

Android-Based Trivia Game Development to Raise Children's Awareness about Disabilities

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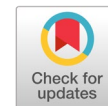
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ABSTRACT

Disability, a multifaceted and widespread phenomenon impacting millions globally, suffers from a prevalent lack of awareness among the general population, particularly adults. Consequently, it becomes imperative to instill an understanding and appreciation for diversity from early childhood. Introducing children to the concept of disability at a young age proves beneficial in fostering such comprehension and appreciation. Digital games, increasingly popular and effective in educating children, offer numerous advantages such as motivation, engagement, immediate feedback, and support.

The development of an Android game, "Kuis Disa," aimed to address this need for early education on disability, guided by the MDLC framework through stages of planning, design, development, testing, deployment, and maintenance. Collaborative efforts from developers and educators involved collecting diverse materials like images, audio files, and disability-related trivia for the game. The study's objective encompassed assessing the MMDLC's efficacy in guiding game development, evaluating the game's educational value, and gauging user engagement. The outcome, a system usability score of 81.53, reflects participants' overall perception of the game as user-friendly, intuitive, and effective in meeting their needs.



KEYWORDS

Disability
Education
Learning
Children
MDLC



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1. Introduction

The teaching and learning process plays a crucial role in student comprehension and achievement [1]. Educational games, particularly those combining digital gaming and knowledge, have become prevalent tools for enhancing learning outcomes [2]. Integrating science and technology into education, especially through game-based concepts, promotes active student engagement and effective learning. However, addressing the educational needs of children with disabilities, who constitute a significant portion of the population, poses unique challenges in Indonesia.

Persons with disabilities face various physical, mental, and social challenges, contributing to a complex issue that demands attention [3]. In Yogyakarta alone, there are over 27,000 individuals with disabilities, with intellectual disabilities being the highest at 26% [4]. Indonesia, with its diverse cultural landscape, struggles with issues like limited accessibility, educational barriers, inadequate healthcare, and social stigma against individuals with disabilities.

Negative societal perceptions and stereotypes further hinder the inclusion of children with disabilities [5]. Overcoming these misconceptions is crucial for providing equal opportunities to these children. An interview with a curriculum expert highlighted prevalent misconceptions and the need for widespread awareness and education to dispel biases. Fostering an inclusive mindset within the community is essential for fair treatment and opportunities for children with disabilities.

To address these challenges, an Android application was developed, targeting a broad audience due to the widespread use of the Android operating system in Indonesia. The decision to create a trivia-style game stems from the recognized effectiveness of trivia games in engaging and educating players. The

game's design aims to capture the attention of normal children, encouraging active participation and transforming the learning process into an enjoyable experience. By incorporating disability awareness topics into a quiz format, the game seeks to dispel misconceptions, reduce stigma, and promote understanding and acceptance of individuals with disabilities among normal children.

The primary goal of the trivia game is to foster empathy, compassion, and inclusive attitudes among normal children towards their peers with disabilities. Through an interactive and entertaining approach, the game serves as a powerful tool for instilling knowledge and promoting a more enlightened and compassionate future.

2. Method (bold, 11 pt) (one single space, 11pt font)

The method used in this app development is MDLC (Multimedia Development Life Cycle). The stages of MDLC can be seen in picture 1 below.

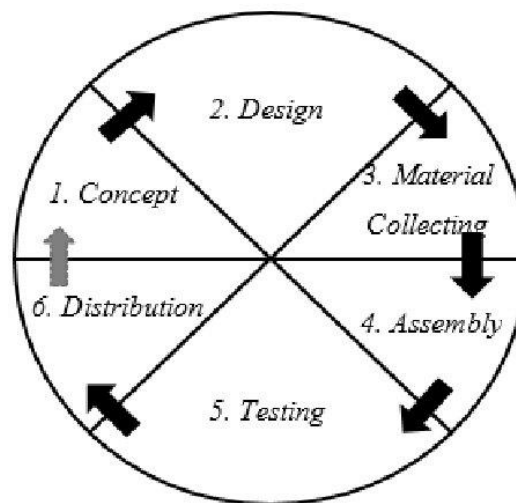


Figure 1. MDLC Stages

2.1. Determining Research Objects

Determining the Research Object is the initial stage in the research, the object of this research is the Android-Based Trivia Game Development to Raise Children's Awareness about Disabilities.

