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# Development of Android Application based on 2D Animation for the Care of Down Syndrome Individuals

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**Abstract**

People with Down syndrome require discipline and care because their condition has shaped their way of life. The development of an Android application based on a 2D animated video aims to help individuals with Down syndrome in their daily lives and assist teachers or parents in caring for and educating them. The ADDIE model was used in the development of this product, consisting of five phases: analysis, design, development, implementation, and evaluation. In the analysis phase, developers analyzed the problems that occurred and identified the software and hardware requirements. In the design phase, the developer created a storyboard to be used as a reference during product development. During the development and implementation phases, developers built the product based on the storyboard. The evaluation and testing process was carried out by five experts in the field of creative multimedia from the Faculty of Technical and Vocational Education and the Methodist Care Center. The instrument used was an expert checklist form. Through the results of the study, all the experts provided positive feedback on the Android application based on the 2D animated video for the care of individuals with Down syndrome. The developed application has been accepted and works well.

## 1. Introduction

The use of technology in learning can improve the ability of instructors to solve various learning and teaching problems when they master the approach. According to Aziz (2019), learning using technology is one of the innovations in the reformed education system aimed at replacing the existing education system. At the same time, multimedia elements are one of the important media used to convey information. Multimedia can be interpreted as an interactive communication system based on a computer in an integrated presentation. The multimedia element has five elements: text, images, audio, animation, and video. Animation is something that uses movement to make objects or characters come to life.

A person with a disability is defined as someone who has a long-term deficiency in terms of mental, intellectual, physical, or sensory abilities when interacting with various obstacles that can block full participation in society (Disabled ACT, 2008). The World Health Organization (2020) defines disability as someone who is unable to meet the full or partial needs of his social life as a normal individual due to a physical or mental condition. Based on the Department of Social Welfare, there are seven categories of disabled people that can be considered for the registration of the disabled by the Department of Social Welfare: disabled hearing, visually impaired, speech impaired, disabled physical, learning disabilities, mental disabilities, and multiple disabilities.

Learning disability is a problem of brain intelligence that is not in line with biological age. Learning disabilities include late global development, intellectual disability, and Down syndrome. Down syndrome is the most common autosomal abnormality in the world, and it is caused by genetic factors, specifically an extra chromosome on the 21st chromosome, which is known as Trisomy 21. As a result, a baby has 47 chromosomes instead of 46, which causes abnormalities in physical and mental development.

## 1.1 Background of Problem

Down syndrome is caused by the abnormal production of the 21st human chromosome, one of the 47 chromosomes that cause the problem of Down syndrome in a person since birth (Reynolds, 2010). Down syndrome is a genetic defect. This problem is known as trisomy 21 because it involves the presence of part or all of chromosome 21 in Down syndrome. 3 Through aspects of their physical development, some characteristics are identified for a person suffering from Down syndrome, i.e., a flat face shape, a slightly shorter neck than a normal human, a short tongue, and a height that is disturbed from the level of normal development. According to Rusdial Marta (2017), slow and irregular growth of teeth and muscles results in stunted growth.

According to the Ministry of Health's Official My Health Portal, Health Malaysia, a person with Down syndrome struggles to balance physical, cognitive, and behavioral aspects of his daily life. Development in terms of the physical body and speaking skills is slow compared to that of normal children. In terms of cognitive development, someone with Down syndrome has poor memory, attention, and comprehension, as well as the inability to act quickly. Down syndrome affects every part of the body and can lead to various complications, such as joint and bone muscle movement problems. Their emotional development and behavior are erratic, aggressive, and passive, and they want more attention from their family. Down syndrome is characterized by impatient behaviors and emotional instability, where their hopes are unrealistic, and they react with fear or anger.

The IQ level of people with Down syndrome is low, thus causing their learning ability to become weak. People with Down syndrome have intellectual disabilities, with IQs ranging from 50 to 70. This explains that people with Down syndrome have a low level of thinking and need special guidance to learn something new. According to Will et al. (2019) down syndrome teenagers have difficulties in managing themselves which can lead to increased dependency on caregivers for routine tasks and personal care.

