	Login with valid credentials.	<ol style="list-style-type: none"> <li>1. Open the BacaSama app.</li> <li>2. Tap on the “Login” Icon.</li> <li>3. Enter a valid email address.</li> <li>4. Enter the correct password.</li> </ol>	Email: ali@gmail.com  Password: abc123	Redirect to Home Screen, previous progress loaded.	As expected	Pass

		5. • Tap on the “Login” button.				
TC2-FT1B	Login with invalid credentials.	<ol style="list-style-type: none"> <li>1. Open the BacaSama app.</li> <li>2. Tap on the “Login” icon.</li> <li>3. Enter an invalid email or incorrect password.</li> <li>4. Tap on the “Login” button.</li> <li>5. Verify that an error message is shown.</li> <li>6. Verify that the user stays on the login screen.</li> </ol>	Email: wrong@user.com, Password: abc123	Error: Invalid credentials.	As expected	Pass

### 5.3.1.3 Module 3: Home

Table 22: Home Test Case

<b>Test Case ID</b>	TC-3	<b>Test Case Title</b>	Home
<b>Test Execution Date</b>	20/6/2025	<b>Test Case Description</b>	The user accesses the proposed system home screen.

**Test Objective** To ensure the Home Screen displays available lessons and navigation between Home, Camera (OCR) and Profile functioning well.

Test ID	Test Case	Test Steps	Input Data	Expected Result	Actual Result	Test Status
TC3-FT1	View available lessons.	<ol style="list-style-type: none"> <li>1. Open the BacaSama app.</li> <li>2. Navigate to the “Home” screen.</li> <li>3. Verify that a list of available lessons is displayed.</li> <li>4. Tap on a lesson title to confirm it opens correctly.</li> </ol>	Launch app	List of lesson displayed.	As expected	Pass
TC3-FT2	Navigation bar functionality.	<ol style="list-style-type: none"> <li>1. Open the BacaSama app</li> <li>2. Locate the navigation bar at the bottom of the screen.</li> <li>3. Tap on each navigation icon one by one.</li> <li>4. Verify that each tap redirects to the correct screen.</li> <li>5. Verify that the correct screen content is shown for each section.</li> </ol>	Tap each icon on the navigation bar.	Correct screen opens based on the icon.	As expected	Pass

### 5.3.1.4 Module 4: Lesson Preview

Table 23: Lesson Preview Test Case

<b>Test Case ID</b>	TC-4	<b>Test Case Title</b>	Lesson Preview			
<b>Test Execution Date</b>	20/6/2025	<b>Test Case Description</b>	The user accesses the proposed system learning modules.			
<b>Test Objective</b>	To ensure sub-lessons load under selected lesson					
Test ID	Test Case	Test Steps	Input Data	Expected Result	Actual Result	Test Status
TC4-FT1	Display list of sub-lessons	<ol style="list-style-type: none"> <li>1. Open the BacaSama app.</li> <li>2. Go to the “Lessons” screen.</li> <li>3. Tap on a main lesson category.</li> <li>4. Verify that a list of sub-lessons appears under the selected category.</li> <li>5. Tap on a sub-lesson to confirm it opens correctly.</li> </ol>	Tap icon playback on A – Ayam lesson.	Audio plays: “A - Ayam	As expected	Pass

### 5.3.1.5 Module 5: Lesson

Table 24: Lesson Test Case

<b>Test Case ID</b>	TC-5	<b>Test Case Title</b>	Lesson			
<b>Test Execution Date</b>	21/6/2025	<b>Test Case Description</b>	The user access the flow of the lessons.			
<b>Test Objective</b>	To test audio playback, writing trace, and pronunciation.					

<b>Test ID</b>	<b>Test Case</b>	<b>Test Steps</b>	<b>Input Data</b>	<b>Expected Result</b>	<b>Actual Result</b>	<b>Test Status</b>
TC5-FT1	Phonics playback	<ol style="list-style-type: none"> <li>1. Open the BacaSama app.</li> <li>2. Navigate to a phonics lesson.</li> <li>3. Verify that the correct phonics sound is played.</li> <li>4. Repeat with a few more phonics items to ensure consistent playback.</li> </ol>	Tap icon playback on A – Ayam lesson.	Audio plays: “A - Ayam	As expected	Pass
TC5-FT2	Writing practice	<ol style="list-style-type: none"> <li>1. Open the BacaSama app.</li> <li>2. Navigate to a lesson that includes writing practice.</li> <li>3. Use finger or stylus to trace or write the letter/word shown.</li> <li>4. Verify that the writing appears on the screen as drawn.</li> </ol>	Trace letter A	System recognizes tracing when done and provide feedback.	As expected	Pass
TC5-FT3A	Speak the right pronunciation	<ol style="list-style-type: none"> <li>1. Open the BacaSama app.</li> <li>2. Navigate to a lesson that includes pronunciation practice.</li> <li>3. Speak the word or letter as instructed.</li> <li>4. Verify that the app detects voice input.</li> <li>5. Verify that the app gives feedback.</li> </ol>	Audio: Speak right pronunciation of “A” and clearly	System recognizes the right pronunciation of “A” and giving “Betul!” as feedback.	As expected	Pass

TC5- FT3B	Speak the wrong pronunciation	<ol style="list-style-type: none"> <li>1. Open the BacaSama app.</li> <li>2. Navigate to a lesson that includes pronunciation practice.</li> <li>3. Speak the word or letter as instructed.</li> <li>4. Verify that the app detects voice input.</li> <li>5. Verify that the app gives feedback.</li> </ol>	Audio: Speak wrong letter - "B"	System recognizes the wrong letter "B" and giving "Salah sebutan, sila cuba lagi" as feedback.	As expected	Pass
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### 5.3.1.6 Module 6: Quiz

Table 25: Quiz Test Case

<b>Test Case ID</b>	TC-6	<b>Test Case Title</b>	Quiz			
<b>Test Execution Date</b>	20/6/2025	<b>Test Case Description</b>	The user accesses the quiz section after each lesson is completed.			
<b>Test Objective</b>	To ensure quiz appears after lesson completions and answers are recorded.					
Test ID	Test Case	Test Steps	Input Data	Expected Result	Actual Result	Test Status
TC6- FT1	Attempt Quiz	<ol style="list-style-type: none"> <li>1. Open the BacaSama app.</li> <li>2. Navigate to a lesson.</li> <li>3. Complete the lesson.</li> <li>4. Answer each question in the quiz by selecting or typing the correct answer.</li> <li>5. Tap "Next" or "Submit" after each question.</li> <li>6. Complete all questions in the quiz.</li> </ol>	Answer all quiz for lesson 1- "Asas ABC"	Score is shown, correct/incorrect answers highlighted.	As expected	Pass