2.2. Data Collecting Method

2.2.1. Documentation

Documentation technique involves collecting research data through reading literature like books, papers, and articles, as well as studying internet resources. Sugiyono describes it as a method to obtain data from various sources. The researcher chose this method due to its accessibility and the abundance of resources on children's education about disabilities. The collected data includes public knowledge about disabilities, diverse school approaches to disability education, and the existence of similar apps for educating children about disabilities.

2.2.2. Surveys

Surveys, a common research data collection method, involve asking a large number of people questions about a specific topic [17]. Administered in various ways, such as in person, over the phone, or online, this research will utilize Google Forms to survey college students. The data sought includes whether these students received knowledge about disabilities during childhood. Another survey will assess UI design perceptions, targeting both 13 to 16-year-old children and university students specializing in UI design.

2.2.3. Interview

The interview method, a qualitative research technique, involves face-to-face or phone conversations to gather participants' perceptions and experiences about a specific topic [18]. In this study, teachers, particularly those with experience in teaching children with disabilities, will be interviewed. They offer valuable insights into how children learn about disabilities, the challenges in teaching this topic, and the

most helpful resources. Teachers also play a crucial role in determining suitable materials for the application.

2.3. Research Stage

The Multimedia Development Life Cycle (MDLC) is a popular method for creating multimedia products like android games, involving stages like Concept, Design, Material Collection, Assembly, Testing, and Distribution. Utilizing a flowchart to illustrate these stages can offer a clear and concise overview of the research process before delving into the details of each stage

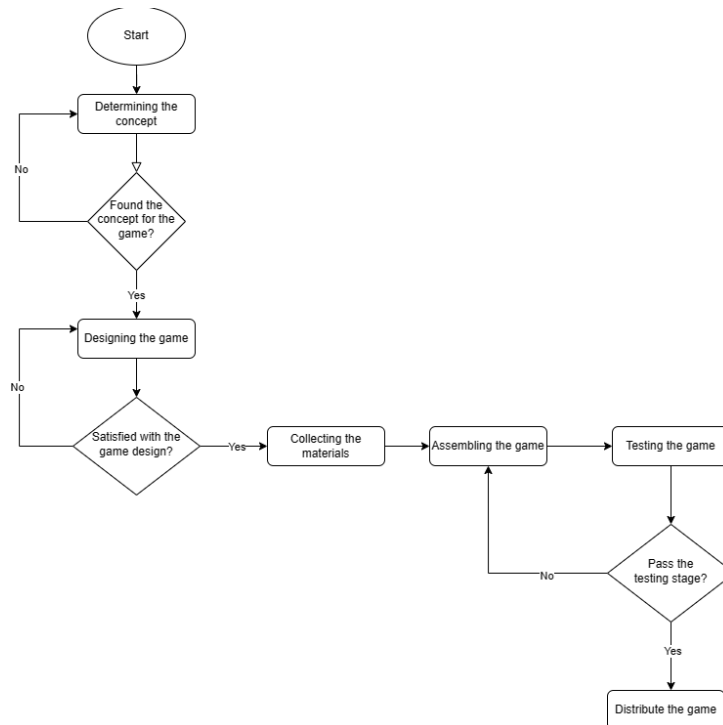


Figure 2. Research stage flowchart

2.3.1. Concept

In the concept stage, the researcher determined the purpose of the game, namely to provide knowledge to children about disabilities but in an interactive and fun way.