As a result, it is the responsibility of teachers or parents to care for them and teach them, particularly in terms of teaching how to manage themselves so that individuals with Down syndrome can be self-sufficient. So, their parents or close people need to know about taking care of Down syndrome person as well as providing support to them (Buckley, Bird, & Sacks, 2006). When successful in an activity, self-care is important for Down syndrome's daily functioning and development to remain balanced.

## 1.2 Statement of Problem

Individuals with Down syndrome teenagers have difficulties in managing their daily routine such as self-management. Therefore, they need help from others to aid them in performing their daily tasks. People around them such as parents need to have some knowledge of how to support and encourage them. This study aims to develop an application that provides information about knowing and managing Down syndrome people. It is hoped that by such information, their parents or caretakers can gain sufficient knowledge and be able to help individuals with Down syndrome manage their daily routines.

## 1.3 Objectives of the Study

1. To design an Android application based on 2D animation of individual children with Down syndrome.
2. To develop an Android application based on 2D animation of Down syndrome individuals.
3. To test the functionality of an Android application based on 2D animation for the care of people with Down syndrome.

## 2. Methodology

The methods and techniques used to achieve results are covered in the research methodology. The objectives and goals of the study were developed. The goal of the methodology is to help people understand the application of the method more broadly or more deeply by describing the research process. Methodology is a system that combines procedures and concepts and is used in a specific activity or subject.

Development of an android application based on 2D animation for the care of Down syndrome individuals, the ADDIE (1996) design model was selected as the study design model. There are five main phases in this model which consist of the analysis phase, the design phase and development phase, the implementation phase, and the evaluation phase.

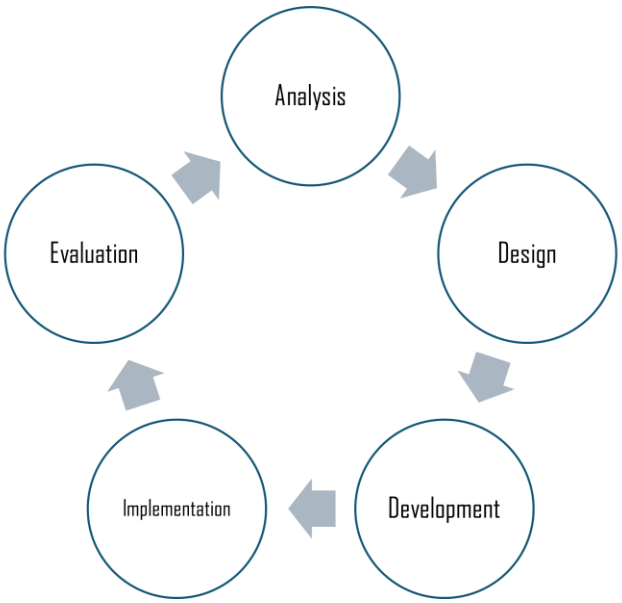



**Fig. 1** *ADDIE Model (Molenda, 2015)*

## 2.1 Analysis Phase

This phase involves several processes for determining and identifying the problem to be resolved. This phase includes activities such as clarifying the problem, identifying the source of the problem, and determining the problem's resolution. This phase also involves research techniques such as analysis of needs, job analysis, and task analysis. In this phase, developers collect data by conducting preliminary questionnaires to determine the needs of users and appropriate usability elements.

## 2.2 Design Phase

In this phase, explain the overall view of the appearance, structure, theoretical approach, type of media, and technology to be used. This phase is the travel phase of an operation based on the interface design process, users, and design storyboards. In this phase, developers will design a storyboard for a 2D animation product, put colour on the sketch, and choose the appropriate colours for the text, background, etc. The main steps in the performed phase will determine the way implementation, specification, and production of flowcharts and storyboards are handled.

## 2.3 Development Phase

This stage entails constructing the actual system using all media and technology elements chosen based on requirements. In this phase, the development will develop every interface that has been sketched, enter the program code, display each learning video, text, graphic, and audio that has been designed, and produce an effect that matches the wishes of the application.

