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Changing Hitting Chest to be Stroking Chest with Shaping and Differential Reinforcement of Alternative Behavior Method for a child with Autism Spectrum Disorder with Intellectual Impairment

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Abstract- Self-injury behavior is a behavior that can cause or potentially cause redness, bruising, or injuries to body parts. Some of the children who perform such behavior are children with Autism Spectrum Disorder (ASD). Children with ASD perform self-injury to seek attention, avoid things they dislike, to obtain what they want, or for self-stimulation. In this study, the children who were participants in the study were 10-year-old boys who had ASD conditions with below-average intelligence problems and carried out self-injury behaviors in the form of hitting the chest using their hands. The hitting-chest behavior carried out by the participants had been excessive, causing redness in part of each child's chest, pain in the chest, and sometimes a feeling of breathless. Therefore, a study was performed to eliminate the behavior of hitting the chest by applying intervention using the method of shaping and differential reinforcement of alternative behavior (DRA) according to the principle of behavior modification in children with ASD. The given alternative behavior is a stroking-chest behavior. After administering the intervention for 18 days (2 days of shaping session and 16 days of DRA sessions), the researchers obtained the results that the shaping and DRA methods are effective to eliminate the hitting-chest behavior and shape the stroking-chest behavior as an alternative behavior in children with ASD whose intelligence is below the average.

Keywords: autism spectrum disorder; shaping; differential reinforcement of alternative behavior (DRA); hitting-chest behavior; stroking-chest behavior

Introduction

Autism Spectrum Disorder (ASD) is categorized as a clinical disorder focusing on the obstruction of social communication skills, including minimal eye contact, difficulty in keeping up conversations and social relationships, and showing restrictive behavior and repeated pattern behaviors, such as the behavior of stereotypes, hypo- or hypersensitivity, and unusual interest (American Psychological Association (APA), 2013). ASD is observed in early childhood and continues throughout life. One area that has often been the focus of studies in children with ASD is behavioral problems. The behavior considered problematic disrupts the functioning of individuals during activities and has the potential to cause harm or damage, such as physical aggression, verbal aggression, damage to property, rampage, and self-injury behavior (SIB; Minshawi, Hurwitz, Odstad, Morriss, & McDougle. 2014).

SIB is defined as an act causing or potentially causing redness, bruising, or other injuries on body parts, by, for example, hitting body parts with a hand, hitting body parts with an object, pulling hair or skin, pinching, biting body parts, and rubbing or scratching (Matson & LoVullo, 2008). According to McCorkle (2012), four functions of behavior are observed when children with ASD display SIB, namely, an attention function, to escape or avoid something that is not liked (*escape function*), a tool to obtain what a child wants (*tangible items function*), and *self-stimulation* (*sensory function*).

According to Baghdadli, Pascal, Grisi, and Aussilloux (2003), 50% of children with ASD in this research performed SIB and 14.6% were at a severe level. Therefore, SIB is a common behavior in children with ASD. The impact caused by SIB varies from disturbed routine activities, to suffering minor injuries, to causing death (Matson & LoVullo, 2008). Therefore, eliminating SIB in children with ASD behavior is critical.

The participant in this research is a boy diagnosed with ASD, by the psychologist, who performs the SIB of hitting the chest. Chest-hitting often makes part of the participant's chest reddish in color and causes pain until he feels short of breath. This behavior has endangered safety and disrupted participant activity. This condition has been deemed necessary to provide an intervention to reduce the chest-hitting behavior by implementing a behavior modification program. The program is in accordance with the statement by Matson and LoVullo (2008): The program of behavior modification becomes the program evaluated as the most effective to eliminate SIB in children with ASD.

In determining the intervention technique and method, the function of the hitting-chest behavior emergence needed to be explored (McCorkle, 2012). In the participant, the hitting-chest behavior that he performed was a part of seeking attention to begin interactions and a tool to obtain what he wanted. Because the impact generated from chest-hitting is already a danger to safety and health, such a behavior must be eliminated.