2.3.2. Design

In this stage, the researcher develops the application's design and layout, utilizing wireframes, storyboards, and prototypes to convey the game's appearance, user experience, and gameplay. Software requirements, initially identified in the needs analysis stage, progress to design representation, preparing for implementation in the subsequent phase. Key design aspects encompass flowchart and user interface design.

2.3.3. Material Collecting

In this stage, educational content for the application is gathered from disability literature studies. Additional materials, including disability-related images, graphics, sound effects, and trivia questions with answers, are also collected.

2.3.4. Assembly

In this stage, the project is designed and developed using various tools and techniques, involving the creation of graphics, animations, audio, and video content, as well as programming and coding. The researcher designs and develops the game based on gathered data and materials, using the Multimedia Development Life Cycle (MDLC) method, chosen for its focus on creating interactive multimedia for children to learn about disabilities. Next steps include testing the game and inviting beta testers to provide feedback for improvements.

2.3.5. Testing

In this stage, the researcher may test the game using the System Usability Scale (SUS) method, which involves asking users standardized questions to evaluate usability and user-friendliness. Test subjects will

include college students with mobile android game development experience to identify technical issues, and teachers from schools for disabled children to assess the accuracy and appropriateness of the game's content.

2.3.6. Distribution

In this stage, the finished game would be made available online either from an outside download link or from Google Play Store.

3. Results and Discussion

3.1. Data Collection Results

Based on the results of data collection that has been carried out in SLB Negeri 2 Yogyakarta and online through Google Forms, the following data is obtained.

3.1.1. Documentation Results

Documentation involves researching articles and books from various sources, including the internet and disability-focused literature. Comparative analysis is conducted, revealing a lack of disability knowledge in college students until ages 16-17. Students express a desire for more engaging ways to learn, such as through cartoons or video games. Examination of school books shows a deficiency in disability education. Based on this, an android trivia app for elementary school children is created to enhance understanding of disabilities.

3.1.2. Interview Results

An interview with the vice curriculum of SLB Negeri 2 Yogyakarta gauged the best method for teaching children about disabilities and authenticated materials for an android trivia game. Given the sensitivity of the topic, an expert's input ensures non-offensive and appropriate content presentation. Insights into challenges dealing with societal perceptions about kids with disabilities were sought to understand potential educational issues. The conclusion from the interview supports the use of an educational android game as an effective method. Approval for content materials for the application was obtained.

3.1.3. Survey Results

A survey targeting college students aimed to assess their knowledge about disabilities, exploring the potential long-term impact of early education on attitudes. The findings reveal that only 5 out of 20 students grasp disabilities beyond physical issues during ages 6-12. The majority develop this understanding at later ages (13-18) through real-life experiences or media exposure. Another survey solicited opinions on the UI design of the app, involving 10 middle-school children and 10 informatics students specializing in android media development. The overall result indicates general approval of the app's design.

3.2. Determining the Concept

The initial stage for developing the application is the concept design phase, guided by data from documentation and surveys. This involves outlining both functional and non-functional requirements.

Table 1. Outlining the requirements for the Concept

Non-functional Requirements	Functional Requirements
Main users: young children in elementary and junior high school	Ensure prompt responsiveness to user interactions
Child-friendly UI with vibrant colors, large buttons, and intuitive controls	Implement an intuitive and child-friendly user interface
Ensure all buttons function correctly	Ensure the game effectively imparts knowledge about disabilities
Verify proper functionality of all app sounds with adjustable volume	Develop a stable and reliable game to prevent crashes or interruptions
Confirm all scenes load correctly	

3.3. Design of the Application

3.3.1. Content Design

The content design for the Disability Trivia game ensures a comprehensive and engaging user experience. Beginning with a brief display of the game title on the opening page, users are seamlessly transitioned to the main page, featuring menu buttons for 'PLAY,' 'STORIES,' and 'SETTINGS,' each connecting to distinct game features. The Play Menu page offers two buttons, 'LEVEL 1' and 'LEVEL 2,' leading users to different game levels. Level 1 introduces 10 basic theory questions with a 10-second timer, while Level 2 presents 5 scenarios, each with 2 questions and a timer. The third and final level, LEVEL 3 Page, challenges users to find hidden objects in pictures. The STORIES Page lists successful figures with disabilities, accompanied by biographies and navigation buttons. Additionally, the Settings Page allows users to configure music and sound effects (sfx) settings, enhancing their overall gaming experience.