## 2.4 Implementation Phase

This phase is to study the development of applications that have been developed by holding a presentation to users to test the effectiveness of every part, button, and line of program code in this system. This phase also aims to identify the problems that exist during the design and development of an application. 2D Animation Application Testing regarding the care of disabled people at home with Down syndrome is to test the whole system to avoid failure of the application function while it is being used.

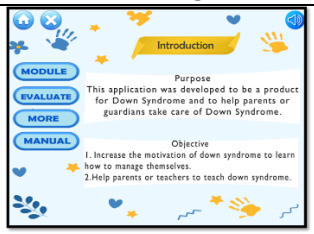
## 2.5 Evaluation Phase

Assessment is divided into two parts: formative assessment and summative assessment. Formative assessment covers each phase of the ADDIE process and is conducted at all levels to ensure its effectiveness. Summative assessment involves a specific test design that requires feedback from the users. This phase is the last stage of application development. On Day 24, user feedback data must be collected to determine the application's effectiveness and user satisfaction. This feedback was obtained from a specialist who teaches teenagers with Down syndrome at the Agape Center.

## 2.6 Interface Design

Design Interface design is the whole set of content, multimedia, and interactive elements available. This design will show the initial sketch of the product development. In this study, developers use storyboards to focus on multimedia elements and content in the development of animated videos. Through storyboards, developers will organize product development content such as the main page, the animation video 2D interface, the evaluation display interface, and the exit page.

**Table 1** *Page Interface*

| Page Interface | Description |
|---|---|
|  Start Page | The start page interface shows the use of text and graphic<br><br>Graphic- the design of the background page Text- Title and button name |
|  Introduction Page | The introduction interface shows the use of text and graphic<br><br>Graphic- the design of the background page<br>Text- Title and button name |
|  Page Button Video | Main page for video interface button<br><br>Graphic - The design of the background page<br>Text – Page title and button name |
|  Video Page | Video page for video interface button and it will hyperlink to YouTube.<br><br>Graphic - The design of the background page<br>Text – Page title and button name |

| | |
|---|---|
|  <br>Evaluation Page | Evaluation page for Google Form button and it will hyperlink to Google Form.<br><br>Graphic - The design of the background page<br>Text – Page title and button name |
|  <br>More Page | More page for center information<br><br>Graphic - The design of the background page<br>Text – Page title and button name |
|  <br>Exit Page | The exit page interface, shows the use of text and graphic<br>Graphic - The design of the background page<br>Text – Title and button name |

## 3. Findings and Discussion

On the testing and evaluation instruments, two questionnaires have been prepared, namely the interface expert evaluation form and the content expert evaluation form. For the interface experts, a total of three experts and 2 experts of content. Among them are three expert lecturers, consisting of a lecturer in the field of creative multimedia at the Faculty of Technical Education and Vocational (FPTV) and two experts from the Agape Center who teach in related fields.

The questionnaire for the expert content analysis section is section A found in the expert evaluation form. It contains general and background information such as gender, educational level, field of specialization, work experience, sector, and position. This interface evaluation form is given to two experts consisting of lecturers from the Agape Centre in Sarawak who have been selected. The expert design that has been selected are lecturers from the Faculty of Technical and Vocational Education, UTHM. The items in the interface design and content expert review form were divided into several sections namely text, graphics, animation, audio, video, and interaction design. all experts mostly chose to agree with the items stated however there were also items that the experts disagreed with. The analyzed data is presented in the form of frequency and percentage values.

Table 2 shows the findings of expert confirmation of content design. As a result of the findings, all experts agree on all the items described in the expert checklist form. The use of navigation in the application gets support and agreement from all experts, they agree that navigation and navigation options work well, so the user can achieve any information in a particular order. Then all the experts also agree that the inserted audio and video can be played well.

