

Si Bijak Nombor: An Interactive Learning Application That Emphasize Number for Special Education Students

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Abstract

"Si Bijak Nombor" is an interactive application aimed at improving numerical literacy in primary school children aged 8 to 10, particularly special education students. Many children, especially those in special education, struggle with conventional teaching methods, which they often find unengaging and difficult to follow. This leads to a lack of interest in learning numbers and delays in acquiring basic mathematical skills. The application is developed using the Multimedia Development Life Cycle (MDLC), which emphasizes a structured process in the design and integration of multimedia elements. It is suitable for use in educational settings such as primary schools, special education programs, and also as a home learning aid. "Si Bijak Nombor" aims to spark students' interest in mathematics and enhance their understanding of basic mathematical concepts. The main objectives of this application are to design a user-friendly interface that encourages students to actively participate through fun and engaging quizzes and interactive elements, to develop interactive learning activities that support the understanding and practice of basic numerical concepts especially for special education students, and to evaluate user acceptance by providing a tool that can supplement traditional classroom learning. Based on usability testing, the application achieved a System Usability Scale (SUS) score of 79.79%, indicating that it is well-received and user-friendly.

1. Introduction

Mathematics plays a crucial role in developing fundamental skills such as logical thinking, problem-solving, and decision-making in everyday life. For primary school students in special education, particularly slow learners, mastering basic numeracy skills is essential for academic achievement and independent living. The mathematics curriculum for special education students aged 8 to 10 years is specifically adapted to their cognitive abilities and learning needs. It focuses on foundational concepts such as number recognition, counting, addition, subtraction, shapes, and patterns through simplified instructional approaches and repetitive learning activities.

Despite these adaptations, teaching and learning mathematics among slow learners remain challenging. Many students experience difficulties in recognizing numbers and understanding basic arithmetic concepts due to limitations in cognitive processing, memory retention, and attention span. At Sekolah Kebangsaan Tenglu, slow learners often struggle to achieve numeracy proficiency because traditional classroom environments provide limited opportunities for individualized instruction and immediate feedback. Although teachers employ various teaching methods, including visual aids, hands-on activities, worksheets, and one-to-one guidance, these approaches may not always sustain students' interest and engagement throughout the learning process.

Currently, mathematics instruction in special education settings largely relies on conventional teaching methods such as printed materials, physical manipulatives, and teacher-led activities. While these methods provide personalized support, they often lack interactive and engaging elements that can motivate students and enhance learning effectiveness. To supplement traditional instruction, some schools have introduced digital learning resources, including educational applications and multimedia presentations (Prokofyeva, 2023). However, many existing applications are designed for general learners and do not adequately address the specific learning requirements of slow learners. Recent studies suggest that digital learning tools incorporating adaptive learning strategies, multimedia elements, and immediate feedback can significantly improve student engagement and learning outcomes by accommodating individual learning styles and paces (Davis, 2024).

To address these challenges, this study proposes the development of *Si Bijak Nombor*, a multimedia-based educational application designed specifically for slow learners in special education classes. The application integrates animations, audio, visual elements, and interactive activities to create an engaging learning environment that supports the development of fundamental numeracy skills. By combining educational content with multimedia features, the application aims to make learning mathematics more enjoyable, accessible, and effective for students with diverse learning needs.

The application focuses on primary school students aged 8 to 10 years and covers three main modules: *Mari Mengenal Nombor*, *Tambah & Tolak*, and an *Exercise Module*. Developed using the Multimedia Mobile Content Development (MMCD) methodology, the application will be presented in Bahasa Melayu to ensure accessibility and cultural relevance for Malaysian learners. The system is designed to provide seamless navigation, user-friendly interfaces, and interactive learning experiences that can be used both in school and at home.

Therefore, the objectives of this study are threefold: (1) to design a user-friendly multimedia application that promotes engagement in numeracy learning among slow learners; (2) to develop interactive learning activities that facilitate understanding of number recognition and basic arithmetic concepts; and (3) to evaluate users' acceptance of the application as a supplementary learning tool for special education mathematics instruction. It is anticipated that *Si Bijak Nombor* will enhance students' numeracy skills, increase learning motivation and confidence, and serve as an effective complement to conventional teaching approaches in special education classrooms.

2. Related Work

The *Si Bijak Nombor* app enhances learning through two main technologies: audio-based learning and learning style adaptation. Audio-based learning, featuring clear instructions in Bahasa Melayu and sound effects, improves comprehension and engagement, particularly for auditory learners (Oladele, 2024) (Moloo, 2023). Learning Style Adaptation customizes instructional content for visual, auditory, and kinesthetic preferences, using vibrant visuals and interactive activities like drag-and-drop tasks to cater to diverse learner needs (Bates, 2020). While these approaches effectively support varied learning styles, they require high-quality resources and careful implementation to avoid overwhelming users (Rautela, 2024).