3.3.2. Rules of the Game

The game's rules are crafted to provide players with a fair, enjoyable, and educational experience. Each of the three levels consists of 10 questions, each valued at 10 points, totaling 100 points per level. For instance, correctly answering all questions yields 100 points, while getting one question wrong results in 90 points. The levels present unique challenges: the first focuses on fundamental concepts about disabilities, the second involves real-life scenarios, and the third requires players to find hidden objects related to disabilities. These challenges are strategically designed to incrementally deepen players' awareness and understanding of disabilities as they progress through the game.

3.3.3. Menu Design

The game's rules are crafted to provide players with a fair, enjoyable, and educational experience. Each of the three levels consists of 10 questions, each valued at 10 points, totaling 100 points per level. For instance, correctly answering all questions yields 100 points, while getting one question wrong results in 90 points. The levels present unique challenges: the first focuses on fundamental concepts about disabilities, the second involves real-life scenarios, and the third requires players to find hidden objects related to disabilities. These challenges are strategically designed to incrementally deepen players' awareness and understanding of disabilities as they progress through the game.

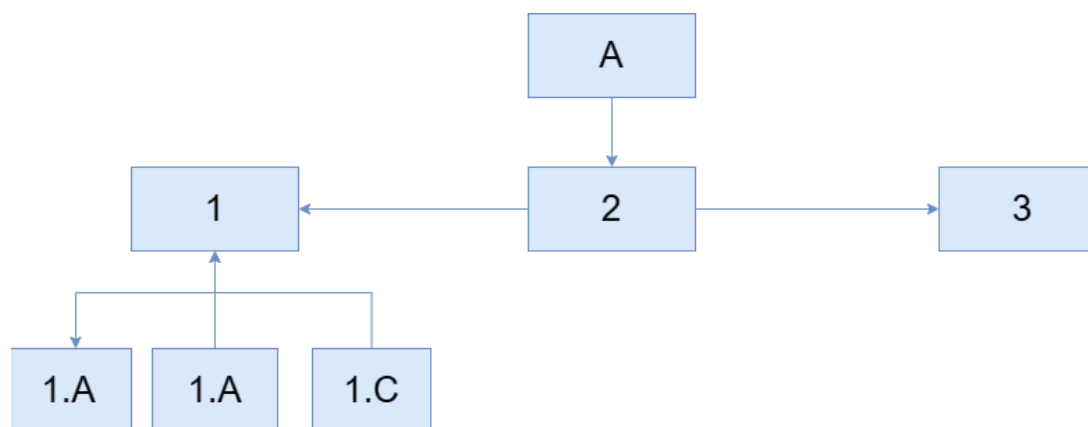


Figure 2. Menu Structure

3.3.4. Navigation Design

Designing navigation diagrams is essential to visually represent the flow and structure of the app's navigation, ensuring a seamless and user-friendly experience for the game users.