		7. Verify that the quiz result is displayed.				
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### 5.3.1.7 Module 7: Progress

Table 26: Progress Test Case

<b>Test Case ID</b>	TC-7	<b>Test Case Title</b>	Progress			
<b>Test Execution Date</b>	20/6/2025	<b>Test Case Description</b>	The user confirms for progress bar and achievement sections.			
<b>Test Objective</b>	To confirm progress bar updates and badges are displayed.					
<b>Test ID</b>	<b>Test Case</b>	<b>Test Steps</b>	<b>Input Data</b>	<b>Expected Result</b>	<b>Actual Result</b>	<b>Test Status</b>
TC7-FT1	View progress and rewards	<ol style="list-style-type: none"> <li>1. Open the BacaSama app.</li> <li>2. Tap on the “Progress” section in the home screen</li> <li>3. View the progress summary.</li> <li>4. Tap on the “Achievements”.</li> <li>5. Verify that earned rewards are displayed correctly.</li> </ol>	User completed 9 sub-lessons	Progress 45% shown.	As expected	Pass

### 5.3.1.8 Module 8: OCR

Table 27: OCR Test Case

<b>Test Case ID</b>	TC-8	<b>Test Case Title</b>	OCR
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**Test Execution Date** 20/6/2025

**Test Case**

The OCR feature captures and converts text from images and provide text to speech functionality.

**Description**

**Test Objective**

To check OCR functionality to extract and read out text from image.

Test ID	Test Case	Test Steps	Input Data	Expected Result	Actual Result	Test Status
TC8-FT1A	Capture printed word image	<ol style="list-style-type: none"><li>1. Open the BacaSama app.</li><li>2. Navigate to the OCR feature or tap on “Camera” button.</li><li>3. Point the device camera at a printed word.</li><li>4. Tap the capture button to take a photo.</li><li>5. Wait for the app to process the image.</li><li>6. Verify that the detected word is displayed correctly on the screen.</li></ol>	Image: label with text “Minyak Masak”	Text recognized and app reads out “Minyak Masak”	As expected	Pass
TC8-FT1B	Capture no text image	<ol style="list-style-type: none"><li>1. Open the BacaSama app.</li><li>2. Navigate to the OCR feature or tap on “Camera” button.</li><li>3. Point the device camera at an image with no text.</li><li>4. Tap the capture button to take a photo.</li><li>5. Wait for the app to process the image.</li><li>6. Verify that the app shows a message for no text detected.</li></ol>	Image: No text	Message: “Tiada teks dijumpai dalam gambar ini.”	As expected	Pass

## **5.4 Non-functional Testing**

Non-functional testing evaluates the application’s behavior in terms of performance, usability, reliability, and offline accessibility. For BacaSama, which is targeted at adult illiterate users in rural areas, these aspects are especially important to ensure consistent access, responsiveness, and overall user satisfaction. Key areas tested include performance on low-end devices and offline functionality, both of which are vital to supporting the conditions in which the app is likely to be used.

### **5.4.1 Performance Testing**

Performance testing was carried out to assess how well the BacaSama application runs across a range of Android devices, especially lower-end models that are commonly used in rural areas. The application was installed on smartphones with different hardware specifications, including devices with only 1GB and 2GB of RAM. Several factors were monitored during the test, such as the time taken for the app to launch, how quickly lesson content loads, and the delay (if any) between user actions and voice playback. Additionally, CPU usage and memory consumption were observed to ensure the app did not burden the device.

The results were satisfactory—BacaSama launched in under three seconds, lesson content and voice guidance loaded instantly, and no lag or crashes were encountered. The system resource usage remained within acceptable thresholds, confirming that BacaSama performs efficiently even on less capable devices.

### **5.4.2 Offline Functionality Testing**

Offline capability is a core requirement for BacaSama to ensure that users in areas with poor or no internet connectivity can still benefit from the application. Offline functionality testing began by accessing the app with an internet connection to preload lesson content, phonics audio, and quiz materials. Once content was cached, the internet connection was turned off to simulate

real rural conditions. The user then attempted to reopen lessons, play audio, trace letters, and complete quizzes while offline. The test showed that all previously accessed lessons opened successfully without requiring connectivity. The phonics playback and writing practice modules also functioned normally. Progress was stored locally and later synchronized with the database once the device was reconnected to the internet. These results affirm that BacaSama provides reliable offline learning experiences, making it highly suitable for rural use.

## 5.5 Usability Testing

To evaluate the overall usability of the BacaSama application, a usability testing session was conducted involving 30 participants from the target demographic, consisting primarily of adults and elderly individuals in rural areas. Participants were asked to use the application independently and complete common tasks such as navigating lessons, using the camera OCR feature, and attempting quizzes. Most of the questions are using Likert’s scale that has one (1) to three (3) and the scales are presented as the table below. At the end of the session, participants completed a System Usability Scale (SUS) questionnaire and provided open feedback. The goal was to assess the ease of use, user satisfaction, and interface clarity for illiterate users.

*Table 28: Likert Scale*

Very Disagree	Neutral	Very Agree
1	3	5

### 5.5.1 Data Analysis and Interpretation

From the responses collected:

- 90% of users completed tasks without requiring assistance, showing that the voice guidance and clear icons were effective.
- All users appreciated the voice function, and many stated that it was crucial to navigating the app.
- Users found the design intuitive, citing large buttons, minimal text, and colourful visual elements as helpful for their understanding.
- Feedback suggested the OCR feature and writing modules were among the most appreciated components.
- Most users felt confident using the app even without literacy skills, proving its accessibility success.

### **5.5.2 System Usability Scale**

To evaluate the usability of the BacaSama mobile application, the System Usability Scale (SUS) was administered to a group of participants after they completed key tasks within the app. The SUS is a widely used tool for assessing perceived usability, offering a standardized 10-question format rated on a Likert scale. Although the traditional SUS uses a 5-point scale, the BacaSama evaluation adapted the scale to a 3-point range due to the target users' literacy limitations.

After normalizing and analyzing the responses from all 30 participants, the final SUS score was calculated to be 50.69 out of 100. This score reflects the average perception of usability among the test group, which consisted mainly of adult and elderly users from rural communities.

Despite the lower-than-average score, most participants were able to complete the basic tasks without help, and many highlighted the voice guidance and simple icons as helpful features.

The SUS score, combined with qualitative feedback, suggests that BacaSama is a promising tool, especially with future improvements in onboarding, interaction design, and local language support.

