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Designed animation for daily living skill of children with Down syndrome

ABSTRACT

Children with Down syndrome generally have difficulty with daily living skills. Therefore, an appropriate learning approach is needed to train DS children to have daily living skills. The aim of this research is to identify the level of learning visual ability of children with Down syndrome, then explain the parameters of visual content animation as a tool to obtain responses from children with Down syndrome, and to determine the effective animation content to help the independence process of children with Down syndrome. The research method used is a mix method. This research uses an experimental study where the participants are children with Down Syndrome. Data collection methods use interviews, observation and questionnaires. Data analysis using the Wilcoxon Sign Rank test
The results of this research found that Down syndrome children have different characters, levels of learning abilities and interests even though they are the same age and DS children tend to experience problems with independence, especially toilet training. Independent intervention to be used as a learning medium can be done through animation media whose visual content matches their character and preferences. The test results show that there is a significant effect of learning through animated videos on the level of message understanding and toilet training independence in DS children. With the characters, environment, duration, colors, figures in the video that they like, it will further increase their interest in the video so that they can understand the message in the animated video easily.

Ercilia Rini Octavia [1]
Muhizam Mustafa [2]
Dermawan Syamsuddin [3]

[1] Universitas Sebelas Maret, Faculty of Art and Design, Surakarta, Indonesia
[2] Universiti Sains Malaysia, School of The Art, Penang, Malaysia
[3] Binus University, School of Design, Jakarta, Indonesia

Corresponding author:
Ercilia Rini Octavia
e-mail:
erciliaoctavia@staff.uns.ac.id.

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Introduction

Data from the World Health Organization (WHO) estimates that every year there are 3,000–5,000 babies born with Down syndrome, with an estimated one incidence of Down syndrome per 1,000–1,100 births worldwide (Agheana & Duţă, 2015). WHO also estimates that globally, there are currently 8 million people with Down syndrome.

In Indonesia, based on Basic Health Research (Riskesdas) 2010–2018, the incidence of Down syndrome tends to increase. In 2018, 0.41 percent of congenital disabilities were recorded for children aged 24–59 months, and Down syndrome was experienced by 0.21 percent of that age group.

Down Syndrome (DS) is a condition of retarded physical and mental development in children caused by abnormalities in chromosomal development (D'Souza et al., 2020). Based on the research results, there was a gene mutation on chromosome 21, where there was an additional part of this chromosome (Mohamed et al., 2021). People living with Down Syndrome have three chromosomes 21. This excess chromosome is characteristic of Down Syndrome or what is known as Trisomy 21 (Boundy et al., 2023).

Children with DS have distinctive facial features, congenital disabilities, mental retardation, heart defects, lung problems, and widespread infections (Krinsky-McHale et al., 2014).

Children with Down syndrome vary greatly in ability, but the majority show moderate learning difficulties, and some have severe learning difficulties (Agheana & Duţă, 2015). Children with disabilities also experience problems in daily living skills (Auld, Foley & Cashin, 2022). Daily living skills are essential for improved quality of life and autonomous living (Auld, Foley & Cashin, 2022). On average, children with Down syndrome still depend on their parents or other family members to carry out daily life activities (Widyawati & Ardianingsih, 2019). Therefore, an appropriate learning approach is needed to train DS children to have daily living skills.

The development of learning methods linked to technology to overcome problems in children with Down syndrome has been studied by several researchers (Shahid, Law & Verdezoto, 2022). Technology has become something that is greatly needed by all levels of society in all areas of life, including children with special needs (Baldo et al., 2023). The trend is the reason that more research is needed to deeply understand the use and adoption of technology along with their methodology, intervention techniques, and potential in equipping early childhood special needs children to transform them into independent adults (Baldo et al., 2023).

Some existing research focuses on the medical aspects of Down Syndrome, looking at their prevalence, causes, symptoms, diagnosis, medical complications, and overall care management (Agheana & Duţă, 2015; Lukowski, Slonecker & Milojevich, 2020; Morris, Farran & Gilligan-Lee, 2023; Sabeti et al., 2024). Several other researchers use machine learning as an intervention medium for children with DS (Baldo et al., 2023; Porras et al., 2021; Porras et al., 2022; Sabeti et al., 2024). Meanwhile, digital technology has the potential to support children with intellectual disabilities (Constantin & Hourcade, 2018; Tashnim et al., 2017).

