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Teaching Self-Dressing Skill Behavior in a Child with Moderate Intellectual Disability and Low Vision with Backward Chaining Technique

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The aim of this study is to identify the effectiveness of using the backward chaining technique to teach children with moderate intellectual disability (ID) and low vision the self-dressing skill of putting on a T-shirt. Teaching these children such a skill allows them to be independent and ultimately improves their quality of life. One of the intervention programs that can be used to teach the self-dressing skill is the backward chaining technique, which employs behavior modification principles. This study used a single-case subject design and an A-B design for pre- and post-intervention. The participant was a male child, aged six-years and one month. The subject had moderate intellectual disability and retinopathy of prematurity (ROP) stage V (low vision). The proposed behavior modification program combined the backward chaining technique and the administration of prompt and positive reinforcement. The behavioral modification program classified the behaviors into four steps of chain behavior, and the program execution consisted of five phases, each having one session with maximum of six trials. To analyze the effectiveness of the program, a comparison of baseline intervention and follow-up results was conducted using four features of visual analysis. The outcome of the study showed that the implementation of the backward chaining technique, along with the prompt and positive reinforcement, proved to be effective in helping the participant master the ability to wear a T-shirt independently.

Keywords: backward chaining; intellectual disability; low vision; self-dressing behavior

Introduction

According to the American Psychiatric Association (APA, 2013), intellectual disability (ID) is a disorder that occurs in the development phase, and covers intellectual and adaptive function deficiencies in the conceptual, social, and practical domain. The limitations of this ability can be clearly observed if the children with ID are compared with their peer groups in terms of sex and sociocultural background (Swapna & Sudhir, 2016). Weis (2014) mentioned that children with ID experience difficulties in the following areas: perceiving and processing new information, in learning efficiently and quickly, in applying knowledge and skills to overcome new problems, in thinking creatively and flexibly, as well as in responding to anything exactly and accurately. Based on the limitation of adaptive function, individuals with ID can be classified into four levels: mild, moderate, severe, and profound (APA, 2013). The distinction indicates the different abilities that may be observed in the aspect of adaptive ability. The limitation of cognitive and adaptive functions may cause delayed development in various aspects, one of which is the ability to perform daily activities independently (Hallahan & Kauffman, 2006; Kitchener, Jorm, Kelly, Pappas, & Frize, 2010). To be able to master all of those activities, children with ID need assistance or more intensive training from other people (Wenar & Kerig, 2006).

According to Ardic and Cavkayter (2009), teaching children with ID the skills to be independent, such as eating, drinking, taking a bath, brushing the teeth, defecating, urinating, dressing up, wearing shoes, buttoning shirts, and bodily healthcare, is extremely important. Gaining mastery of the skills required to be independent is essential in helping children with ID improve their

self-esteem, which in turn, increases the level of acceptable probability of entering new environments with new people. Furthermore, gaining mastery of these skills also determines the children's ability to live independently (Wehman & Targett, 2004).

One of the basic independent abilities that must be taught to children with ID is the ability to dress up. Based on the Coventry Children's and Young People's Occupational Therapy Service (2017), the behavior of dressing up is one that is inseparable from our daily lives. The ability to wear clothes, particularly a T-shirt, is a simple skill that must be mastered by children by the age of 6. According to Westling and Fox (2000), learning skills (e.g., dressing up) in the self-care area is important thing for children with ID, especially if the skills possessed are not in accordance with their ideal chronological ages. Gaining mastery of the ability to dress up is important as it has a basic function in protecting the body from environmental damages and exposures while conducting daily activities. The dressing-up skill generally starts developing when the children reach the age of 1 year (12 months), and they are expected to be fully dressed without any assistance upon reaching the age of 2 year (48 months) (Westling & Fox, 2009).

According to the APA (2013), the dressing-up skill in children with moderate ID can be developed even though it requires a long time, constant encouragement, prompts, and assistance before they can finally do it. The challenge involved in training children with ID, apart from the limitation of their intelligence, is worsened by the existence of a neurological or physical problem experienced by the children. For instance, the subject of the current study has low vision. Essex and Chatham (2014) state that children with low vision and blindness significantly risk having problems in other areas of development, such as gaining independence.