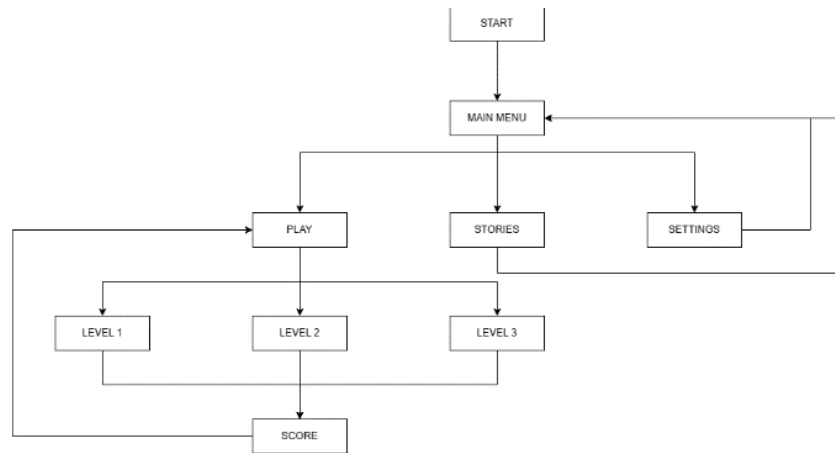


Figure 3. Navigation Diagram

3.3.4. Storyboard

Creating a storyboard is essential to visually outline the sequence of screens, interactions, and user actions in the game, providing a blueprint for the app's development and ensuring a coherent and engaging user experience.

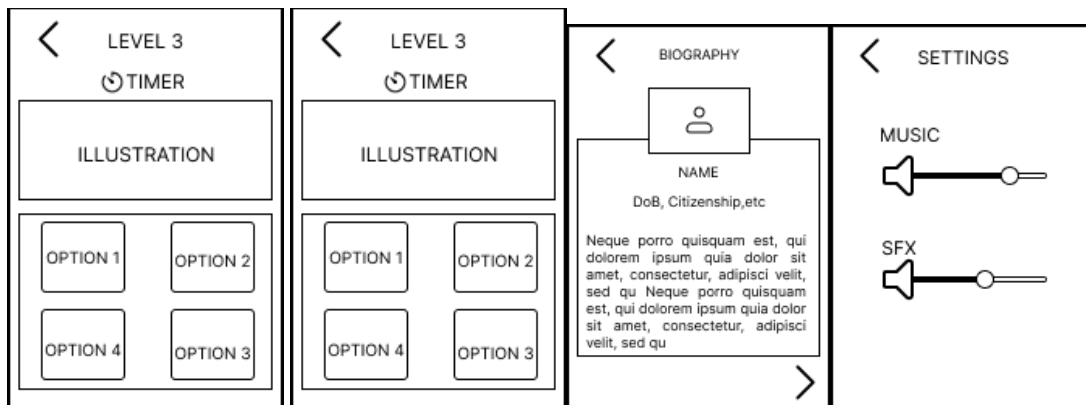


Figure 4. Storyboards

3.4. Material Collecting

After finalizing the concept and design of the system to be developed, the subsequent stage entails gathering essential materials and creating assets for the Disability Game quiz. The collected materials encompass pictures of well-known figures with disabilities, background images, sound effects, music, disability-related topic materials, and other assets essential for the game's development.





Figure 5. Materials

3.5. Assembly

Implementation or assembly is the stage of implementing the concept that has been made before. The goal is that the program can be operated by users according to the concepts that have been made.

3.5.1. Main Menu

The main menu page is the first menu that appears when the game started. It contains three buttons that takes the user to a different page. There is also an exit button at the top corner of the screen.



Figure 6. Main menu screen

3.5.2. Play Menu

The Play Menu page is accessed when the user selects the 'PLAY' button from the main menu. This page features two buttons, each leading to the LEVELS Page. However, during the user's initial game launch, the LEVEL 2 button is initially locked.