Several studies have proposed several teaching methods and materials that can result in more effective learning for children with DS. One of them is the use of electronic media to teach DS children. Research conducted by Agheana & Duţă (2015) shows that there is significant progress in the acquisition of basic mathematics skills in children who use electronic media compared to children who only use concrete objects. The research results also show that teaching using visual learning can improve children's education in coping with Down syndrome if they are exposed to the right conditions that suit their needs. Shahid, Law & Verdezoto (2022) specifically presented a systematic literature review regarding technology support for children with Down Syndrome and adolescents appropriate for the mental age of children considered neurotypical (NT). This synthesis identified several key findings, namely that there is a diversity of technological supports available for children with Down Syndrome that target individual abilities.

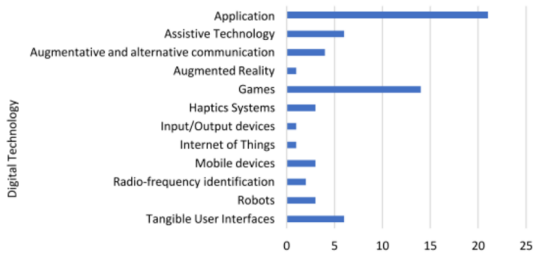
Technological developments also help in overcoming the problems of children with Down syndrome; several studies have used technological interventions to overcome the difficulties of children with Down syndrome (Shahid, Law & Verdezoto, 2022). Augmentative and alternative communication (AAC) is an intervention, method, and technology used to supplement an individual's speech alternatives. AAC ranges from symbol systems using charts, boards, communication books, and individual cards (Foreman & Crews, 1998). The Foreman & Crews (1998) study used Makaton as an intervention technique that was considered more effective with positive results for alternative communication among Down Syndrome. The use of Makaton as a sign language supports visuospatial memory and the ability to reflect iconic components compared to verbal speech.

This field focuses on designing interactive technology, how children can benefit from this technology, and its effectiveness in the child's development process. Technology is increasingly being used to support children with special needs, for example, in the areas of health, education, behavior, and social communication. To measure or evaluate children's interactions with technology, several different methodologies have been studied. Manojlovic, Boer & Sterkenburg (2016) in their paper present a fun interaction, also known as Theraplay, to strengthen the bond between parents and children with Down Syndrome families in the Netherlands. This approach can benefit other children who experience visual and hearing impairments throughout their development (Manojlovic, Boer & Sterkenburg, 2016).

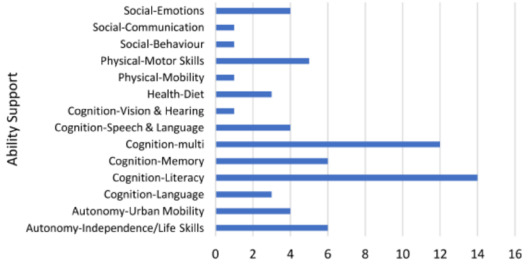
Macias et al. (2020) studied interactions between parents and children with Down Syndrome to explore role-play experiences. After observation, it was discovered that parents, especially mothers of children with Down Syndrome, used directed behavior more often than mothers of children who were developing. The increased use of directed behavior causes children to become easily distracted and divert their attention from the activity they are doing. Macias et al. (2020) used puzzle games to observe the type of directed behavior given and the child's response to the directed behavior. Interaction analysis is used to predict what happens in similar activities involving two people. The result is that excessive use of directed behavior can damage a child's autonomy and independence. The results of a literature review conducted by Shahid, Law & Verdezoto (2022) show that the use of digital technology to support the learning of DS children still needs to be improved, with most applications being used in 21 papers, others under 15 papers (Figure 1).