Many programs and techniques are used to develop adaptive functions in children with ID, such as, meta cognition, behavior modification, assertive behavior, aversive techniques, ABC, rational emotive behavior therapy, and Applied Behavior Analysis (Swapna & Sudhir, 2016). According to the World Health Organization (WHO, 2012), an effective intervention given to a person with ID is often done at home or in community settings. This kind of intervention not only minimizes the cost, but also permits service provision in a familiar and caring environment. One type of intervention that meets these criteria is behavior modification. The behavior modification program employs several strategies, such as positive and negative reinforcement, time-outs, token economy, differential reinforcements, physical restraint, chaining, and more (Swapna & Sudhir, 2016).

The technique used in this study's behavior modification program is backward chaining technique. According to Tekin-İfta and Kurcali-İftar (as cited in Aykut, Emeceen, Dayi & Karasu, 2014), the behavioral chaining technique can be used to form behaviors or develop skills that consisted of a particular sequence, such as the skill of dressing up. This technique is used because the ability to dress up is quite complex; thus, a specified sequence to perform the task is required (Turner, Lammi, Friesen, & Phelan, 2001). The decision of choosing the chaining technique is also due to the fact that the behavior of dressing up consists of several steps that can be conducted respectively from the start to the end. We also decided to use this technique because the backward chaining technique itself has an advantage in naturally providing reinforcement in every sequence or phase of behavior, which is also added to the chain of behavior (Martin & Pear, 2010). Backward chaining has also proven to be effective in

developing the skill of wearing a T-shirt among children with ID (Matson, Taras, Sevin, Love, & Fridley, 1990). However, in the present study, in addition to the condition of ID, the participant was also diagnosed with low vision, and such visual impairment hinders the development of his adaptive skills. In addition to ID and low vision, other challenges include the parents' views that teaching their child this skill would be difficult and the fact that they lack knowledge on how to teach this skill to their child. In addition to focusing on the target behavior, behavior modification procedures can also be performed and taught to other people, such as teachers and parents, to name a few. For the children with moderate ID and low vision, the skills in adaptive function always require support from others so the selection of this technique is also expected to help parents teach other adaptive skills. Therefore, it is important to study the effectiveness of backward chaining technique to help children with ID and low vision gain mastery of putting on a T-shirt independently in an appropriate sequence.

Methods

Participant

The subject of this study is a male child named "F." F is aged 6 years and 1 month and has a history of premature birth, having been delivered in the 6-month-old gestational age with a weight of only 800 grams. F experienced delayed development both in his motor and cognitive skills. An initial psychological assessment showed that F has the IQ score of 42 (scale SB L-M) and mental age of 2 years and 11 months; thus, he is classified as having an intellectual disability. Generally, F's cognitive ability is very limited. His understanding of the basic concepts of verbal and non-verbal communication and his ability to follow instruction are both extremely limited. F also has a limitation in his motor skill development. Hence, he requires assistance while walking by holding on to a wall or a chair. F uses his left hand more dominantly than his right hand. Another prominent health condition that affects his daily functioning is that F has Stage V Retinopathy of Prematurity (ROP), also classified as low vision. Thus, F has difficulties in seeing small or distant objects.

Apart from experiencing developmental delay in his cognitive and motor functions, F also experiences problems in his adaptive functions in that he constantly requires assistance and supervision from his parents. For example, F still uses disposable diapers as he still wets himself. He is also fully dependent on his parents when it comes to bathing, dressing up, and eating. His ID, combined with the lack of stimulation from parents, are the main reasons why it is important to train F and teach him the skill of wearing a T-shirt as a start. Ultimately, this will improve his independence.

Research Design

This study used a single-case subject design and an A-B design for pre- and post-intervention. The aim of the study was to identify the effectiveness of using the backward chaining technique in developing the independent self-dressing skill of children with moderate ID and low vision. Aside from the backward chaining technique, the intervention also featured prompt administration and positive reinforcement to assist the process of enhancing the subject's ability to dress up independently. The venue of the intervention program was F's home and the program was implemented every day at 45 to 60 minutes for each session. The design of the intervention

was approved by his parents and was given ethical clearance by the Universitas Indonesia's ethical board.