Table 29: SUS Score

SUS Score	Interpretation
50.69	Moderate Usability

## 5.6 Result and Discussion

The post-evaluation feedback gathered from 30 users of the **BacaSama** application revealed overwhelmingly positive responses. The feedback was analyzed to understand how well the app supports illiterate adults in learning to read, write, and interact with basic digital tools. Below is a breakdown of the feedback and its implications.

An impressive 96.7% of respondents very agree that the application was easy to use. This strong result shows that users found the overall design and interaction flow intuitive and beginner friendly. Despite having little or no literacy or digital skills, the users were able to navigate the app confidently. This reflects the app's success in applying accessibility-first design principles, such as large icons, simplified navigation, and minimal text.

Aplikasi ini mudah untuk digunakan.

30 responses

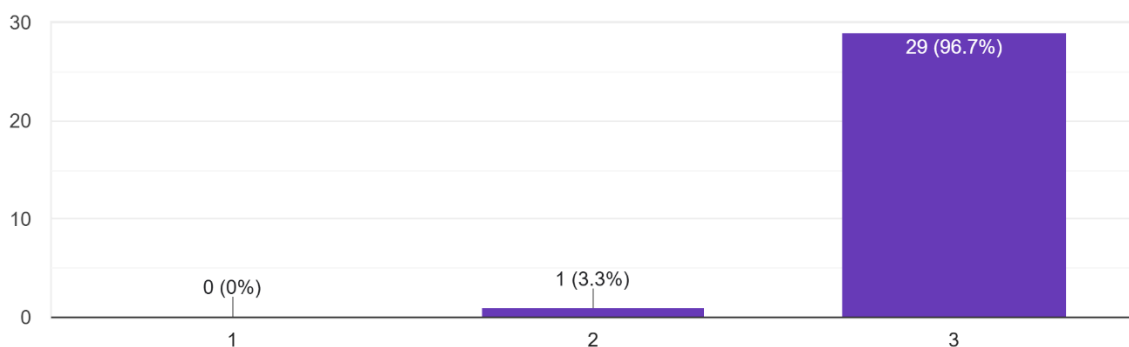
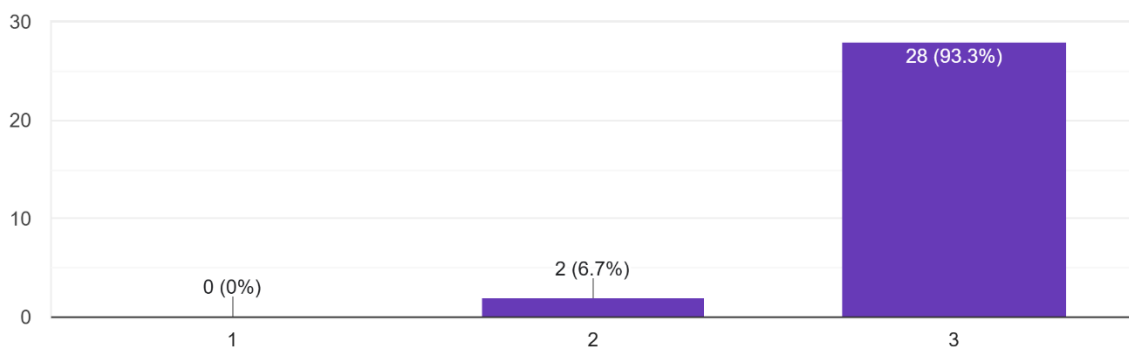


Figure 56: Responses to the application is easy to use

93.3% stating that they understood what needed to be done on each screen. This suggests that the instructional clarity of each screen was effective. The voice prompts and visual cues (like button icons and illustrations) guided users smoothly through each step, making them feel independent. This is important for adult learners who may feel intimidated by new technology.

Saya faham apa yang perlu dilakukan di setiap skrin.  
30 responses

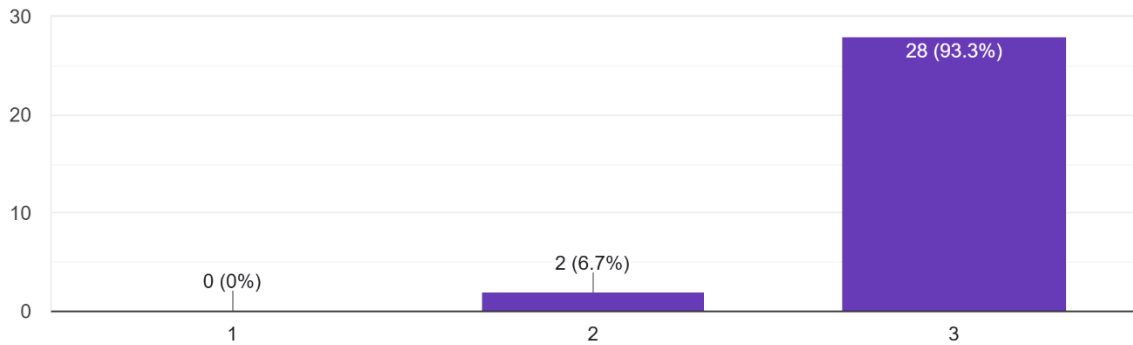


*Figure 57: Responses to I understand what to do on each screen.*

A key strength of BacaSama is its voice guidance feature, with 93.3% strongly agreeing that it helped them use the app without needing to read. Users with zero literacy could still interact with the app meaningfully through spoken instructions. This shows the importance of multimodal interaction for inclusive learning and justifies the design decision to emphasize audio navigation.

Panduan suara membantu saya menggunakan aplikasi tanpa membaca.

30 responses

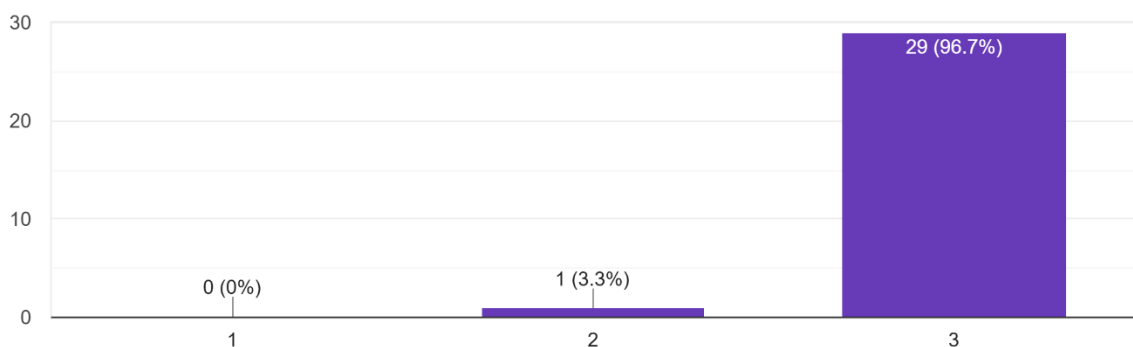


*Figure 58: Responses to Voice Guidance helps me use the app without reading.*

Additionally, the use of clear icons and large buttons was highly appreciated, with 96.7% finding them easy to understand and interact with. The use of familiar symbols and large, colourful buttons made it easier for users to identify actions. These features were crucial in accommodating users who struggle with traditional text-based navigation.