The results of a literature review conducted by Shahid, Law & Verdezoto (2022) also showed that there were only six papers regarding the types of characteristics of previous research related to independence/daily living skills (Figure 2).

The six previous studies were: Alesii et al. (2013), Costa et al. (2015), Franchi et al. (2016), Gomez et al. (2017), Kramer et al. (2015), Lara et al. (2019).



» **Figure 1:** *Use of Digital Technology for DS Children*



» **Figure 2:** *Characteristics of Research Related to Independence*

The results of the literature review above show that the literature on learning interventions for children with Down's syndrome is still limited, as well as the use of technology to overcome the problems experienced by children with Down's syndrome. To fill the research gap regarding the use of digital technology for learning for children with Down syndrome, this research will examine the impact of using animated learning media on the daily living skills of children with DS. Daily living skills tasks include eating, dressing, bathing, and mobility (Auld, Foley & Cashin, 2022). Daily living skills are essential for improved quality of life and autonomous living (Auld, Foley & Cashin, 2022). In addition, on average, children with Down syndrome still depend on their parents or other family members to carry out daily life activities (de Weger, Boonstra & Goossens, 2021). The use of visual media can facilitate understanding, strengthen memory, foster interest, and establish connections between material content and the real world (da Cruz Netto et al., 2020). Children with Down syndrome have a greater ability to perceive instructions visually. Audio-visual learning is appropriate for DS children because this media can stimulate the senses of sight and hearing (Az Zahra et al., 2021).

Animated videos can help children form good characters, which is reflected in polite words in everyday life (Mashuri & Budiyono, 2020). Based on these problems, there are three objectives to be achieved in this research, namely:

RO1: To identify the level of learning visual ability of children with Down syndrome

RO2: To explain the parameters of visual content animation as a tool to obtain responses from children with Down syndrome

RO3: To determine the effective animation content to help the independence process of children with Down syndrome

Method

Methodology is an important part of any research because it presents and justifies the way the survey is organized and conducted. In this research, the methodology used is mix method research. To be more specific, we used an experimental study where the participants were children with Down Syndrome. The research tool used is qualitative research (initial/final evaluation, interviews and non-participatory observation) using several quantitative research tools as a complement.

The location of this research is in Central Java, Indonesia, which has an area of 32,800.69 km², or around 28.94% of the area of Java Island, Indonesia. Study Population Overall the children who are members of PIK Potads Central Java have 490 children with Down syndrome.

The subject criteria for this research are: 1) Children with Down syndrome 2) Boys and girls 3) Age 7-9 years 4) Resides in Central Java 5) Trisomy 21 Spectrum 6) Having moderate and low mental retardation. Based on these criteria the population in this study were children aged 7-9 years, numbering 75 children. By considering the age of the child, we choose appropriate audio visuals, namely Upin & Ipin videos and Nusa & Rara videos which provide daily living skills education.

Participants

Participants in this study were children with Down Syndrome. Participants were children selected based on certain criteria, namely having an official diagnosis of Down syndrome. Selected participants will be given learning media to investigate whether these children will successfully respond to audio visuals and ultimately learn audio visuals to increase their independence. In this study, children's independence was measured by daily living skills tasks including toilet training (Loue & Sajatovic, 2008).

Procedure

This research follows certain stages. First, semi-structured interviews were conducted to obtain information about the level of learning of visual abilities of children with Down syndrome.

Second, analyze the parameters of animated visual content as a tool to obtain responses from children with Down syndrome, and third, analyze animated content that is effective in helping the process of independence for children with Down syndrome. In the third stage, intervention was carried out, namely testing animated videos to test the ability of children with Down syndrome to understand animated videos about toilet training. This test was carried out in stages over 3 weeks, namely by watching 1 video (first week), 2 videos (second week), and 3 videos (third week).