2.1 Learning Approach

Si Bijak Nombor is an interactive learning app in Bahasa Melayu, designed for special education students aged 7 to 9 to develop numeracy skills. The app uses learning style adaption and auditory learning to provide an engaging, adaptive, and personalized experience. It simplifies number concepts through an intuitive interface and customized learning paths, enabling students to learn at their own pace. Activities include counting, number recognition, and basic math operations, supported by clear audio instructions. Key features include an adaptive difficulty to match tasks to learners' abilities, fostering confidence and steady progress. The app's auditory features, vibrant visuals, and exclusive use of Bahasa Melayu ensure cultural and linguistic relevance for Malaysian students. By addressing gaps in traditional methods and existing tools, *Si Bijak Nombor* offers a comprehensive, inclusive, and effective learning experience tailored to special education students (Rahmatullah, 2024).

2.2 Comparative Analysis

Si Bijak Nombor stands out with its adaptive difficulty, ensuring tasks match the learner's abilities, and its focused cultural relevance by exclusively using Bahasa Melayu to cater to Malaysian students. The app enhances engagement through a combination of gamification and auditory feedback, creating a fully immersive learning experience. Specifically designed for special education students, it addresses gaps in existing apps, effectively combining their strengths while overcoming their limitations to offer a comprehensive numeracy learning solution. Table 1 show the comparison between three existing applications and Si Bijak Nombor.

Table 1 Comparison of Existing Applications

Application	Mari Nombor Dwibahasa	Belajar 123 Numbers - Count & Tracing	Learning Numbers For Kids	Si Bijak Nombor
Technology Used	-Focuses on bilingual learning using static multimedia elements (audio and visuals). -Does not include gamification or adaptive difficulty features.	-Incorporates gamified elements like rewards and badges. -Does not support adaptive learning pathways.	-Uses interactive features like tracing and puzzles. -Static difficulty level without personalization.	-Adaptive Learning: Adjusts difficulty based on the learner's progress and skill level. - Audio-Based Learning: Clear verbal instructions in Bahasa Melayu for auditory support.
Content	-Covers basic numeracy concepts with instructions in both Malay and English. -Emphasis on bilingual vocabulary development alongside numeracy.	-Focus on tracing numbers and simple counting games	-Focus on number tracing and counting through playful puzzles.	- Basic numeracy concepts such as number recognition, counting, and simple math operations. - Culturally and linguistically tailored content in Bahasa Melayu for Malaysian learners.
Modules	Includes matching exercises, number recognition, and pronunciation practice.	Tracing, matching, and memory activities. Basic gamification but no in-depth learning progression.	Number recognition, tracing, and basic puzzles. No structured progression or adaptive challenges.	-Mari Mengenal Nombor -Tambah & Tolak -Latihan

Table 1 Comparison of Existing Applications (Continued)

Application	Mari Belajar Nombor Dwibahasa	123 Numbers - Count & Tracing	Learning Numbers For Kids	Si Bijak Nombor
Multimedia Elements	-Bright visuals and clear voice overs in two languages. -No animations or interactive storytelling.	-Interactive visuals and cheerful sound effects. -Limited linguistic customization.	-Colorful graphics and playful sound effects. -Limited feedback or guidance mechanisms.	-Colorful and vibrant graphics to make learning engaging. -Encouraging voice feedback, instructions, and verbal reinforcement.
Advantages	-Promotes bilingualism and simple engagement -User friendly for beginners.	-Gamified rewards motivate learners. -Easy to navigate and visually appealing.	-Encourages interaction with touch-based activities. -Simple layout for independent use by children.	- Adaptive difficulty ensures content matches the learner's current ability. -Clear audio in Bahasa Melayu ensures better understanding for auditory learners. -Designed specifically for Malaysian children, making it contextually appropriate.

3. Methodology/Framework

The Si Bijak Nombor application was created implementing the Multimedia Development Life Cycle (MDLC) methodology, with the goal of providing an engaging and dynamic educational support tool for special education students. The MDLC comprises six major phases which is concept, design, material collection, assembly, testing, and distribution. Each phase was carefully implemented to guarantee that the Si Bijak Nombor application achieves the unique needs of its users while also providing a smooth, interactive, and successful learning experience. By using this organized technique, the development team was able to produce a high-quality teaching tool focused on to the learning styles of slow learners and young children, making mathematics both accessible and enjoyable.

Navigation Structure (Figure 1) shows how users move between the different pages or sections of the application. The navigation structure helps ensure that the interface is user-friendly and easy to explore, especially for young users and special education students. Flowchart (Figure 2) represents the logical flow or process of the application step by step. It visually explains how the system behaves when the user performs an action. This figure helps developers and users understand the decision-making process and sequence of operations in the application. Content Structure (Figure 3) outlines how all the educational materials and multimedia elements are organized within the application. It shows how the content is grouped and layered, helping to ensure consistency, logical progression, and accessibility of learning materials.