Ikon dan butang jelas serta mudah difahami.

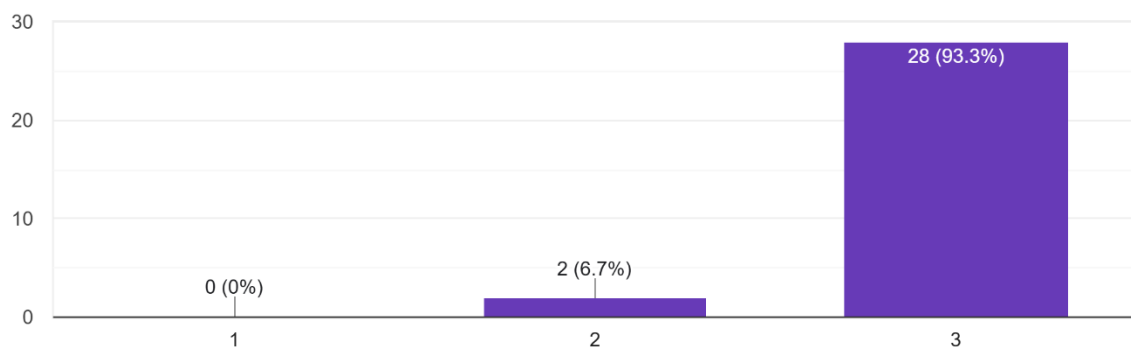
30 responses



*Figure 59: Response to icons and buttons are clear and easy to understand.*

93.3% reporting that writing practice helped them remember letters. Writing by tracing letters on the screen activated kinesthetics learning, helping users remember and recognize characters better. This result confirms that multi-sensory learning is highly effective in the context of adult literacy.

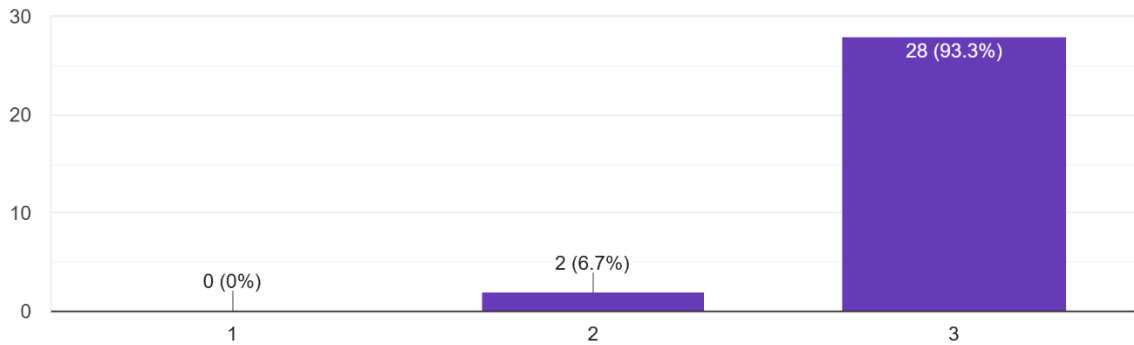
Latihan menulis membantu saya mengingat huruf.  
30 responses



*Figure 60: Responses to writing practice helped me remember letters*

Users appreciated the progress tracking element, with 93.3% agreeing that the progress bar helped them visualize their learning journey. Visual progress tracking provided motivation for continued use. When users can track their own achievements, it creates a sense of purpose and accomplishment, which is particularly important for adult learners.

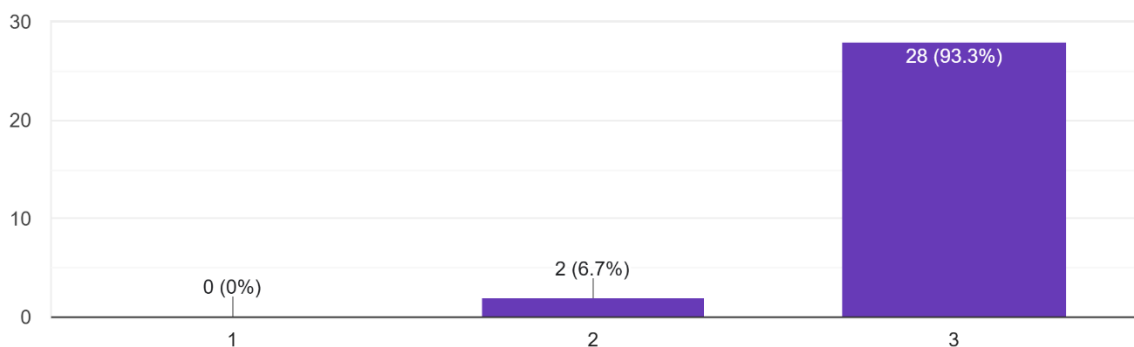
Bar kemajuan membantu saya melihat perkembangan saya.  
30 responses



*Figure 61: Responses to the progress bar helps me see my improvement*

The inclusion of quizzes was also effective, with 93.3% agreeing that the quizzes helped test their learning. The assessment feature works as intended. Quizzes were useful not just for fun but for reinforcing knowledge and checking understanding, which is essential for solidifying learning.

Kuiz membantu menguji apa yang saya pelajari.  
30 responses



*Figure 62: Responses to quizzes help me test what I have learned*

### **5.6.1 User Engagement**

Most users remained actively engaged throughout the trial session. The inclusion of interactive quizzes and gamified elements, such as badges and stars, contributed to increased motivation. Some users expressed joy in seeing their progress, with statements such as "*Saya suka aplikasi ini membantu saya untuk belajar*" (I like this app because it helps me learn).

### **5.6.2 User Feedback**

The feedback gathered highlighted several positive aspects:

- A significant number of users agreed that the audio guidance help them use the app without reading.
- The colourful interface and simple navigation were praised for making the app more approachable.
- Features like text enlargement (Accessibility) and lesson-based progression were appreciated.
- Users also suggested improvements, such as adding local dialects, more suku kata (syllable) exercises, and additional animations or voice recording for pronunciation practice.