The In the literature, interventions have been widely used to eliminate or decrease SIB in children with ASD. Studies have used negative punishment methods with extinction techniques that have proven effective for removing SIB in children with ASD (Blamires, 2002). Likewise, positive reinforcement with differential reinforcement of other behavior techniques has also proven effective for eliminating SIB in children with ASD (Heffernan & Lyons, 2016). Notably, in the evaluation of the two studies, the child begins looking for another SIB behavior when she or he needs self-stimulation to recover her or his sensory needs. This phenomenon is in line with the evaluation stated by Minshawi and kolega (2012), which suggested the elimination of the (*extinction*) SIB and added to and shaped the new, more positive behavior (*alternative behavior*).

Based on the evaluation from the three aforementioned studies, we attempt to investigate the effectiveness of implementing alternative behavior formation to decrease SIB in children with ASD. In the behavior modification, the technique used is called differential reinforcement of alternative behavior (DRA). The formation of alternative behaviors was carried out to replace the SIB carried out by children. A behavior chosen as an alternative behavior is a behavior that is still related (compatible behavior) to an undesired target behavior (Kazdin, 2013). The stroking-chest behavior is considered still a compatible behavior with the hitting-chest behavior, and both use the hands and chest as a medium to shape behavior. In addition, the interest of the participant in the chest body part becomes that unchanged part because the ASD condition has

a limited interest. Accordingly, the hitting-chest behavior will be replaced by a stroking-chest behavior by using behavior therapy according to the principles of behavior modification.
Regarding the participant's condition, the stroking-chest behavior has never been observed, and one of the requirements of DRA is the existence of other behaviors (desired behavior) that have been observed (Miltenberger, 2012). In this condition, the desired behavior has never been formed before; thus, before implementing DRA, we must form (shaping) the behavior (Miltenberger, 2012); thus, in this study, we applied two techniques: shaping and DRA. According to our review of the literature, the application of these two techniques in one case is a novel approach. Therefore, we attempted to investigate the effectiveness of DRA and shaping to eliminate the hitting-chest behavior by forming a stroking-chest behavior as the alternative behavior in children with ASD.

Method

Study Design Characteristic.
The research design used in this research was a *single-subject design,* also known as *single-case design*. This research was categorized into a quasi-experimental us pretest and posttest procedure to determine the effects or change after the treatment or the intervention. The *pretest* and *posttest* were employed to observe the change in the scores by comparing the observation results of the hitting-chest behavior and the stroking-chest behavior performed by the participant.

The variables in this research were hitting-chest behavior and stroking-chest behavior. The operational definition of hitting-chest behavior is the behavior of hitting the chest hard to produce a pounding and repeated sound using the palm of a hand that is performed at home. The operational definition of stroking-chest behavior is the behavior of touching the chest gently with a stroking movement using the palm of a hand that is performed at home. Both variables were measured using a measuring instrument observation sheet whose method of recording the appearance of behavior uses recording intervals (examples of the observation sheets are attached). We used this method to assess the number of occurrences of participant behavior in carrying out the instructed behavior. At the time of the shaping session, the researchers noted the results of the formation of chest-stroking behavior according to the target in each session. During DRA, the researchers noted the number of occurrences of chest-hitting behavior and chest-stroking behavior carried out by the participants in each trial using the table to determine the frequency of the behavior in each program session, calculate the percentage of the number of occurrences of the behavior, and monitor the successful progress of the participant during the program. During the research, the mother was involved in the implementation of the 5th to 9th sessions to provide verbal prompts and social reinforcement (the program schedule is attached).

The mother was also asked to be involved in recording the hitting-chest behavior and stroking-chest behavior observed outside the timeframe of the program. The recording sheet serves to monitor the mother's response to the hitting-chest behavior and the behavior of participants when they hit the chest and stroke the chest (sample notes will be attached). The results of this task sheet can be used as a material for evaluating the development of a target behavior. The

completed worksheet would always be requested by the researcher when the researcher visited to the house as an evaluation document.