Educational objectives

In accordance with the research objectives set for this intervention, children must be able to:

1. Understand animation as an assistive medium,
2. Carry out the process of independence in the toilet.

Data collection and analysis

The data collection procedure is carried out with the following steps:

1. In depth interviewing: semi structured interview 1 pediatrician, 1 therapist, team psychologist (Table 1), and 13 parents of children with Down syndrome (Table 2); Observation (Partisipant Quisi): IQ test for 13 children with Down syndrome;
2. Multiple Case Study: 3 series of animated films Ipin Upin and 2 films series Nusa & Rara; In depth interviewing: semi structured interview on 13 children with Down syndrome;
3. Questionaire: Before and after trial to test prototype with Wilxocon Sign Rank tst; 30 Pilot Study respondents; 75 Respondents to test the prototype; Analysis the response.

Results

The results of data analysis in this research are divided into three parts to answer the research objectives. The following is the arrangement:

Identify the level of learning visual ability of children with Down syndrome

To identify the level of visual learning abilities in children with Down syndrome, the method in this research uses in-depth interviews with experts who are competent in their fields, namely pediatricians, therapists, psychologists and parents of children with Down syndrome. Themes that will be identified in this research include the basic abilities of children with Down syndrome (Prena, 2014; Whalen, Schreibman & Ingersoll, 2006), learning for Down syndrome children (Wester Oxelgren et al., 2019), and the interests of children with Down syndrome (Amatori et al., 2022). The results of in-depth interviews with pediatric, therapists, psychologists, and parents of children with Down syndrome to Identify the level of learning visual ability of children with down syndrome are as follows.

Table 1

Conclusions from in-depth interviews with experts

Theme	Aspect	Results
Basic Abilities of Down Syndrome Children	Speech Pathology	The speaking ability of each child with Down syndrome is different, it cannot be generalized based on age
	Audiology	On average, the hearing of children with Down syndrome is normal, except for those with comorbid hearing problems
	Psychology	Understands the feelings of joy and sorrow, is emotional and has a lower IQ than ordinary children
	Occupational Therapy	Having done occupational therapy, toilet training is predominantly a problem of independence
Learning Children with Down Syndrome	Daily Living Skill (ADL)	The milestone for ADL independence is toilet training, so children with Down syndrome need to be trained to be independent.
	Independence Therapy	It is necessary to repeat therapy at home repeatedly so that children with Down syndrome are independent
	Animated Video as Learning Tool	Animated films as an intervention medium have not yet been found specifically for toilet training children with Down syndrome
Interest	Intervention Media	Animated films are an alternative medium for teaching independent toilet training, with the right content
	Screen time & problem behaviors	The need to limit time when viewing animated films
	Media for children's screen time	Hope there is an animated film for toilet training interventions with dishes that children with Down syndrome like

The results of interviews and observations with pediatricians, therapists and psychologists found that each child with Down syndrome has a different character, level of learning ability and interests even though they are the same age. Independence is their problem, especially toilet training, so they need an animated film that they like as a medium for their intervention.

Table 2

Conclusions from the results of in-depth interviews with 13 parents of children with Down syndrome

Theme	Aspect	Results
Basic Abilities of Down Syndrome Children	Speech Pathology	92.3% of children with Down syndrome at home use Indonesian, not all of them can speak it
	Audiology	Another 76.92% of normal hearing suffer from moderate impairment & Sensorineural Hearing Loss (SNHL)
	Psychology	69.2% are worried about the emotions and independence of children with Down syndrome
	Occupational Therapy	53.84% of children with Down syndrome cannot hold a ladle and 46.1% can hold a ladle
Learning Children with Down Syndrome	Daily Living Skill (ADL)	69.2% of respondents chose toileting as the most difficult activity and the second activity was brushing their teeth.
	Independence Therapy	53.84% of children with Down syndrome carry out therapy independently at home under parental supervision using audio-visual via television and smart phone
	Animated Video as Learning Tool	76.92% of respondents wanted animated videos as learning aids and the rest wanted direct learning
Interest	Intervention Media	76.3% independent therapy which is carried out using audio-visual media.
	Screen time & problem behaviors	100% of children with Down syndrome watch animated videos
	Media for children's screen time	69.2% most often use smartphones and the least use televisions Ipin upin and Nusa Rara

These results are supported by observations made by parents of children with DS who found that the basic abilities of Down syndrome children aged 7-9 years cannot be generalized. The abilities of DS children aged 7-9 years are equivalent to children usually 3-5 years old. Parents worry about independence especially toilet training. Parents carry out further intervention through animated videos, via TV and YouTube platforms. Children with Down syndrome concentration is longer when viewing animated videos than other media. Down syndrome children like animated videos because of their cute appearance, main characters in pairs, music and songs, and showing daily activities. Down syndrome children aged 7-9 years are equivalent to normal children aged 3-5 years. Down syndrome children are interested in animated videos (Ipin Upin and Nussa Rara).