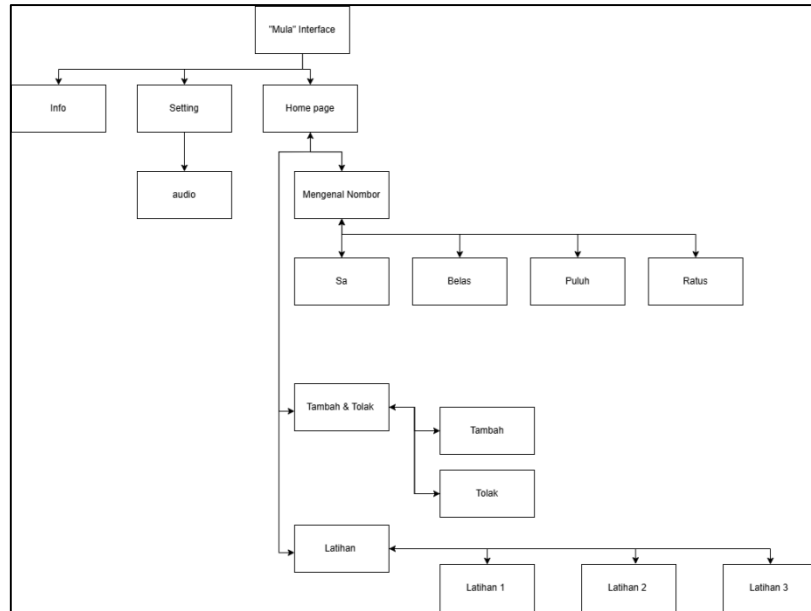


Fig. 1 Navigation Structure

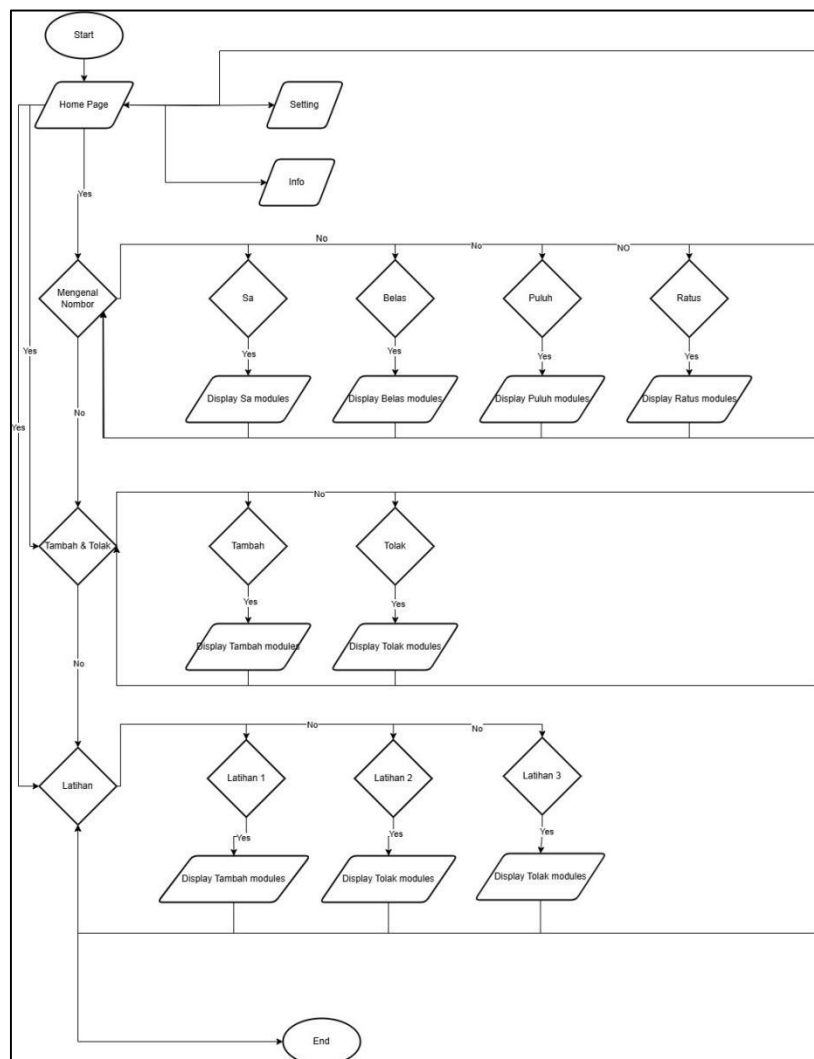


Fig. 2 Flowchart

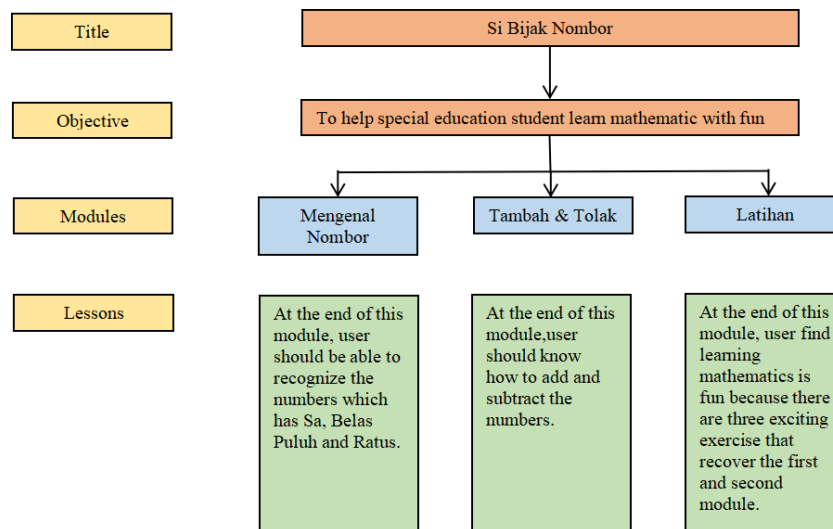


Fig. 3 Content Structure

Table 2 Application Development Workflow

Phase	Activity	Output
Concept Phase	- Identify the core idea: helping special education students learn numbers more effectively through interactive multimedia. - Gather initial requirements from teachers, parents, and students. - Define project goals, target users, and timeline. - Conduct early user analysis and educational needs.	- Project background, problem statement, objectives, and scope. - User, hardware, and software requirements. - Gantt chart and project schedule. - User feedback insights from early interviews.s.
Design Phase	- Plan app structure and user interface (UI). - Design user navigation, layout, and learning flow. - Create storyboards for interactive elements and activities. - Determine functional and non-functional requirements (e.g., usability, performance).	- UI design mockups (menus, quiz screens, results page). - Storyboard for number-learning modules. - Navigation flow and interface structure. - Functional and non-functional specification document.
Material Collecting Phase	- Collect or create multimedia assets: images, icons, audio, sound effects, etc. - Record and edit voice feedback or background music. - Gather educational content (e.g., number sets, questions).	- Image and icon assets. - Background music and sound effects. - Quiz questions and answer sets. - Voice clips for feedback.
Assembly Phase	- Integrate UI design and multimedia assets into Unity. - Implement functionality using C# scripts (e.g., BGMusic, SwitchScene, quiz logic). - Add interactive modules, animations, and transitions. - Build functional flow between scenes (main menu, quizzes, score screen).	- Interactive modules for number recognition and quizzes. - Linked scenes with buttons and feedback logic. - Script-driven activities and navigation. - Application assembled as a working Unity project.

Table 2 Application Development Workflow (Continued)

Phase	Activity	Output
Testing Phase	- Conduct alpha testing to identify bugs or logical errors. - Conduct beta testing with 12 children aged 8–10. - Collect feedback from real users (students and educators). - Analyze performance, usability, and engagement.	- Alpha test results: initial debugging and code fixes. - Beta test results: 58.3% male, 41.7% female. - Age breakdown: 33.3% (10 years), 41.7% (9 years), 25% (8 years). - Final refinements based on feedback.
Distribution Phase	- Compile final version of the application into a .apk file. - Distribute via desktop installation (file shared manually or via USB/drive). - Provide installation instructions for teachers or parents.	- Completed .apk file. - Installer folder with necessary files. - Distribution instructions.

Table 2 shows the Application Development Workflow for the “Si Bijak Nombor” project. It presents a structured overview of the six phases involved in the development process based on the Multimedia Development Life Cycle (MDLC). This workflow helps to ensure that the development process is systematic, organized, and aligned with the project’s goals. It also demonstrates how multimedia elements and interactive features were planned, created, and integrated into the final product.