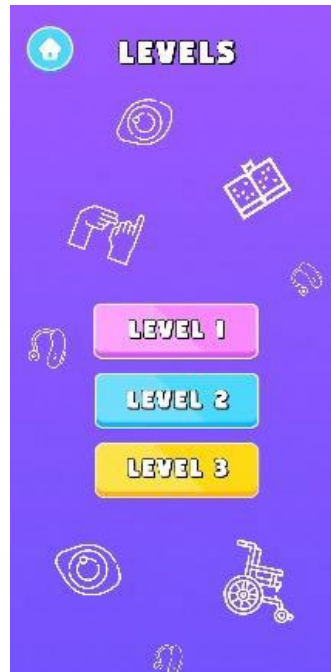


Figure 7. Play menu screen

3.5.3. LEVELS Menu

LEVELS page is displayed when the user selects one of the buttons from play menu page. This page is where the gameplay started. A question is displayed and the user has 20 seconds to answer the question. There is a back button at the top left of the screen for the user to go back to play menu page.



Figure 8. LEVEL 1 menu screen

3.5.4. STORIES Menu

STORIES page is displayed when the user selects the STORIES button at the main menu page. STORIES page displayed a biography of successful figures with disabilities.



Figure 9. STORIES menu screen

3.5.5. Settings Menu

SETTINGS page is displayed when the user selects the SETTINGS button at the main menu. SETTINGS page is where the user can adjust the volume of both the music and fx audio.



Figure 10. Settings menu screen

3.6. Testing

3.6.1. Black Box Test

Black box testing is applied to evaluate the application's functionality and user experience without delving into its internal code. This method ensures a focused assessment of the application's external behavior, enabling a thorough evaluation of the quiz's features, confirming alignment with intended functionalities, and identifying any potential issues before the final release. The testing results indicate that all buttons and functions of the Android-based Disability Trivia game are working correctly. The assessment of the game reveals a perfect score, with 27 out of 27 aspects found to be in accordance with the functional requirements, resulting in a 100% alignment. No issues deviating from the specified requirements were identified during testing. Based on the outcomes of the black box testing, it can be confidently concluded that the Disability Trivia game aligns well with its functional requirements and operates seamlessly.

3.6.2. System Usability Scale Test

The System Usability Scale (SUS) test evaluated the Disability Trivia game with children from Kelurahan Gedongkiwo, guided by parents, and university students. Participants played the game with instructions and assistance, providing feedback on usability and user-friendliness. The test, involving diverse users, aimed to gather insights for refining the game's design. Results from this comprehensive assessment will enhance the game, ensuring an inclusive and enjoyable learning experience.

Table 2. SUS Test Questions

NO	Questions
1	I found the game unnecessarily complex.
2	I thought the game was easy to use.
3	I felt confident using the various features of the game.
4	I needed to learn a lot of things before I could get going with the game.
5	I found the game complicated to use.
6	I thought the game was straightforward and user-friendly.
7	I felt very confident using the game.
8	I needed the support of a technical person to be able to use the game.
9	I found the game very boring.
10	I would imagine that most people would learn to use the game very quickly.

SUS calculation steps:

1. For odd-numbered questions (1, 3, 5, 7, 9), subtract 1 from the response. For even-numbered questions (2, 4, 6, 8, 10), subtract the response from 5. Example: If a participant gave a score of 4 to question 1, the individual question score is $4 - 1 = 3$.
2. Add up the scores from all 10 questions. Example: If the individual question scores are 3, 4, 5, 2, 4, 1, 5, 3, 2, and 4, the sum is 33.
3. Multiply the sum by 2.5 to normalize the score to a 0-100 scale. Example: For a sum of 33, the calculated score is $33 * 2.5 = 82.5$.

Table 3. SUS Score Table

SUS Score	Grade	Adjective Rating
>80.3	A	Excellent
68 – 80.3	B	Good
68	C	Okay
51-68	D	PoorA
<51	E	Awful