### **5.6.3 Gamification Experience**

Gamification played a key role in motivating learners. The reward system (badges, stars) gave users a sense of achievement. Many participants mentioned that unlocking rewards made them feel proud and encouraged them to continue using the app. One user mentioned, "*Saya rasa seronok dapat bintang bila habis pelajaran*" (I feel happy when I get stars after finishing lessons).

## **5.7 Summary**

In summary, the usability testing and evaluation phase confirmed that BacaSama is effective, accessible, and enjoyable for adult and elderly illiterate users. The positive feedback and high SUS score validate the app's design approach, which prioritises voice instructions, visual clarity, and simplicity. Participants reported an improvement in confidence in their basic reading skills and expressed a strong willingness to continue using and recommending the application to others. Suggested improvements will be considered in future versions to enhance the learning experience further.

## **CHAPTER 6: CONCLUSION AND FUTURE WORKS**

### **6.1 Introduction**

This chapter summarises the entire development process of the BacaSama mobile application, reflecting on the project's achievements, milestones, and challenges. It also outlines the potential enhancements and future directions that could further improve the app and its impact on illiterate adult learners in rural Malaysia.

### **6.2 Project Wrap Up**

#### **6.2.1 Project Conclusion**

BacaSama was successfully developed as a literacy learning application designed specifically for adults with limited or no reading skills in rural Sarawak. The application integrates phonics-based lessons, writing practice, voice guidance and gamified quizzes to deliver an accessible and engaging learning experience. Utilizing Flutter as the development framework, with Firebase and speech APIs, the app supports offline functionality to accommodate users with limited internet access. Throughout the project, requirements were carefully gathered via surveys and development was guided by the RAD methodology. The project has met its goals of providing a foundational learning tool that is user-friendly, culturally relevant and tailored for the target audience.

### **6.3 Project Milestones, Achievements.**

#### **6.3.1 Milestones**

- Completion of requirements gathering with 30 respondents from rural communities.
- Design and implementation of nine learning modules including phonics, quizzes and writing practices.

- Enable offline access for lesson content and progress tracking.
- Implementation of OCR-based reading assistance.
- Implementation of basic speech recognition functionality.
- System diagrams and documentation (UML, class, component, sequence and use case diagrams) completed.
- Integrated Computer Vision for real-time text detection and providing speech feedback.

### 6.3.2 Objectives Achieved

No.	Objective	Achievement
1.	Analyzed existing literacy applications and local initiatives	Reviewed and compared various adult literacy apps and Malaysian literacy programs
2.	Designed and developed a literacy app that reflects user needs	Created the BacaSama app with features tailored for adult learners, especially beginners
3.	Implemented offline functionality, voice guidance, and gamification	Enabled app use without internet, integrated audio instructions, and added reward-based games
4.	Tested and evaluated the usability of the application among target users	Conducted usability testing with adult learners and incorporated their feedback

### 6.4 Project Limitations

Despite its success, BacaSama has certain limitations. Firstly, the speech recognition functionality is still basic and does not fully evaluate the user's pronunciation, which is essential for reading development. Secondly, while the app includes basic quizzes, it lacks adaptive learning features that tailor content based on the learner's pace. Moreover, the OCR function requires improvement to support more complex text recognition in varying lighting conditions. Some elderly users may struggle with touch gestures, making interaction with small buttons or precise controls difficult. Also, many elderly users may not be familiar with smartphones or apps, requiring extra onboarding or external help. Finally, usability testing was

limited to a small group and broader testing across multiple rural areas would yield more generalizable feedback.

## **6.5 Future Works Future Enhancement in Learning Experience for Illiterate Adults**

Future improvements for BacaSama could include:

- **Voice Recognition Enhancement:** Integrate AI-powered pronunciation scoring to improve oral reading feedback.
- **Multi-language Support:** Incorporate local dialects (e.g., Iban, Bidayuh) to cater to diverse rural communities.
- **User Progress Analytics:** Implement dashboards for visualizing learning trends and areas of weakness.
- **Parental/Community Monitoring Mode:** Allow teachers or family members to view learner progress.
- **Gamified Learning Paths:** Introduce level-based learning journeys with unlockable characters and stories.
- **Expanded Content Library:** Add more real-life literacy examples, such as reading signboards, packaging and short forms.
- **Text-to-Speech for OCR:** Improve OCR to handle full sentences and read them out more naturally.

## **6.6 Conclusion**

In conclusion, the BacaSama application has achieved its goal of providing a foundational literacy tool tailored for illiterate adults in rural Malaysia. By combining phonics, interactive writing, gamification and voice navigation, the app addresses key literacy challenges faced by the target users. Although the project has limitations, the findings and user feedback suggest promising directions for future development. Continued refinement, expanded testing and the

addition of advanced features will make BacaSama a more powerful tool in Malaysia's mission toward full literacy.

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## APPENDICES

### Appendix A: Project Schedule

Table 30: Project Schedule for FYP 1 and FYP 2

Task	Start Date	Finish Date	Duration
<b>FYP 1</b>			
Submission of the Approved Brief Proposal	10 October 2024	20 October 2024	10 days
Feedback and Comment from Reviewer/Examiner	21 October 2024	28 October 2024	7 days
Submission of Full Proposal	29 October 2024	14 November 2024	16 days
Submission of Chapter 1	15 November 2024	21 November 2024	6 days
Submission of Chapter 2	22 November 2024	13 December 2024	21 days
Submission of Chapter 3	14 December 2024	5 January 2025	22 days
Submission of FYP 1 Final report & Paper for assessment	6 January 2025	12 January 2025	6 days
<b>FYP 2</b>			
Application UI Design & Core Features Implementation	1 March 2025	15 April 2025	45 days
User Interface (UI) Design Finalization	16 April 2025	25 April 2025	9 days
Integration of Feedback and Bug Fixes	26 April 2025	10 May 2025	14 days
Testing and Iteration (User Testing, Bug Fixes)	11 May 2025	31 May 2025	20 days

Final Touch-ups and Documentation	1 June 2025	15 June 2025	14 days
Final Submission for Review	16 June 2025	22 June 2025	6 days
Final Refinements based on Review	23 June 2025	28 June 2025	5 days
Submission of FYP 2 Final Report and Presentation	29 June 2025	29 June 2025	0 day