Measures

The targeted behavior of the intervention program was the independent skill of wearing an unbuttoned T-shirt in a child with moderate ID and low vision. The target of intervention was to develop the subject's skill in independently wearing a T-shirt in the appropriate order. The operational definition of F's behavior was the behavior of wearing a T-shirt in the appropriate order as follows: putting his head into the collar, putting his left hand into the left armhole, then his right one into the right armhole, positioning the T-shirt around his neck, and pulling down the T-shirt until it covered the stomach area. F himself must be able to perform these steps independently.

The effectiveness of this intervention was measured through the skill development of the subject. The number of sessions was determined by F's rate of success in each session; if F F failed to fulfill the target in one session even though he had performed for six times, then the session with the exact same program would be repeated the next day. Furthermore, in each trial, time management was also performed. One trial was considered a failure if the expected behavior was not performed in more than one minute. Furthermore, the session in that particular step ended only after F managed to fulfill the targeted behavior mastery by performing well in at least four out of six trials attempted.

The equipment needed in the intervention were a T-shirt (sleeved and unbuttoned), a stopwatch, an observational checklist, and a video camera to record the intervention process. The recording was done by giving the checklist every time F successfully completed the target behavior. The checklist also recorded the time, reinforcement given, and the prompt used. Table 1 describes the observation sheet used in each phase.

Table 1
Observation Sheet

Total Trials	Results	Time/ second	Reinforcement	Prompt	Information
Trial 1					
Trial 2					
Trial 3					
Trial 4					
Trial 5					
Trial 6					
Observation					

Procedure

The intervention consisted of three phases: baseline, intervention, and follow-up. The intervention began with a Functional Behavior Assessment to obtain the descriptions of the subject's behavioral functions and to identify the correlation between antecedent, behavior, and consequences so that an effective behavior modification program can be established (Kazdin, 2013).

Table 2
Functional Behavior Assasment

Antecedent	Behavior	Consequences
• F has never been taught to dress independently by his parents. • F has always been assisted in dressing up by his parents. • The parents possess no knowledge to teach F how to dress up independently.	• There has never been any behavior shown where F wears a T-shirt independently.	• F is not able to wear a T-shirt with sleeve independently; F has to always be assisted by others. • The parents have to assist F in dressing up.

Based on the analysis of F's behavioral functions, apart from his moderate ID and low vision, F's self-dressing skill has not been developed because of his parents' limited knowledge on how to teach F to dress up independently; thus, they have never taught F this skill. The impact of having limited self-dressing ability has resulted in F being unable to wear a T-shirt independently and always needing help from others.

By using the backward chaining technique, the program executor previously determined the behavioral chain from the target of the behavior. Behavioral chain (stimulus-response chain) is a sequence of consistent stimuli and responses that occur extremely close from one to another and the last response is followed by reinforcement (Martin & Pear, 2010). Each response produces a stimulus affecting discriminatory stimulus (SD^S) for the following responses until the whole chain has finally completed and reinforcement occurs to strengthen the very last response (Miltenberger, 2012). The steps of wearing clothes that would be executed in the program were actually all the steps explained by Turner, Lammi, Friesen, and Phelan in their work (2001). As a start, F was taught from the last step of wearing a T-shirt. The steps of wearing clothes, such as choosing clothes from the wardrobe, as well as determining which was the front and the back of the clothing were not taught to F because his low vision prevented him from performing those tasks.

Figure 1. Behavioral Chaining To Dress Up

$$S^D_1 \rightarrow R_1 \rightarrow S^D_2 \rightarrow R_2 \rightarrow S^D_3 \rightarrow R_3 \rightarrow S^D_4 \rightarrow R_4 \rightarrow S^+$$

- (S^D_1) The collar is on top of the head → (R_1) The subject puts his head into the colar
- (S^D_2) The T-shirt is around the neck of the sucject → (R_2) the subject puts his left hand into the left side of the sleeve of the t-shirt
- (S^D_3) The left hand is already inside of the left side of the sleeve →(R_3) the subject puts his right hand into the right sleeve of the t-shirt
- (S^D_4) Most part of the t-shirt is around the chest of the subject → (R_4) the subject pulls the t-shirt down until it covers the whole stomach area.