Table 4. SUS Test Results

<i>ID</i> <i>Participants</i>	<i>F1</i>	<i>F2</i>	<i>F3</i>	<i>F4</i>	<i>F5</i>	<i>F6</i>	<i>F7</i>	<i>F8</i>	<i>F9</i>	<i>F10</i>	<i>Score</i>
01	4	2	5	1	3	2	4	1	5	2	82.5
02	4	1	5	1	5	2	5	1	5	1	92.5
03	4	2	5	1	3	2	4	1	5	2	80
04	4	2	5	1	3	2	4	1	5	2	80
05	4	2	5	1	4	2	5	1	5	2	87,5
06	4	2	5	1	5	2	5	1	5	2	85
07	4	2	5	1	5	2	5	1	5	2	85
08	4	2	5	1	3	2	4	1	5	2	82.5
09	3	2	5	1	5	2	5	1	5	1	90
10	4	2	5	1	5	2	5	1	5	1	92.5
11	3	1	5	1	4	1	5	1	5	1	92.5
12	4	1	5	1	5	1	5	1	5	1	97.5
13	4	2	5	1	5	2	5	1	5	2	85
14	4	2	5	1	3	2	4	1	5	2	82.5
15	3	2	5	1	5	2	5	1	5	1	85
Average Score											81.53

With an average SUS score of 81.53 from 15 participants, the evaluated system demonstrates a solid level of usability. This score falls within the "Excellent" range according to established SUS benchmarks, indicating that users generally found the system to be user-friendly and effective. The high "A" letter grade further underscores this positive evaluation. While the overall score is commendable, addressing any lower-scoring aspects could further enhance usability and user satisfaction, ensuring an exceptional user experience and potentially expanding the system's user base.

3.6.3. Media Validation Test

In conclusion, the media validation test conducted with Mr. Dinan Yulianto, S.T., M.Eng, a lecturer at Universitas Ahmad Dahlan, yielded a favorable score of 80/100. This indicates a strong foundation for the app's development, reflecting positively on its content, design, and overall effectiveness in achieving the intended goals of disability awareness for children. The feedback and suggested revisions provided by Mr. Yulianto will be instrumental in further enhancing the app, ensuring that it aligns even more closely with educational objectives and offers an optimal learning experience for the target audience. The constructive input received during the validation test will be carefully incorporated into the app's refinement process, contributing to its overall quality and potential impact on children's understanding and attitudes towards disabilities.

3.6.4. Material Validation Test

In the material validation test with Mr. Bekti Winoto, Vice Curriculum of SLB Negeri 2 Yogyakarta, a school for disabled children, valuable insights were gained regarding the app's content relevance to the specific needs of the target audience. As an expert in special education, Mr. Winoto's feedback ensured the material's appropriateness and alignment with the curriculum for disabled children. This collaboration has been crucial in meeting educational requirements and addressing the unique learning needs of students in a special needs school. Constructive feedback received will inform refinements to enhance the app's educational value and relevance. The collaborative validation underscores a commitment to creating an inclusive and beneficial educational tool for children with disabilities. The test concludes with Mr. Bekti Winoto, M.Pd, approving the materials used in the application.

3.7. Distribution

In the distribution stage, the objective is to effectively reach and engage the target audience. The game should be accessible on popular app stores like Google Play Store or IOS App Store, ensuring easy availability on mobile devices for a broad reach among children in the specified age range. Utilizing social media platforms, educational websites, and partnerships with schools can enhance the promotion of the

game and its educational objectives. Compatibility with various devices and operating systems should be considered to maximize accessibility.

4. Conclusion

The "Android-Based Trivia Game Development to Raise Children's Awareness about Disabilities" research has yielded the following conclusions:

- An educational quiz android game application focused on disabilities has been successfully developed to raise awareness among children.
- Usability testing using the System Usability Scale (SUS) with 46 functions and 10 questions resulted in a final score of 88, classifying the educational game as ACCEPTABLE.
- Black Box testing method showed 100% functionality alignment after two tests.
- Material and media validation were conducted by Mr. Beki Winoto, Vice Curriculum of SLB Negeri 2 Yogyakarta, and Mr. Dinan Yulianto S.T., M.Eng, a media production lecturer from Universitas Ahmad Dahlan.).

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