3.1 Concept Phase

A questionnaire survey through online interview via Google Meet with subject matter expert who teach the special education students has been done. The meeting was conducted with Mr Roslee from Sekolah Kebangsaan Tenglu. Meanwhile Table 2 show the user requirement analysis extracted from the interview with SME and questionnaire.

Table 3 User Requirement Analysis

Stakeholder	Role in product	Design implication	Action needed
Subject Matter expert(SME): Mr Roslee	Content consultant expert in Syllable learning for special education students.	-Easy to navigate the pages. -Interactive and simple user interface.	-Contain back and home button. -Consistent button size. -Simple navigational structure. -More icon button than the text-based. -Suitable font and readable .

3.2 Design Phase

In this second phase it necessary to understand the system requirements which is the requirement that the system or application must do or what features it needs. In this section, the system requirement analysis of the Si Bijak Nombor will be explained including the functional and non-functional requirements.

Table 4 *Functional Requirement*

Functional Requirement	Module	Description
Autonomous System	Homepage	The button shall display three modules which is "Mengenal Nombor", "Tambah & Tolak" and "Latihan" modules after user hit the button "Mula".
	Mengenal Nombor	In this module user has four choices which is "Sa", "Belas", "Puluh" and "Ratus".
	Tambah & Tolak	In this module user can choose to learn "Tambah" or "Tolak".
	Latihan	In this module user has three choices of "Latihan".
	Setting	The application shall provide the setting page to on or off the sound.
User Interaction	Mengenal Nombor	User shall be able to understand each content.
	Tambah & Tolak	User shall be able to understand and count the number.
	Latihan	User shall be able to know and count to answer the question.

Table 5 *Non-Functional Requirements*

Non-functional Requirement	Descriptions
Performance	-The application is offline-based when it can play without an internet connection. -The application should be two second of response time for any interaction.
Operational	-The application available 24 hours per day. -The application should be able to operate on window 11.
Usability	-The application should be user friendly and easy to use for users.
Legal	-The application cannot be modify or change any content from user but can view only.
Cultural	-The application will apply in simple Malay language

3.3 Material Collecting Phase

Planning Si Bijak Nombor's technical and design elements was part of the process design step. To keep kids' attention, activities included creating interactive elements like visually appealing animations and drag-and-drop number matching games. Detailed technical designs, such as UI/UX layouts, the incorporation of sounds for encouragement of this phase. For example, to inspire kids and provide a memorable learning environment, vibrant characters and sound effects were incorporated.