**Table 2** *Finding of expert confirmation of interface design*

| Item | Content | Frequency | | Percentage |
|---|---|---|---|---|
| | Teks | YES | NO | |
| 1. | The text color used is appropriate | 2 | 1 | 67% |
| 2. | The type of text font used is appropriate | 1 | 2 | 33% |
| 3. | The text size used is appropriate | 3 | 0 | 100% |
| 4. | The arrangement of the text is consistent. | 3 | 0 | 100% |

| | | | | |
|---|---|---|---|---|
| 5. | The type of text used is simple to read | 1 | 2 | 33% |
| 6. | The type of text used is simple to read | 2 | 1 | 67% |
| | Graphics | | | |
| 7. | The graphics used have high resolution and are clear | 3 | 0 | 100% |
| 8. | The 2D graphics used are attractive | 3 | 0 | 100% |
| 9. | The graphic color used is adapt. | 3 | 0 | 100% |
| 10. | The graphics used are interesting. | 2 | 1 | 67% |
| 11. | The use of icons is appropriate. | 2 | 1 | 67% |
| | Video | | | |
| 12. | 2D animated videos are easy to understand | 3 | 0 | 100% |
| 13. | 2D animation video quality is satisfying | 1 | 2 | 33% |
| 14. | The duration of the video used is appropriate | 3 | 0 | 100% |
| 15. | Video can be controlled. | 0 | 3 | 0% |
| 16. | An organized video journey | 1 | 2 | % |
| | Animation | | | |
| 17. | The resulting 2D animation can convey information clearly | 1 | 2 | 33% |
| 18. | The 2D animation produced is attractive | 1 | 2 | 33% |
| 19. | The 2D animation produced is appropriate | 3 | 0 | 100% |
| 20. | 2D animation design is perfect | 1 | 2 | 33% |
| 21 | Animated movement works well with | 3 | 0 | 100% |
| 22 | good<br>Animation movements are clear. | 3 | 0 | 100% |
| | Interaction Design | | | |
| 23. | The position of the interaction button used is consistent. | 3 | 0 | 100% |
| 24. | The interaction buttons used can work well. | 3 | 0 | 100% |
| 25. | The interaction button uses the icon-appropriate | 3 | 0 | 100% |
| 26. | Interaction buttons use text sizes that are appropriate | 1 | 2 | 33% |
| 27. | The interaction button uses the | 1 | 2 | 33% |
| 28. | color of the text to match | 1 | 2 | 33% |
| 29. | Design the interaction button so that it is appropriate.<br>The provided button goes to the correct page. | 3 | 0 | 100% |
| | Audio | | | |

| | | | | |
|---|---|---|---|---|
| 30. | The background music used is appropriate | 3 | 0 | 100% |
| 31. | The audio for animated videos is clear. | 3 | 0 | 100% |
| 32. | The background music used does not interfere with hearing | 3 | 0 | 100% |
| 33. | Audio resolution and background music are high. | 3 | 0 | 100% |

On the text side, the results of analysis from expert review form responses have indicated that expert 1 disagrees with items one and six, that is, that the color of the text used is appropriate and easy to read text. Whereas items one and six were approved by experts 2 and 3. For the second and fifth items in the text section, experts agree that the type of font used is appropriate and the type of text used is easy to read. For the other items, namely items three and four, the results of the frequency analysis of the percentage of expert acceptance are 100%. The items specified are that the size of the text used is appropriate and that the arrangement of the text is consistent.

In addition, the three experts have agreed on items seven through nine. The items described are graphics that are used in high resolution and are clear, 2D graphics used are attractive, and the graphic colors used are appropriate. While only two experts agreed on items 10 and 11, on the audio side, all the items on the audio part were also agreed upon by the three experts. The items that are stated are the 12th to 15th item, which is the background music used. Accordingly, the audio for the animated video is clear, the background music used is not disturbing, and the audio resolution and background music are high.

Following that, the three experts agreed on items 16 and 18 in the video section, stating that 2D animation videos are easy to understand and that the duration of the video used is appropriate. Meanwhile, in the 17th and 20th items 59, only an expert accepts that the quality of 2D animation videos is satisfying and organized. The three experts could not agree on the 19th item in the video section. The specified item is a video that can be controlled. On the animation side, only one expert agreed on items 21st, 22nd, and 24th. The items mentioned are 2D animations that can convey information, the 2D animation produced is interesting, and the 2D animation design is perfect. On the item specified with the 2D animation produced is appropriate, the animation movement works well, and the animation movement is agreed upon by all three experts, namely the 23rd item, the 25th item, and the 26th item.