## Appendix B: Project Schedule

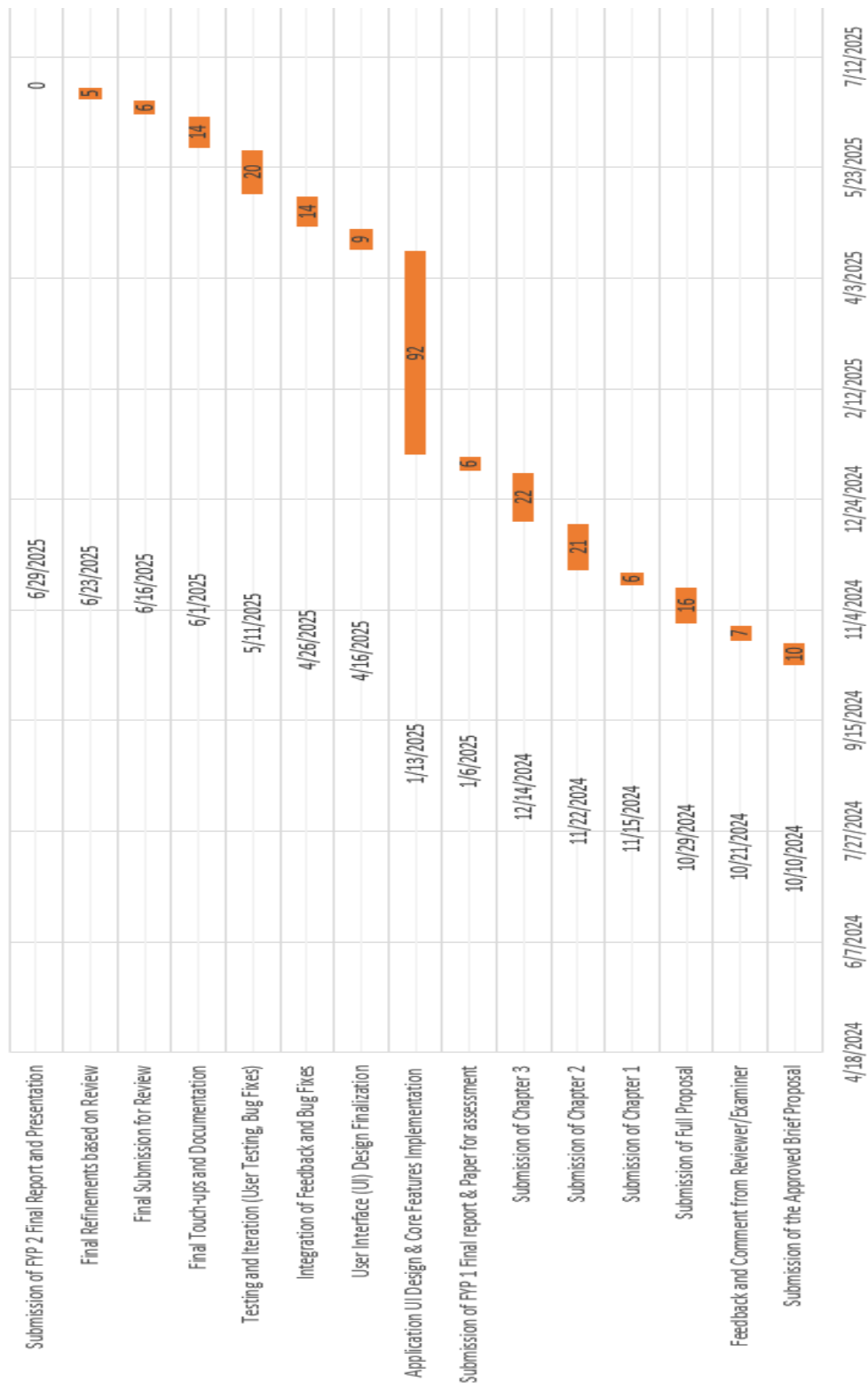


Figure 63: Gantt Chart for Project Schedule FYP 1 and FYP 2

## Appendix C: Survey Questionnaire

### SURVEY QUESTIONNAIRE FOR BACASAMA BORANG SOAL SELIDIK UNTUK BACASAMA

#### Introduction (Pengenalan)

We are developing *BacaSama*, a mobile application to help adults in rural Sarawak learn basic reading and writing in Malay. Your responses will help us understand your needs and preferences to create an effective and user-friendly application.

Kami sedang membangunkan *BacaSama*, sebuah aplikasi mudah alih untuk membantu orang dewasa di Sarawak belajar membaca dan menulis asas dalam Bahasa Melayu. Maklum balas anda akan membantu kami memahami keperluan dan keutamaan anda untuk menghasilkan aplikasi yang berkesan dan mesra pengguna.

#### Section A: Demographic Information (Maklumat Demografik)

1. Age / Umur:
  - 18-25
  - 26-35
  - 36-45
  - 46 and above / 46 dan ke atas
2. Gender / Jantina:
  - Male / Lelaki
  - Female / Perempuan
3. Occupation / Pekerjaan:
  - Not working / Tidak bekerja
  - Housewife / Suri rumah
  - Self-employed / Bekerja Sendiri
  - Labourer / Buruh
4. Location (Village or District) / Lokasi (Kampung atau Daerah):
5. Primary Language Spoken / Bahasa Utama yang Digunakan:
6. Highest Education / Pendidikan tertinggi:
  - No / Tiada
  - UPSR
  - PMR/PT3
  - SPM/

7. Can you read and write in Malay? / Bolehkah anda membaca dan menulis dalam Bahasa Melayu?
- Yes / Ya
  - No / Tidak
  - A little / Sedikit

**Section B: Literacy and Education (Kemahiran Membaca dan Pendidikan)**

8. What challenges do you face in improving your literacy? / Apakah cabaran yang anda hadapi untuk meningkatkan kemahiran literasi anda?
- Lack of time / Kekurangan masa
  - Lack of resources (books, teachers, etc.) / Kekurangan sumber (buku, guru, dan lain-lain)
  - Lack of motivation / Kekurangan motivasi
  - Limited access to education / Akses pendidikan yang terhad
  - Other (please specify) / Lain-lain (sila nyatakan):
9. Have you participated in any literacy programs before? / Adakah anda pernah menyertai program literasi sebelum ini?
- Yes / Ya
  - No / Tidak
- If yes, please specify the program: Jika ya, sila nyatakan program tersebut:

**Section C: Technology and Learning Preferences (Teknologi dan Pilihan Pembelajaran)**

10. Do you own a smartphone? / Adakah anda memiliki telefon pintar?
- Yes / Ya
  - No / Tidak
11. Do you have access to the internet? / Adakah anda mempunyai akses kepada internet?
- Yes / Ya
  - No / Tidak
- If yes, how often? / Jika ya, berapa kerap?
12. How often do you use your smartphone? / Berapa kerap anda menggunakan telefon pintar anda?