Figure 1. above tells about behavioral chaining to dress up (wearing t-shirt) based on *task analysis*

After classifying and forming the chain of behavior in an appropriate order, the next step was to designing the program of intervention. The more completed explanation is presented in the table below.

Table 3.
Program Design of the Behavior of Wearing a T-Shirt Using the Backward Chaining Technique

Steps of Implementation	Mastery Behavior Target	Steps and Activities Implemented
Step 1	Step 4	The administration of a prompt is executed in the implementation of steps 1 to 3, with the addition of step 4, in which F will have to do it independently.
Step 2	Step 4 and 3	The prompt is executed in the implementation step 1 and 2, with the addition of step 3 and step 4 being done by F independently.
Step 3	Step 4,3 and 2	The prompt is executed only in the implementation step 1 with the rest (steps 2, 3, and 4) being done by F independently.
Step 4	Step 1,2,3 and 4	The prompt is no longer administered and F needs to execute every step of the implementation of wearing a T-shirt (prompts 1 to 4) independently.

According the step in Table 3, each step in this program will be done in a session or more with six trials in every session. The number of trials served as an opportunity for F to show consistency in performing the target dressing behavior. The ability to master each step can be categorized successfully if F showed more than 50% rate of consistency from the total of six trials.

Apart from using backward chaining technique, the behavior modification program also used prompt administration. Prompting systems have been proven to be effective in teaching discrete tasks or chaining tasks (Morse & Schuster, 2004). Sample prompts administered to F included physical prompts (e.g., directing and guiding F's hands in the steps of wearing the T-shirt) and verbal prompts (e.g., giving verbal instructions). Prompt administration was eliminated based on the steps formulated by measuring the ability of the subject himself.

Along with prompt administration, the program was also administered to provide more positive reinforcement. The positive reinforcements used in the behavior modification program included social and consumable reinforcements. Social reinforcements were administered every time the subject succeeded in performing the steps of dressing up. Consumable reinforcements were scheduled to be administered at the end of each session of the intervention. According to Cooper, Heron, and Heward (2007), the reinforcements provided should match the needs and motivations of the research subjects and should always include praising the subjects.

Baseline. The baseline measurement aimed to identify how far the subject has mastered all the phases/steps of the behavior of wearing clothes, and to analyze the surrounding environment of the subject to determine the factors that can influence the intervention process. The baseline measurement was performed by the program executor accompanied by the parents in F's house. The behavioral sequence performed by F based on task analysis was recorded.

Intervention. The intervention program and the success criteria in each session during the intervention were adjusted at each phase program based on the chain of behavior demonstrated by the subject. During the program execution, the program designer calculated F's rate of success in each session, how many trials were attempted, and F’s progress from the beginning to the ending of the program. The training of the behavior of dressing skill was only performed when F managed to commit all the steps in the appropriate sequence in dressing up. The success criteria of this program were based on an increase in the subject's skill in independently wearing a T-shirt (sleeves and unbuttoned ones) with the appropriate order.

Follow Up. In order to determine the rate of success of the intervention, two follow-up processes were required after the program was finished. The follow-up phase was done twice so that we can compare F's abilities at the baseline phase and after the intervention. The first follow-up process would be done one week after the intervention, and the second follow-up was would be done two weeks after the intervention. A 1-week break in between two follow-up phases was included to determine whether the changes were sustained after the program was finished (response maintenance) within a certain time. As one on evaluation to determine the success of the behavior modification program, a comparison was done by recording all of F's attempts in independently and accurately wearing a T-shirt following a chain of behaviors.