Table 6 *Button Design*

Button	Function Descriptions
	• This “Mula” button appears on the first user interface. • It navigate user to the module Home page
	• This “Keluar” button appear on the first user interface. • It navigate user to exit the app.
	• This home icon appear in every interface to navigate user to the homepage interface
	• This is information icon that display info of Si Bijak Nombor application.
	• This icon is to lead user to next page in “Mengenal Nombor” module.
	• This icon is to lead user to return to the page before in “Mengenal Nombor” module.
	• This icon is to lead user to the main page which is “Mengenal Nombor”, “Tambah & Tolak” and “Latihan” modules.
	• This button used in “Tambah & Tolak” module lead user to next page.
	• This button used in “Tambah & Tolak” module lead user to the page before.
	• This is setting icon that lead user to setting page which has in every page of the application.
	• This icon has in info and setting page navigate user to back in the page they has been before.
	• This button design is used in “Latihan” interface which is button for “Latihan 1”, “Latihan 2” and “Latihan 3” to navigate user to each modules.
	• This button design is used in “Mengenal Nombor”, “Tambah & Tolak”, “Latihan” and “Rekod Latihan” modules to navigate user to the content of each modules.

Table 6 *Button Design (Continued)*

Button	Function Descriptions
	This button design is used in “Mengenai Nombor” interface which is button for “Sa”, “Belas”, “Puluh” and “Ratus” to navigate user to each modules.
	This button design is used in “Tambah & Tolak” interface which is button for “Tambah” and “Tolak” to navigate user to each modules.

3.4 Assembly Phase

The Unity engine was used to incorporate all multimedia elements, including images, audio, and interactive components, into the final application during assembly. This phase involved combining the main components defined during the design and development phases to create a fully functional interactive learning application.

To provide an entertaining and engaging experience, the BGMusic.cs script was used (Figure 4). This script uses DontDestroyOnLoad() and looping settings to ensure that the background music plays uninterrupted when the user navigates through different scenes. The music provides stability and emotional engagement throughout the learning experience. Sound effects for actions such as correct or incorrect replies were handled with Unity's built-in AudioSource component and a script called SoundEffect.cs script (Figure 6), which plays feedback noises when users interact with items correctly or poorly. These noises boost motivation and promote learning reinforcement.

The main scenes, which included the quiz modules, score display, and record display, were linked and accessed by buttons and custom C# scripts. Each button was assigned a function to handle the smooth transition between scenes and modules using a script like SceneSwitcher.cs (Figure 4), ensuring user-friendly interaction for all users.

The user interface (UI) was created to be simple, bright, and intuitive, with a focus on special education kids. Clear iconography, high-contrast images, and appealing character illustrations were employed to improve accessibility and keep users interested. All visual elements, such as number cards, drag-and-drop boxes, and pop-up feedback panels, were carefully selected to promote cognitive development and visual learning.

```

public class BGMusic : MonoBehaviour
{
    public static BGMusic instance;

    void Awake()
    {
        if (instance != null)
            Destroy(gameObject);
        else
        {
            instance = this;
        }
        DontDestroyOnLoad(this.gameObject);
    }
}

```

Fig. 4 *BgMusic Script*

```
using System.Collections;

using System.Collections.Generic;

using UnityEngine;

using UnityEngine.SceneManagement;

public class SceneManagerScript :
MonoBehaviour

{

public void LoadScene(string sceneName)

{

SceneManager.LoadScene(sceneName);

}

}
```

Fig. 5 *SwitchScene Script*

```
using UnityEngine;

public class SoundEffect : MonoBehaviour
{

    public AudioSource audioSource;

    public void PlaySound()
    {
        audioSource.Play(); // mainkan bunyi
    }

}
```

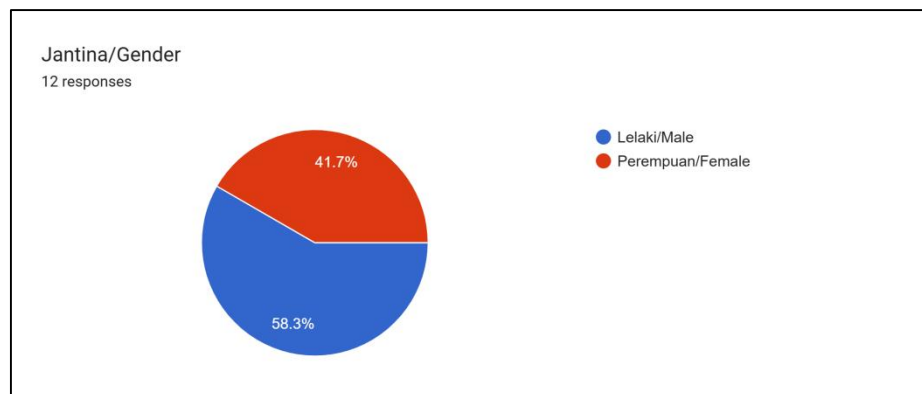
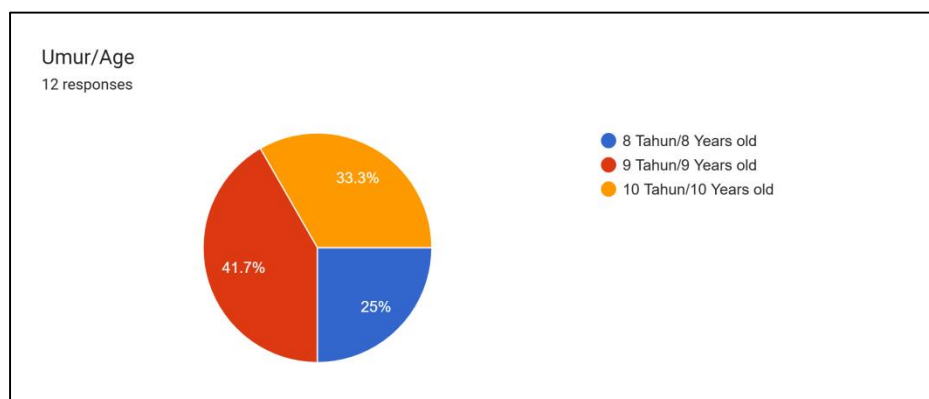
Fig. 6 *SoundEffect Script*