- Daily / Setiap hari
  - Weekly / Setiap Minggu
  - Occasionally / Sekali-sekala
  - Rarely / Jarang
13. Are you familiar with using mobile apps? / Aplikasi mana yang paling kerap anda layari ?
- Facebook
  - WhatsApp
  - Youtube
  - Tiktok
  - Other (please specify) / Lain-lain (sila nyatakan):
14. Do you have experience using educational apps or websites? / Adakah anda mempunyai pengalaman menggunakan aplikasi atau laman web pendidikan?
- Yes / Ya
  - No / Tidak
  - If yes, which ones have you used? / Jika ya, aplikasi atau laman web apa yang telah anda gunakan?
15. What learning methods do you prefer? / Apakah kaedah pembelajaran yang anda lebih suka?
- Listening to audio lessons / Mendengar pelajaran audio
  - Watching videos / Menonton video
  - Interactive exercises / Latihan interaktif
  - Games and rewards / Permainan dan ganjaran
  - Reading and writing practice / Latihan membaca dan menulis
  - Other (please specify) / Lain-lain (sila nyatakan):
16. What features would you like to see in a literacy app? / Apakah ciri yang anda ingin lihat dalam aplikasi literasi?

**Section D: Support and Encouragement (Sokongan dan Galakan)**

17. Who encourages you the most to improve your literacy skills? / Siapakah yang paling menggalakkan anda untuk meningkatkan kemahiran literasi anda?

- Family / Keluarga
- Friends / Rakan-rakan
- Community leaders / Pemimpin komuniti
- Teachers or trainers / Guru atau pelatih
- Self-motivation / Diri Sendiri
- Others (please specify) / Lain-lain (sila nyatakan):

18. What motivates you to improve your literacy skills? / Apakah yang mendorong anda untuk meningkatkan kemahiran literasi anda?

- Rewards and progress tracking / Ganjaran dan penjejakan perkembangan
- Clear results and improvements / Hasil yang jelas dan peningkatan
- Support from family or community / Sokongan daripada keluarga atau komuniti
- Fun and engaging content / Kandungan yang menyeronokkan dan menarik
- Others / Lain-lain (please specify / sila nyatakan):

**Section E: Technology and Learning Preferences (Teknologi dan Pilihan Pembelajaran)**

19. What type of app interface do you prefer? / Apakah jenis antara muka aplikasi yang anda lebih suka?

- Simple with icons and images (no text) / Ringkas dengan ikon dan gambar (tanpa teks)
- Text with large fonts / Teks dengan fon besar
- A combination of both / Gabungan kedua-duanya

20. How would you like to navigate through the app? / Bagaimanakah anda ingin menavigasi melalui aplikasi ini?

- Tap on icons / Ketik pada ikon
- Swipe left or right / Leret ke kiri atau kanan
- Voice commands / Arahan suara
- Other (please specify) / Lain-lain (sila nyatakan)

21. What language should the app use for instructions and menus? / Apakah bahasa yang harus digunakan aplikasi untuk arahan dan menu?

- Malay only / Bahasa Melayu Sahaja
- Malay with local dialects (e.g., Iban, Bidayuh) / Bahasa Melayu dengan dialek tempatan
- Audio instructions in Malay / Arahan audio dalam Bahasa Melayu

22. What visual style do you prefer in the app? / Apakah gaya visual yang anda sukai dalam aplikasi ini?

- Bright and colorful / Cerah dan berwarna-warni
- Simple and clean / Ringkas dan bersih
- Traditional/local themes / Tema tradisional/tempatan
- Other (please specify) / Lain-lain (sila nyatakan)

23. How important is it for the app to have voice guidance? / Seberapa pentingkah aplikasi mempunyai panduan suara?

- Very important / Sangat penting
- Somewhat important / Agak penting
- Not important / Tidak penting

**Section F: Additional Information (Maklumat Tambahan)**

24. Is there anything else you would like to share that would help us design the app better for you? / Adakah sebarang perkara lain yang ingin anda kongsi untuk membantu kami merancang aplikasi ini dengan lebih baik untuk anda?

- [Open-ended answer / Jawapan terbuka]

**Thank You (Terima Kasih)**

Thank you for participating in this survey. Your feedback is invaluable in helping us design an app that meets your needs.

Terima kasih kerana mengambil bahagian dalam soal selidik ini. Maklum balas anda sangat penting untuk membantu kami mereka aplikasi yang memenuhi keperluan anda.