Data Analysis

The result of the program was analyzed using visual analysis. There are four features used to look at effective interventions: (1) level, (2) trend, (3) the effect of proximity, and (4) overlapping effects between different phases (Kratochwill, Hitchcock, Horner, Odom, Rindskopf, & Shadish, 2010). Levels and trends in each phase need to be observed to determine the performance in each phase. Meanwhile, rapid changes between phases and the less overlapping data between phases can show evidence of an effective intervention. Single-case study researchers have traditionally relied on visual analysis of the data to determine evidence of a relation between a variable and an outcome variable as well as the strength or magnitude of that relation. In this study, visual analysis was done to determine the effect of the intervention.

Results

The baseline session was performed in two sessions for two days with six trials in each sessions. During the process, F was quite cooperative, although he seemed easily distracted by other activities. The responses from parents in supporting F ("You can do it F!" or "Smart F, you can do this!") also contributed in enhancing F's effort to try again when he failed. Based on the outcome of the baseline from Session 1 and Session 2, it seemed that F's ability was very limited only in the first step of wearing the T-shirt. Although the aforementioned steps did not occur often, he was not able to show them consistently and also needed quite some time to do the first step. It could be concluded that his ability was very limited, suggesting that the intervention had to start from the first step.

The behavior modification program was conducted in six sessions with a total of 36 trials. Generally, the program could be executed well, although sometimes F really wanted to do other activities, and refused to repeat the trials requested. F's parents needed to warn and persuade him for quite a while or allow F to do the other activities he really liked prior to each intervention session.

After some time, F was able to master the target behavior in each step until he no longer needed to repeat all of them all over again. The mastery behavior of dressing up was found to be hardest at the third step. In several trials, there were also instances where F needed to change to another T-shirt because its collar was too wide. After the sessions of intervention elapsed, two follow-up sessions were then executed on the first and the second week after the intervention was concluded. During the whole steps, F performed all the steps by reciting some of the steps, such

as mumbling "down here" or "this side." The following graph presents the results of the intervention program.

Figure 2. Comparison Of Stage Mastery Levels Of Self-Dressing Skill Between Phases

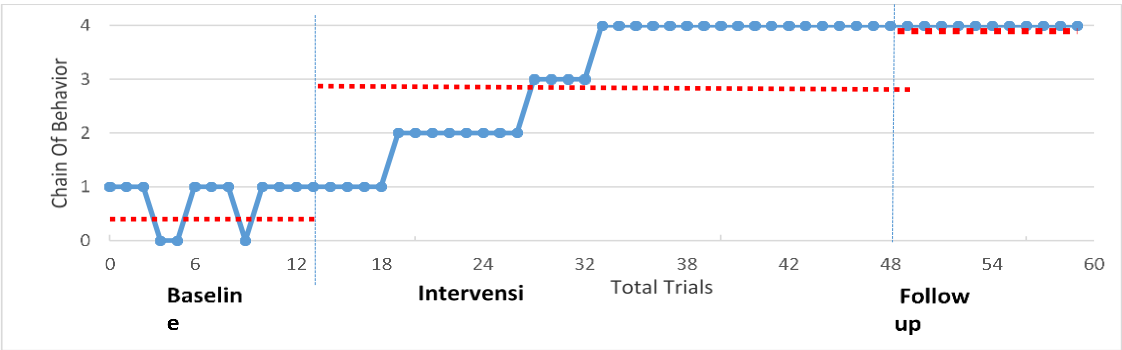

Figure 2. shows total chains of behavior based on 60 trials from the baseline phase, intervention, and follow-up phase.

Based on feature-level visual analysis, Figure 2 shows the development of F's mastery of the behavioral chain of self-dressing starting from the baseline phase, the intervention, and the follow-up after 60 trials. In the baseline phase, the mastery of self-dressing skill is inconsistent in 1 step and there was an increased level of mastery self-dressing skill into 4 steps in the last intervention and follow-up phases.