Table 7 User Main Interfaces

Item	Description
	- Onboard screen - There is a Start button here - Start button will navigate user to the Main Menu page
	- Home page -Display four modules
	-Module of Mengenal Nombor -Contain four chapter
	-Module of Tambah & Tolak -Contain two chapter
	-Module of Latihan -Contain 3 exercise

3.5 Testing Phase

Known as beta testing, this stage concentrates on assessing the usability and functionality of the application through the System Usability Scale (SUS) method. A total of 12 respondents participated in the test, all of whom were special education students from SK Sri Benut. The students were between the ages of 8 and 10. Among them, 58.3% were male and 41.7% were female (Figure 5). In terms of age distribution, 33.3% were 10 years old, 41.7% were 9 years old, and 25% were 8 years old (Figure 6). The purpose of this SUS-based beta testing was to collect feedback on how easy, engaging, and appropriate the application is for its intended users.

**Fig. 7 Gender****Fig. 8 Age**

3.6 Distribution Phase

After the testing phase was done, the application was ready to be distributed to users. The application was created as a .apk file in Unity and tested on a desktop machine. The .apk file was distributed manually by file-sharing services such as Google Drive. This made it simple for teachers, parents, and students to download and use the app. This strategy provided easy access to the app for intended users, particularly special education children.

4. Result and Discussion

The thorough alpha testing carried out independently with the Subject Matter Expert(SME) teacher made the beta testing phase successful. This development concentrated on locating and resolving significant usability, interface, and technical problems throughout this phase. Before exposing the app to real users, this application had the chance to thoroughly examine how it works and make any modifications that are needed by testing it both independently and with the SME teacher. Because of this, the student beta testing went well, and the majority of the feedback focused on improving the user experience rather than fixing significant bugs. This demonstrates that throughout the beta testing phase, the application was already stable and usable. The System Usability Scale questions used during testing are shown in Table 8.

Table 7 Alpha Testing

Category	Expected Result	Actual Result
"Mula" button	Navigate to homepage	Pass
"Keluar" button	Navigate to exit application	Pass
Info button	Navigate to info page	Pass
"Mengenal Nombor" button	Navigate to "mengenal nombor" page	Pass

Table 7 Alpha Testing (Continued)

Category	Expected Result	Actual Result
"Tambah & Tolak" button	Navigate to "Tambah" and "Tolak" page	Pass
"Latihan" button	Navigate to "Latihan" page	Pass
"Rekod Latihan"	Navigate to exercise record page	Pass
"Sa" button	Navigate to "Sa" content page	Pass
"Belas" button	Navigate to "Belas" content page	Pass
"Puluh" button	Navigate to "Puluh" content page	Pass
"Ratus" button	Navigate to "Ratus" content page	Pass
"Tambah" button	Navigate to "Tambah" content page	Pass
"Tolak" button	Navigate to "Tolak" content page	Pass
"Latihan 1" button	Navigate to "Latihan 1" content page	Pass
"Latihan 2" button	Navigate to "Latihan 2" content page	Pass
"Latihan 3" button	Navigate to "Latihan 3" content page	Pass
Next button	Navigate to next content page	Pass
Previous button	Navigate to previous content page	Pass

Table 8 Beta Testing

Questions

Saya fikir saya ingin menggunakan sistem ini dengan kerap./ I think that i would like to use this application frequently.

12 responses

Response	Count	Percentage
1	0	0%
2	0	0%
3	0	0%
4	10	83.3%
5	2	16.7%

Saya mendapati aplikasi ini susah./ I found the application unnecessarily complex.

12 responses

Response	Count	Percentage
1	4	33.3%
2	8	66.7%
3	0	0%
4	0	0%
5	0	0%

Saya rasa aplikasi ini mudah digunakan./ I think this application is easy to use.

12 responses

Response	Count	Percentage
1	0	0%
2	0	0%
3	0	0%
4	10	83.3%
5	2	16.7%

Descriptions

Regarding question 1, 16.7% of respondents strongly agree with the statement that they prefer to use this program regularly, while 83.3% agree.