In the string, the three experts also agree with the items on the design section interaction, namely the 27th item, the 29th item, and the 33rd item. The items that are stated are: the position of the interaction button used is consistent, the interaction button used can work well, and the interaction button using the appropriate icons and buttons provided goes to the right page. While only experts agree on the 30th and 32nd items, the specified items are interaction buttons using appropriate text size and color, and the design of the interaction buttons used is appropriate.

Based on the findings of the evaluation, all the experts agree that interface design can meet the target meet of the user (Table 2). This can be proven when mostly all items on the form of the expert checklist of the interface section received the answer "yes" from the expert. The expert gives suggestions and views about interface design which is to improve the color of graphics, and buttons and change the layout.

**Table 3** *Findings of expert confirmations of content design*

| Item | Content | Frequency | | Percentage |
|---|---|---|---|---|
| | | YES | NO | |
| 1. | The objective of the application is to meet the development goal of the care of people with disabilities at home for Down syndrome. | 2 | 0 | 100% |
| 2. | The content of the 2D animation application about caring for the disabled at home with Down syndrome is easy for users to understand. | 2 | 0 | 100% |
| 3. | The content of the 2D animation interface about caring for the disabled at home with down syndrome is easily accessible to users. | 2 | 0 | 100% |

| | | | | |
|---|---|---|---|---|
| 4. | The content of the information conveyed through 2D animation on caring for the disadvantaged At-home efforts for Down syndrome are characteristically realistic. | 2 | 0 | 100% |
| 5. | Information on care in the 2D Animation application care for the disabled with Down syndrome is correct. | 2 | 0 | 100% |
| 6. | English used in the development 2D Animation Caring for the disabled with Down syndrome is easy for users to understand. | 2 | 0 | 100% |
| 7. | 2D animation was created by the delivered content | 2 | 0 | 100% |
| 8 | The developed 2D animation is clear | 2 | 0 | 100% |
| 9 | A 2D animated video of how to wash hands and scrub teeth helps people with Down syndrome focus while studying or watching. | 2 | 0 | 100% |
| 10 | Disability Care 2D Animation Application for Individuals with Down Syndrome, Suitable for Use by Society | 2 | 0 | 100% |

Analysis of the content design expert review form shows that both experts agree with all items from item one to item ten. Item one to the fourth item described is the application's goal of meeting the application development goal of caring for the disabled at home for the syndrome. The content of the 2D animation application on caring for the disabled at home for Down syndrome is easy for users to understand, the content of the 2D animated interface on home care for the disabled for Down syndrome is easily accessible to users, and the content of the information delivered through 2D animation on caring for the disabled at home for down syndrome is realistic. The fifth item mentioned is care information in the application 2D Animation Care of the Disabled at Home of Down Syndrome, which is specifically, the English language used in the development of 2D Animation Disability Care at Home for Syndrome. It is easy for users to understand, and the 2D animation developed accordingly with the content delivered is clear. The competing item, which is the ninth and tenth items, is described as a video with 2D animation of how to wash hands and brush teeth to help people with Down syndrome focus more on learning and watching, as well as 2D animation applications of caring for people with disabilities at home suitable for community use.

Developers have made confirmation of five experts for the evaluation. As a result of the evaluation, it was analyzed using the method in frequency and percentage of acceptance. Table 3 shows the findings of the expert confirmations of content design. As a result of the findings (10), items have been submitted. All experts will agree on all items. The expert suggests the developer consistent the audio used in every video. Overall, all experts have given positive feedback on the design of this application and hardware used in Agape Centre or teachers in using ICT for education.

## 4. Conclusion

Android applications based on 2D animated videos of individuals care Down syndrome have been well developed and successful concerning the learning model used, which is the ADDIE model. Available phases in this ADDIE model have helped developers produce products that are of good quality and developed within the specified time. In the development of a product, several things need to be emphasized, namely the objective of the study, the scope, and the research questions. The developer developed this product concerning these three things so that it can achieve the objectives that have been specified. As a result, hopefully, an Android application based on a 2D animated video of care will be developed. Individuals with Down syndrome can be used as intermediaries by educators or parents in delivering information about Down syndrome care.

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