Explain the parameters of visual content animation as a tool to obtain respons from children with Down syndrome

The second data analysis was carried out by means of a Multiple Case Study using 10 animated videos (Table 3), namely the Upin and Ipin dan videos (5 series) and the Nussa Rara videos (5 series). Upin & Ipin video links and Nussa and Rara videos are below. Video link is in the attachment.

Conclusion:

Visual Character: Physical characteristics of the cartoon: light brown skin, black hair, slanted eyes (mongoloid), thin lips, big head, short neck (resembling a child with Down syndrome), paired. favorite animal is elephant

Environment: The bathroom colors found are bright; The type of closet that is often found is the squat; The color of the closet found is white; The most common toilet door color is blue.

Table 3

Parameters of Visual Content Animation

Visual Character			Environment	Duration	Narrative
Organs	Face	Clothes			
The skin color of the entire cast is the same, namely light brown The hair color of the entire cast is black The hair size of the entire cast is short The head size equation for all casts is large Similar shape of sickle ears Short neck shape	Round eye shape Eyeball color is black Thin lip shape Pink lip color Sharp nose shape	The types of clothes used are both 2 colors There are different colors for each character pairing	Most of the sets where videos are taken are in the home environment and are more often found in bathrooms	The average duration of the video is around 10 minutes The video duration is quite long because 1 video contains 1 episode	The average number of vocabulary words in the title is 3 words The average number of activities in 1 video clip is 4 activities

Duration: The average length of the film is more than 6 minutes; The average duration of each slide is 11-15 seconds; Pronunciation duration 5-6 seconds

Narrative: The font color used for subtitles is white; The type of font used is bold and small; Number of words per slide 5-8 words

Other elements: Likes music, likes 2D and 3D animation, understands story lines, repetitive (repetition)

Determine the effective animation content to help the independence process of children with Down syndrome

Based on the results of the animated visual content parameters found, an animated visual prototype was then created as follows (Figure 3). The animated visual results were then made into an animated video which was tested on DS children related to toilet training (Table 4).

The test results are explained below:

Table 4

The Results of the Wilxocon Sign Rank Test

Variable	Frequency of Watching Videos	Z value	Asymp Sign
Message Understanding	1 x Watch	-1,437	0,151
	2 x Watch	-2,184	0,029
	3 x Watch	-3,417	0,001
Independence	1 x Watch	-1,955	0,051
	2 x Watch	-3,359	0,001
	3 x Watch	-4,571	0,000

Based on the results of the Wilxocon sign rank test, the following conclusions were obtained:

1. Testing the level of understanding of Down syndrome children regarding toilet training messages
    a. The first test was that children with Down syndrome were given the test treatment by watching an animated video about toilet training once, the result was an Asymp Sign value of 0.151, this means there was no significant difference in the level of understanding of children with Down syndrome regarding the toilet training message in the video.
    b. Testing the two children with Down syndrome who were given treatment by watching it twice, the result was an Asymp Sign value of 0.029, this means that there was a significant difference in the level of understanding of children with Down syndrome regarding the toilet training message after watching the animated video twice.
    c. Testing the three children with Down syndrome who were given the test 3 times, the result was an Asymp Sign value of 0.001, this means there is a significant difference in the level of understanding of DS children regarding the toilet training message from the animated video.

Based on these three tests, it shows that the more often DS children are given the treatment of watching animated videos, the more they will improve their ability to understand the message from animated videos related to their toilet training abilities.