Figure 3. Trend Mastery Of Self-Dressing Skill

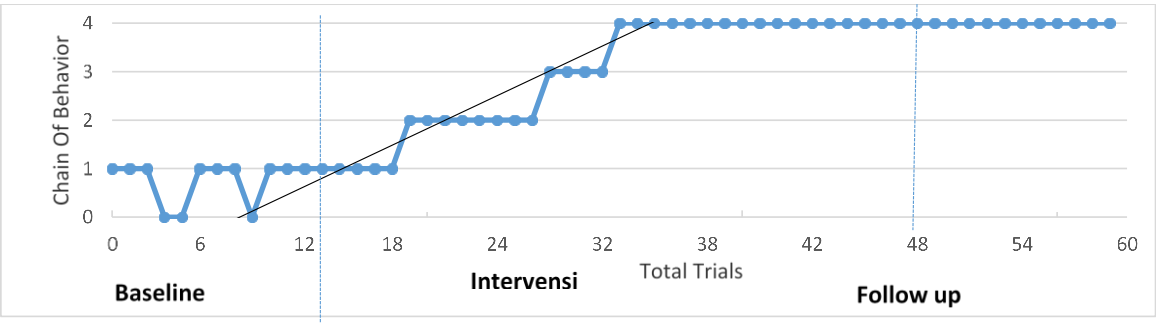

Figure 3. shows the increasing trend of behavioral mastery seen from the increase of graphs in each phase.

The increasing trend of behavioral mastery can be seen in Figure 3. There appears to be a fairly rapid change effect between the baseline phase and the intervention phase. The increasing trend of behavior occurring at each session peaked starting from 12 baseline trials to 34 intervention trials, and from trial 34 until the end of the follow-up phase.

Figure 4. Immediacy Of Effect Between Phases

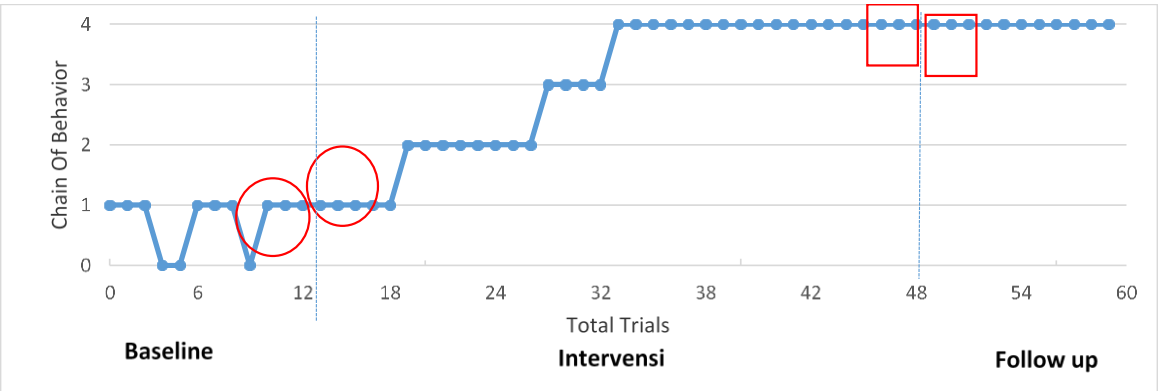

Figure 4. data given oval and square signals indicate the immediacy of the effect in visual analysis. from baseline, intervensi and follow up phase

Figure 4 shows that there is no level change in the last three baseline sessions and the first three intervention sessions. This occurred because at the beginning, the intervention program only targeted one chain of behavior so there was no immediate change showed by the participant. However, towards the end of intervention and follow-up, the graph shows the consistency of the subject's mastery of all behaviors.