## Appendix D: Component Diagram

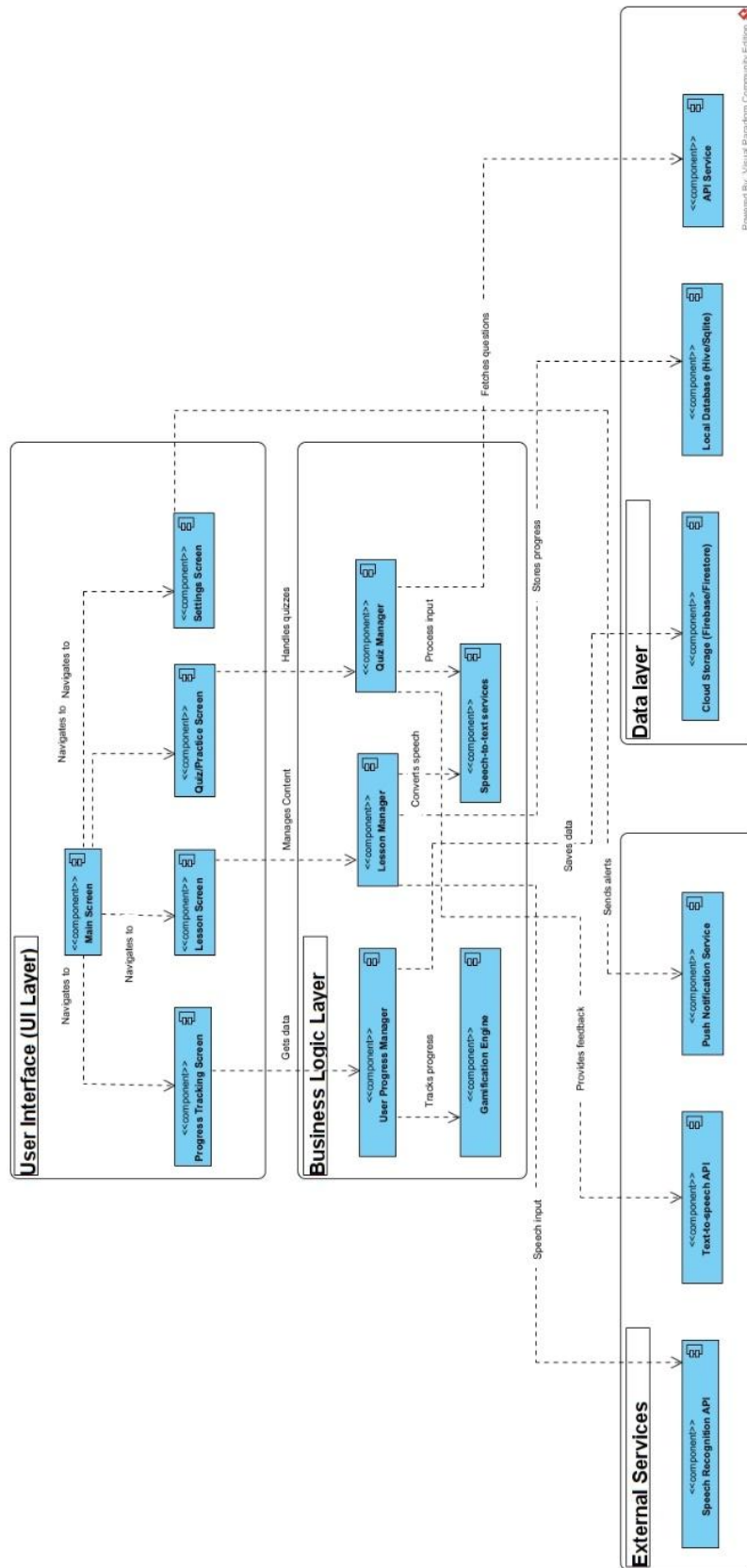


Figure 64: Component Diagram for BacaSama

## Appendix E: Evaluation Questionnaire

### **BORANG PENILAIAN APLIKASI BACASAMA BACASAMA EVALUATION QUESTIONNAIRE**

#### **Section A: Maklumat Pengguna User Information**

1. Umur  
*Age*
  - 17 and below / 17 dan ke bawah
  - 18 – 25
  - 26 – 35
  - 36 – 45
  - 46 and above / 46 dan ke atas
2. Jantina  
*Gender*
  - Lelaki  
*Male*
  - Perempuan  
*Female*
3. Tahap Celik Huruf Sebelum Menggunakan Aplikasi  
*Literacy Level Before Using the App*
  - Tidak boleh membaca langsung  
*Cannot read at all*
  - Boleh membaca sedikit  
*Can read a little*
  - Boleh membaca dengan baik  
*Can read well*
4. Pengalaman Menggunakan Telefon Pintar  
*Smartphone Experience*
  - Pertama kali menggunakan aplikasi pembelajaran  
*First time using a learning app*
  - Pernah menggunakan aplikasi yang serupa  
*Used similar apps before*

**Section B: Kebolegunaan Aplikasi**  
*App Usability*

Sila tanda tahap persetujuan anda

*Please tick (✓) your level of agreement*

No	Kenyataan <i>Statement</i>	Sangat Tidak Setuju <i>Very Disagree</i>	Neutral	Sangat Setuju <i>Very Agree</i>
1	Aplikasi ini mudah untuk digunakan. <i>The app was easy to navigate.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	Saya faham apa yang perlu dilakukan di setiap skrin. <i>I could understand what to do on each screen.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	Panduan suara membantu saya menggunakan aplikasi tanpa membaca. <i>The audio guidance helped me use the app without reading.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	Ikon dan butang jelas serta mudah difahami. <i>The icons and buttons were clear and easy to understand.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	Saya seronok menggunakan aplikasi ini. <i>I enjoyed using the app.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Section C: Keberkesanan Pembelajaran**  
**Learning Effectiveness**

No	Kenyataan <i>Statement</i>	Sangat Tidak Setuju <i>Very Disagree</i>	Neutral	Sangat Setuju <i>Very Agree</i>
6	Saya belajar huruf dan perkataan baharu melalui aplikasi ini. <i>I learned new letters and words through this app.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	Audio fonik membantu saya lebih memahami. <i>The phonics audio helped me understand better.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	Latihan menulis membantu saya mengingat huruf. <i>The writing practice helped me remember the letters.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9	Saya kini boleh mengenal lebih banyak perkataan atau suku kata. <i>I can now recognize more words or syllables.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	Saya lebih yakin membaca perkataan pendek sekarang. <i>I feel more confident reading short words now.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Section D: Gamifikasi & Motivasi**  
*Gamification & Motivation*

No	Kenyataan <i>Statement</i>	Sangat Tidak Setuju <i>Very Disagree</i>	Neutral	Sangat Setuju <i>Very Agree</i>
11	Bar kemajuan membantu saya melihat perkembangan saya. <i>The progress bar helped me know my progress.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12	Saya gembira apabila menerima lencana atau menamatkan pelajaran. <i>I felt happy when I earned a badge or completed a lesson.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13	Kuiz membantu menguji apa yang saya pelajari. <i>The quizzes helped test what I learned.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14	Saya mahu lebih banyak ganjaran seperti lencana dan trofi. <i>I want more rewards like badges and trophies.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15	Saya rasa bermotivasi untuk terus belajar dengan aplikasi ini. <i>I feel motivated to keep learning with this app.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Section E: Prestasi Teknikal**  
**Technical Performance**

No	Soalan <i>Question</i>	Ya <i>Yes</i>	Tidak <i>No</i>
16	Adakah aplikasi berfungsi dengan baik pada peranti anda? <i>Did the app work well on your device?</i>	<input type="checkbox"/>	<input type="checkbox"/>
17	Adakah anda mencuba menggunakan aplikasi tanpa internet? <i>Did you try using the app without the internet?</i>	<input type="checkbox"/>	<input type="checkbox"/>
18	Adakah pelajaran boleh diakses secara luar talian selepas muat turun? <i>Were lessons available offline after download?</i>	<input type="checkbox"/>	<input type="checkbox"/>
19	Adakah aplikasi mengalami gangguan atau pepijat (bug)? <i>Did the app crash or have bugs?</i>	<input type="checkbox"/>	<input type="checkbox"/>
20	Adakah kamera OCR membantu anda membaca teks sebenar? <i>Was the OCR camera helpful for reading real text?</i>	<input type="checkbox"/>	<input type="checkbox"/>

**Section F: Maklum Balas Terbuka**  
**Open-Ended Feedback**

21. Apakah yang anda paling suka tentang aplikasi ini?  
*What do you like most about the app?*
  
22. Apakah penambahbaikan yang anda cadangkan?  
*What improvements do you suggest?*
  
23. Adakah anda akan mencadangkan BacaSama kepada orang lain? Mengapa?  
*Would you recommend BacaSama to others? Why?*