2. Testing the independence of children with Down syndrome in toilet training
    a. The first test for Down syndrome children was given the testing treatment once,

» **Figure 3:** *Animated visual prototype*

watching an animation video about toilet training, the result was an Asymp Sign value of 0.051, this means there is no significant difference in the level of independence in toilet training for Down syndrome children.

b. Testing the two children with Down syndrome who were given treatment by watching it twice, the result was an Asymp Sign value of 0.029, this means that there was a significant difference in the level of toilet training independence for children with Down syndrome after watching the animated video twice.

c. The third test for Down syndrome children was given the test 3 times. The result was an Asymp Sign value of 0.001, this means there was a significant difference in the level of toilet training independence for Down syndrome children after watching the animated video 3 times.

Based on these three tests, it shows that the more often DS children are given the treatment of watching animated videos, the more independence DS children have in carrying out toilet training.

Discussion

To identify the level of visual learning ability in children with Down syndrome

The most common genetic disorders experienced by children with Down syndrome (DS) are neurological deficits and visual impairment (Højberg, Lundbye-Jensen & Wienecke, 2023; Manrique-Niño et al., 2020). The development of these two functions depends on executive control (Manrique-Niño et al., 2020). However, it is not known whether there is a relationship between visual impairment in children with DS and delays in their cognitive development. The purpose of this study is to identify the level of visual learning ability in children with Down syndrome, including the basic skills of children with Down syndrome, how children with Down syndrome learn, and the interests of children with Down syndrome, then carry out evidence-based intervention research for this group.

This study uses in-depth interview techniques with experts and practitioners who are directly related to DS children. The results of this study identified that each child with Down syndrome has a different character, level of learning ability, and interests, even though they are the same age. Basic ability measurements include aspects of speech pathology, audiology, psychology, and occupational therapy. The speech pathology aspect shows that the speaking ability of each child with Down syndrome is different; it cannot be generalized based on age.

Then, in the audiology aspect, it was found that children with Down syndrome had normal hearing, except for those with comorbid hearing problems. The psychological element shows that children with DS understand the feelings of joy and sorrow, are emotional, and have a lower IQ than normal children. Meanwhile, in the occupational therapy aspect, DS children have done occupational therapy, and toilet training is the dominant issue in their independence.

The results of observations involving parents regarding the basic abilities of children with Down syndrome concluded that in the aspect of speech pathology, namely 92.3% of children with Down syndrome at home use Indonesian, and not all of them can speak well. Then, in the audiology aspect, 76.92% of their hearing was normal, while the others experienced moderate impairment and sensorineural Hearing Loss (SNHL). In the psychological aspect, it shows that 69.2% are worried about the emotions and independence of Down syndrome children. In the occupational therapy aspect, it shows that 53.84% of Down syndrome children are not yet able to hold a spoon, and 46.1% can already use a spoon. Based on these results, it can be concluded that the basic abilities of DS children cannot be generalized.

Still, their development is slower than that of children in general, and the skills of DS children aged 7-9 years are equivalent to those of typical children aged 3-5 years.

These results support previous studies, which stated that in children with DS, motor, cognitive, practical, and social skills develop more slowly compared to the development of children in general (Boundy et al., 2023; Morris, Farran & Gilligan-Lee, 2023). After birth, children with DS experience slow growth and maturity (Lukowski, Slonecker & Milojevich, 2020; Morris, Farran & Giligan-Lee, 2023). Furthermore, within a few months, the development of the morphology of the nerves of the visual cortex (where visual information is processed), the size of the cerebellum and brain stem, brain weight, skull size, and visual acuity progressively slow down (de Weger, Boonstra & Goossens, 2021; Manrique-Niño et al., 2020). Eye disorders also limit visual acuity and visual function. These disorders include frequent and severe refractive errors, nystagmus, and slowness of accommodation (da Cruz Netto et al., 2020; Højberg, Lundbye-Jensen & Wienecke, 2023).

The results of interviews and subsequent observations related to DS children's learning in the daily living skills (DLS) aspect show that the milestone for ADL independence is toilet training. Hence, Down syndrome children need to be trained independently regarding toilet training. The aspect of independence therapy shows the need to repeat therapy at home repeatedly so that children with Down syndrome become more understanding and independent.