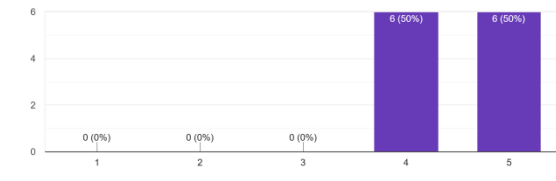
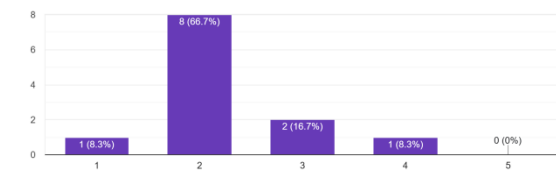
Regarding question 2, 66.7% disagree and 33.3% strongly disagree that this application is too complicated.

Regarding question 3, 16.7% of respondents strongly agree and 83.3% simply agree that this program is easy to use.

Table 8 Beta Testing (Continued)

Questions	Descriptions																		
Saya rasa saya memerlukan sokongan orang teknikal untuk dapat menggunakan aplikasi ini./ I think i would need the support of a technical person to be able to use this system. 12 responses <table><tr><th>Response</th><th>Count</th><th>Percentage</th></tr><tr><td>1</td><td>3</td><td>25%</td></tr><tr><td>2</td><td>8</td><td>66.7%</td></tr><tr><td>3</td><td>0</td><td>0%</td></tr><tr><td>4</td><td>1</td><td>8.3%</td></tr><tr><td>5</td><td>0</td><td>0%</td></tr></table>	Response	Count	Percentage	1	3	25%	2	8	66.7%	3	0	0%	4	1	8.3%	5	0	0%	Regarding question 4, 66.7% of respondents just disagree and 8.3% agree that they require technical assistance to use this application, whereas 25% strongly disagree.
Response	Count	Percentage																	
1	3	25%																	
2	8	66.7%																	
3	0	0%																	
4	1	8.3%																	
5	0	0%																	
Saya dapati pelbagai fungsi dalam aplikasi ini disepadukan dengan baik./I found the various functions in this application were well integrated. 12 responses <table><tr><th>Response</th><th>Count</th><th>Percentage</th></tr><tr><td>1</td><td>0</td><td>0%</td></tr><tr><td>2</td><td>0</td><td>0%</td></tr><tr><td>3</td><td>0</td><td>0%</td></tr><tr><td>4</td><td>11</td><td>91.7%</td></tr><tr><td>5</td><td>1</td><td>8.3%</td></tr></table>	Response	Count	Percentage	1	0	0%	2	0	0%	3	0	0%	4	11	91.7%	5	1	8.3%	Regarding question 5, 8.3% strongly agree and 91.7% agree that the application's functions were properly integrated.
Response	Count	Percentage																	
1	0	0%																	
2	0	0%																	
3	0	0%																	
4	11	91.7%																	
5	1	8.3%																	
Saya rasa aplikasi ini tidak konsisten./ I think this application is inconsistent. 12 responses <table><tr><th>Response</th><th>Count</th><th>Percentage</th></tr><tr><td>1</td><td>1</td><td>8.3%</td></tr><tr><td>2</td><td>11</td><td>91.7%</td></tr><tr><td>3</td><td>0</td><td>0%</td></tr><tr><td>4</td><td>0</td><td>0%</td></tr><tr><td>5</td><td>0</td><td>0%</td></tr></table>	Response	Count	Percentage	1	1	8.3%	2	11	91.7%	3	0	0%	4	0	0%	5	0	0%	Regarding question 6, 8.3% of respondents strongly disagree with the statement that this application is inconsistent, while 91.7% disagree.
Response	Count	Percentage																	
1	1	8.3%																	
2	11	91.7%																	
3	0	0%																	
4	0	0%																	
5	0	0%																	
Saya akan membayangkan bahawa kebanyakan orang akan belajar menggunakan aplikasi ini dengan cepat./I would imagine that most people would learn to use this application very quickly. 12 responses <table><tr><th>Response</th><th>Count</th><th>Percentage</th></tr><tr><td>1</td><td>0</td><td>0%</td></tr><tr><td>2</td><td>0</td><td>0%</td></tr><tr><td>3</td><td>0</td><td>0%</td></tr><tr><td>4</td><td>8</td><td>66.7%</td></tr><tr><td>5</td><td>4</td><td>33.3%</td></tr></table>	Response	Count	Percentage	1	0	0%	2	0	0%	3	0	0%	4	8	66.7%	5	4	33.3%	Regarding question 7, 66.7% of respondents agree and 33.3% strongly agree that individuals would pick up the use of this application extremely quickly.
Response	Count	Percentage																	
1	0	0%																	
2	0	0%																	
3	0	0%																	
4	8	66.7%																	
5	4	33.3%																	
Saya mendapati aplikasi itu susah untuk digunakan./I found the application was cumbersome to use. 12 responses <table><tr><th>Response</th><th>Count</th><th>Percentage</th></tr><tr><td>1</td><td>1</td><td>8.3%</td></tr><tr><td>2</td><td>11</td><td>91.7%</td></tr><tr><td>3</td><td>0</td><td>0%</td></tr><tr><td>4</td><td>0</td><td>0%</td></tr><tr><td>5</td><td>0</td><td>0%</td></tr></table>	Response	Count	Percentage	1	1	8.3%	2	11	91.7%	3	0	0%	4	0	0%	5	0	0%	Regarding issue 8, 8.3% of respondents strongly disagreed and 91.7% disagreed that the application was difficult to use.
Response	Count	Percentage																	
1	1	8.3%																	
2	11	91.7%																	
3	0	0%																	
4	0	0%																	
5	0	0%																	