Figure 5.Overlap Between Phases

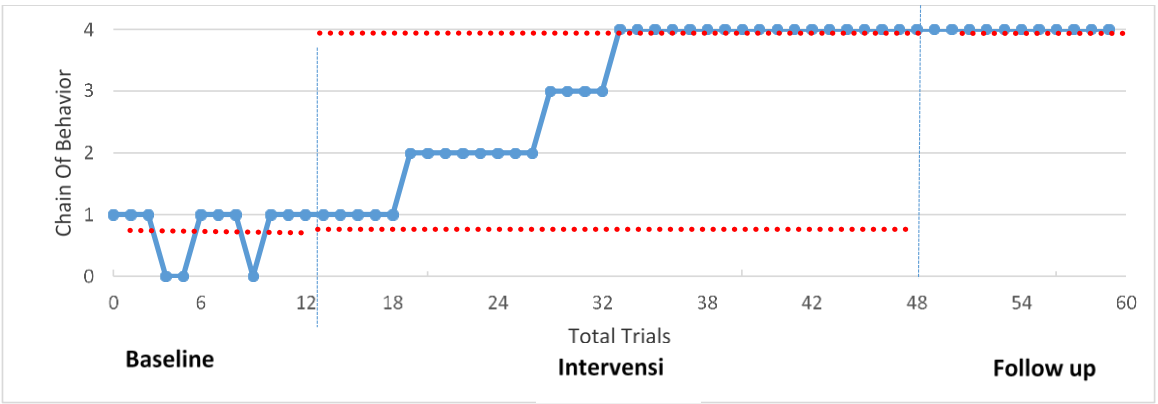

Figure 5. shows the minimum of overlapping data at the baseline, intervention and follow up phases.

Based on Figure 5, the overlapping of data occurred in the baseline and early intervention phases. This occurred because at the beginning, F can only master the first chain of behavior and then continued to master the rest of the chain behaviors. Another overlapping of data also occurred at trial 33 of the intervention program until the follow-up phases. This indicated the magnitude of the intervention effect: F was finally able to master all the chain of behaviors and continued to show improvement at the follow-up phases.

Discussion

Based on the results, the backward chaining technique with prompts and positive reinforcements improved the participant's mastery of self-dressing skill (i.e., wearing a T-Shirt). By comparing the levels between phases, we observed an increase in mastery of self-dressing skill in F (a child with moderate ID and low vision). Furthermore, judging from the trends in each phase, we detected a notable trend of improvement, especially in the intervention phase. Even though the effect of intervention was not immediately shown in the early phases, the end phase and the follow-up phases showed that the participant has consistently mastered the chain of behaviors. This suggests that intervention programs can help a subject develop the self-dressing skill.

Generally, F's ability to gain mastery of the chain of behavior in wearing a T-shirt has been shown to increase from trial 1 to trial 60. The comparison between the results of the baseline and follow-up also shows that F, who used to master only one of four steps, has finally mastered all the steps correctly. Not only that, the ability of F in dressing up (particularly in wearing a T-shirt) has been maintained based on the results of the follow-up sessions 1 and 2. This indicates that the ability to dress up has been consistently mastered by F.

There were several factors that contributed to the success of the program aside from the technique taught and prepared by the program executor. Those were the attitude and supportive environment created by the parents in executing the program, including the social reinforcements during the program, which increased the subject's motivation.

However, there were several other factors that interfered with the intervention program. F was easily distracted and often F showed inappropriate behavior, such as punching his own head. His eye-hand coordination is not fully developed due to his limited motor skills and low vision. This condition affected how well he coordinates the movement on his right hand, especially on how he puts his hand into the sleeves.

There were also several issues that might become a limitation in this intervention program, such as the trials executed continuously without a pause or break, which led to boredom, and the fact that the program used different T-shirts in every session, which may have confused the subject confused and delayed his progress in gaining mastery of all the steps. Furthermore, the intervention program did not include the two steps at the beginning of wearing clothes: getting the clothes from the wardrobe and differentiating the sides of the T-shirt (Turner, Lammi, Friesen, & Phelan, 2001). Thus, although F has already mastered the behavior of putting on the T-shirt, he still needs some assistance from his parents in these two aspects. For the further research and implementation of the intervention program, the first two stages must be included in order to increase the independence of the subject.

Nevertheless, based on the aforementioned explanation, it can be concluded that the backward chaining technique for F (aged 6 years and 1 month), who has moderate ID and low vision is successful in enhancing his ability to wear a T-shirt with minimum prompts and no physical assistance provided by the parents. The ability of F, who only used to master just one of the four steps in wearing a T-shirt, has finally increased as he is now able to perform all of the steps by the end of the intervention sessions.

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