In the Animated Video as a Learning Tool aspect, it is concluded that animated films can be used as intervention media. Still, we have yet to find a special video for toilet training children with Down syndrome. The results of observations from parents of DS children regarding the ADL aspect concluded that 69.2% of respondents chose toilet training as the most difficult activity, and the second activity was brushing their teeth. In the independence therapy aspect, it was concluded that 53.84% of children with Down syndrome carried out therapy independently at home under parental supervision using audio-visual via television and smartphones. Meanwhile, regarding the animated video as a learning tool aspect, it was concluded that 76.92% of respondents wanted animated videos as learning aids, and the rest wanted to know directly.

Based on the results of the interviews and observations above, it can be concluded that children with DS have difficulty learning in toilet training; independent therapy is preferred to be done at home with parents using audio-visuals and the videos that children with DS like to know for learning are animated videos. To overcome this problem, parents carried out further interventions through animated videos on the TV and YouTube platforms; the result was that DS children's concentration was longer when they saw animated videos compared to other media. DS children liked animated videos because they looked cute, there were people and pairs of characters, there was music, and there were daily activities. DS children were especially interested in animated videos Upin and Ipin.

These results support previous research stating that the basic abilities of children with Down's syndrome are different. Still, children with Down's syndrome have the same problems in their daily living skills, so learning media intervention in the form of animated videos is needed to train their motor and cognitive skills so that they develop optimally, especially to teach them (Boundy et al., 2023; de Weger, Boonstra & Goossens, 2021; Lukowski, Slonecker & Milojevich, 2020). DLS includes three subdomains: personal (taking care of self), domestic (taking care of the home), and community skills (school/community life) (Sparrow, Cicchetti & Saulnier, 2016). So, DLS includes Activities of Daily Living (ADL) and Instrumental Activities of Daily Living (IADLs). ADL refers to more basic self-care tasks (e.g., brushing teeth, dressing, and personal hygiene).

In contrast, IADL refers to more complex skills (e.g., financial management, preparing food, and washing clothes) (Guo & Sapra, 2022). The acquisition of these skills impacts the extent of a person's ability to live independently and independently in their routine living environment (Hong et al., 2015). DLS, when carried out alone, can encourage improved quality of life and reduce dependence on other people (Wertalik & Kubina, 2018).

Based on the findings in this research, learning media is needed to train children with DS to be independent, especially animation media, to train toilet training, which some DS children have difficulty doing.

Explain the parameters of visual content animation as a tool to obtain responses from children with Down syndrome

The development of information and communication technology today is increasingly intertwined with everyday life, from using mobile applications to remotely control lighting at home to tracking health-related problems, socialization applications, fitness applications, and much more (Mohammedi & Augusto, 2021). One of the difficult challenges is that only some systems can meet all individual needs, considering that each user group and stakeholder has their priorities, needs, and preferences. The surge in applications that focus on helping people with various health-related conditions, as well as other applications that aim to improve well-being and lifestyle, is increasing in number. However, not all communities are given the same attention; some community groups with special needs still receive less attention because their percentage is small, so they are less attractive from the market side; this widens the digital gap between several sectors of society (Mohammedi & Augusto, 2021).

Based on the identification of basic abilities, learning methods, and interests in children with DS, ADL problems, namely toilet training, were found. These findings require learning media that are effective and appropriate to the character and interests of children with DS, namely animated videos. The animated videos that children like based on observation results are Upin & IPIN and Nusa Rara. In this sub-discussion, we will explain the findings related to the visual parameters of the animated content in the Upin & IPIN and Nusa Rara videos on the YouTube Channel, which will be used as a tool or medium for making prototypes of toilet training learning videos.

YouTube is an option for sharing video content that is entertaining and useful for society because the system is so easy and reaches many people (Az Zahra et al., 2021). Therefore, YouTube has become a forum for sharing knowledge in the form of learning animation videos, where learning animation videos, there is a Voice Over to explain the animations shown in the learning animation videos; apart from that, there are also animations in the form of illustrations as visuals so that they can be easier for the audience to understand (Az Zahra et al., 2021).