Table 8 Beta Testing (Continued)

Questions	Descriptions																		
Saya berasa sangat yakin menggunakan aplikasi ini./I felt very confident using this application. 12 responses  <table><tr><th>Rating</th><th>Count</th><th>Percentage</th></tr><tr><td>1</td><td>0</td><td>0%</td></tr><tr><td>2</td><td>0</td><td>0%</td></tr><tr><td>3</td><td>0</td><td>0%</td></tr><tr><td>4</td><td>6</td><td>50%</td></tr><tr><td>5</td><td>6</td><td>50%</td></tr></table>	Rating	Count	Percentage	1	0	0%	2	0	0%	3	0	0%	4	6	50%	5	6	50%	50% of respondents strongly agree with question 9 that they feel very confident using this program, while the remaining respondents agree.
Rating	Count	Percentage																	
1	0	0%																	
2	0	0%																	
3	0	0%																	
4	6	50%																	
5	6	50%																	
Saya perlu belajar banyak perkara sebelum saya boleh menggunakan aplikasi ini./I need to learn a lot of things before I could get going with this application. 12 responses  <table><tr><th>Rating</th><th>Count</th><th>Percentage</th></tr><tr><td>1</td><td>1</td><td>8.3%</td></tr><tr><td>2</td><td>8</td><td>66.7%</td></tr><tr><td>3</td><td>2</td><td>16.7%</td></tr><tr><td>4</td><td>1</td><td>8.3%</td></tr><tr><td>5</td><td>0</td><td>0%</td></tr></table>	Rating	Count	Percentage	1	1	8.3%	2	8	66.7%	3	2	16.7%	4	1	8.3%	5	0	0%	In response to question 10, 66.7% of respondents disagree that they should understand a lot before using this program, compared to 8.3% who strongly disagree, 16.7% who are neutral, and 8.3% who agree.
Rating	Count	Percentage																	
1	1	8.3%																	
2	8	66.7%																	
3	2	16.7%																	
4	1	8.3%																	
5	0	0%																	

5. Conclusion

An interactive instructional application titled Si Bijak Nombor was created for desktop platforms with the goal of improving primary school students' number recognition and foundational mathematical abilities, particularly for those in special education. The Multimedia Development Life Cycle (MDLC) approach was successfully used to construct the application, and the results of alpha and beta testing show that it functions as anticipated. The positive outcomes from the beta testing phase, discussed in the previous chapter, indicate that the application is well-received by the target users. A total of 12 respondents aged between 8 to 10 years participated in the testing process, and the results show that the majority agreed the application is effective, engaging, and easy to use. In conclusion, the Si Bijak Nombor application has successfully fulfilled its objectives as an educational tool for primary school students, particularly those in special education. The use of the MDLC approach ensured that the development process was well-organized and thorough. The app is effective in making learning more interactive, enjoyable, and accessible. With continued development and enhancement, the application has strong potential to further support inclusive and engaging learning in the future. Si Bijak Nombor is an important tool for promoting early mathematics learning, particularly for students who need more interesting and easily available learning materials. To reach a larger audience, future enhancements can involve extending platform compatibility to mobile devices.

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Author Contribution

The authors confirm contribution to the paper as follows: **study conception and design:** Nurnabilah Hannani binti Mohd Yusof, Noraziahtulhidayu binti Kamaruddin; **data collection:** Nurnabilah Hannani binti Mohd Yusof; **analysis and interpretation of results:** Nurnabilah Hannani binti Mohd Yusof, Noraziahtulhidayu binti Kamaruddin; **draft manuscript preparation:** Nurnabilah Hannani binti Mohd Yusof, Noraziahtulhidayu binti Kamaruddin. All authors reviewed the results and approved the final version of the manuscript.

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Appendix A: Questionnaire in Online Meeting with SME

Questionnaire	Answer
What is the interest of special education students in mathematics subject?	This subject was tough especially to special education students.
What current method do teacher used to teach the special education students?	Printed worksheets: Simple tasks and exercises on paper. One-on-one teacher support: Personalized attention but may lack interaction and engagement for sustained focus.
What content that suitable for students from 7 years old until 9 years old?	For 7 to 9-year-old special education students, the focus should be on basic numeracy skills using simple and interactive approaches.(Sa, Teen Numbers, Tens, Hundreds, adding, subtraction and exercise)
What type of visual elements are most engaging and easy to understand for special education students?	Bright and simple visuals with clear outlines are highly effective.
Are there specific colors or visual themes that enhance student focus?	Primary colors like red, blue, and yellow are appealing. Using high contrast themes
What additional features are needed for students with visual impairments?	Audio instructions, and larger text/font options.
Does the use of interactive voice or audio help in their learning process?	Yes, interactive audio makes learning engaging and reinforces understanding.
Are larger buttons or text sizes more suitable for special education students?	Larger buttons and bold, readable text sizes are necessary for accessibility.
What is the best way to ensure students don't get easily confused while navigating the app?	Use clear and distinct paths with minimal branching. A "home" button should be accessible at all times, and progress indicators can help track where they are.
How can the app design help build students' confidence in their abilities?	Gradual progression in difficulty, frequent rewards