The results of this study found that DS children liked visual characters with physical characteristics such as light brown skin, black hair, slant eyes (mongoloid), thin lips, big heads, short necks (resembling Down syn-

drome children), and pairs. His favorite animal is the elephant. Then, the environmental aspects include the color of the bathroom, which is found to be bright; the type of cupboard that is often seen as squat; the color of the closet is found to be white; and the most common color of the toilet door is blue. Then, in terms of duration, the average duration of the film is more than 6 minutes, the average duration of each slide is 11-15 seconds, and the duration of the pronunciation is 5-6 seconds. In the story aspect, the font color used for the subtitles is white, the font type used is bold and small, and the number of words per slide is 5-8 words. Then others like music, 2D and 3D animation, understanding story lines, and repetition. These results show that DS children like visual characters with physical characteristics that are close to their physical characteristics and environments that tend to be brightly colored.

Based on the findings of these parameters, this research has produced animated learning videos for children with DS. The animated video can be seen at the following link: https://bit.ly/Toilettrainning. This animated learning video for children with DS will be uploaded to the YouTube channel after testing its effectiveness. The results of testing the effectiveness of the learning animation videos are explained in the following sub-discussion.

Determine the effective animation content to help the independence process of children with Down syndrome

In the world of education, the development of information and communication technology in the learning process is increasing (Az Zahra et al., 2021). ICT aims to make the teaching and learning process easier and easier for students to accept. One of the media used in learning is video. The findings of this research show that DS children really like animated videos that match their characters and interests. Based on these findings, this study has created a prototype video for DS children to teach toilet training skills so that DS children can be independent and no longer dependent on other people.

Toilet training is one part of self-development activities, namely self-care activities that are challenging to do for children with Down syndrome. Toilet training is because children with Down syndrome experience motor and emotional problems, which result in difficulty in carrying out procedures for cleaning themselves after defecating. The aim of toilet training for children with Down syndrome is to be able to clean themselves after defecating or urinating. The results of the treatment with animated videos show that learning through animated videos significantly influences the level of message understanding and toilet training independence in DS children. With the characters, environment, duration, colors, and figures in the video that they like, it will further increase their interest in the video so that they can understand the message in the animated video easily. The results of this study support research conducted by Az Zahra et al. (2021), who found that learning with animated videos will further improve children's abilities in daily living skills, namely how to brush their teeth properly.

The self-development program has a central role in assisting students in carrying out self-development for themselves, such as caring for and taking care of themselves, maintaining personal safety, communicating, and adapting to the environment according to their abilities (Auld, Foley & Cashin, 2022). Self-development learning is directed at actualizing and developing students' abilities to carry out self-development for their own needs so that they do not completely burden others (Auld, Foley & Cashin, 2022; de Weger, Boonstra & Goossens, 2021). In the self-development program, there are various aspects that Down syndrome children must master and possess so that each child can live a normal life in accordance with independent functions, including self-care, self-care, self-help, communication, socialization/adaptation, life skills, and fill the free time (Auld, Foley & Cashin, 2022; Zgonec & Bogataj, 2022). Down syndrome children aged 7-9 years in Central Java have different characters, levels of learning abilities, and interests even though they are the same age. DS children tend to experience problems with independence, especially toilet training. Independent intervention to be used as a learning medium can be done through animation media whose visual content is in accordance with their preferences, namely using a forward, simple plot, third person point of view; an optical character with light brown skin color, black hair, slant eyes (mongoloid), thin lips, big head, short neck (resembling a child with Down syndrome), paired; showing the animal character of an elephant as a complement to the main character; bright color; and lasts approximately 5 minutes, and there is happy music.

Conclusion

The results of the treatment with animated videos show that learning through animated videos significantly influences the level of message understanding and toilet training independence in DS children. With the characters, environment, duration, colors, and figures in the video that they like, it will further increase their interest in the video so that they can understand the message in the animated video easily.

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