Participant Characteristics.

Based on the performed series of psychological examinations, the participant was diagnosed by the psychologist as experiencing ASD with accompanying intellectual impairment (severity level 1 – requiring support for social communication & restricted, repetitive behaviors). When the participant was aged 9 years and 5 months, his mental age was equal to a child aged 4 years and 11 months, and the test results of the Colored Progressive Matrices were in the V category. The results of the interview and observation also showed that F has the characteristic of ASD on a severe level.

There were several movements always performed by the participant because he was a little repeatedly without any certain purpose, such as moving the hand in front of the face, hitting the chest, and running or spinning nonstop. The behavior that persists and is always observed is the repeated hitting-chest behavior. That aspect is the focus of this research. The hitting-chest behavior is often observed when the participant feels upset because a desire has gone unfulfilled. The participant would continuously repeat the hitting-chest behavior until their wishes were fulfilled. The participant hit his chest so hard an audible pounding sound was produced and he felt pain. When the clothes were removed, the chest appeared red. In addition, the participant also hit his chest when desiring attention from other people. The participant would continuously hit his chest and follow with the phrase "can't hit the chest, huh?" until he received attention. During this time, the parents only told the participant not to hit his chest and did not attempt to stop the behavior. The mother did not attempt to relieve the feeling of frustration experienced by the participant and did not teach her child other techniques to vent his frustration in a better manner.

Program of behavior modification with shaping and differential reinforcement of alternative behavior.

The stroking-chest behavior can be formed through DRA method. The DRA method is the most effective method to decrease SIB because it implements reinforcement-based treatments (Morano, Ruiz, Hwang, Wertalik, Moeller, Karal, & Mulloy. 2017). DRA is a method used to decrease the undesired behavior and increase the desired behavior (Miltenberger, 2012). The behavior selected as the alternative behavior is the behavior that is still compatible (compatible behavior) with undesired target behavior (Kazdin, 2013). The stroking behavior is perceived to be a behavior compatible with the hitting-chest behavior because both use hand and chest as a media to form the behavior.

The requirements to apply DRA are as follows: another behavior (desired behavior) will improve, and a desired target behavior has been observed and will be a reinforcer to strengthen the desired target behavior (Miltenberger, 2012). In this condition, the stroking-chest behavior (desired behavior) has never been formed before. Therefore, before implementing DRA, we must form (shaping) the behavior (Miltenberger, 2012). Shaping the stroking-chest behavior

was performed so that at least the participants have occasionally stroked the chest and can continue the application of DRA.

In conducting the shaping method, a prompting technique was also provided to assist with the behavior formation (Martin & Pear, 2015). According to Miltenberger (2012), a prompting technique is one of the techniques commonly used and is appropriate to teach one behavior in a child with ASD. There are prompt types based on the level of the need for help from the most to the least, including a physical prompt, modeling prompt, gesture prompt, and verbal prompt (Miltenberger, 2012). The prompt types can be used separately or combined (Kazdin, 2013).

For the participant, the prompts using the shaping implementation were a physical prompt and verbal prompt. The physical prompt performed by the researchers was directing the participant's hand to stroke his chest. The verbal prompt performed by the researcher was explaining to the participant what he has to do and reminding him about the activities that he must do by saying "stroke your chest." Similar to the implementation of DRA, the prompt provided was in the form of a verbal prompt. The researcher said, "just stroke your chest," "how to stroke your chest," or "do not hit the chest, all right? Just stroke."

When during the implementation, the participant continued hitting his chest and did not directly stroke his chest after the researcher gave the instruction to stroke his chest (verbal prompt); next, the researcher held the participant's hand so he would stop the movement of hitting his chest. This performed this action to ensure that the participant's hand moved away from his chest first. After that, the researchers would remove the participant's hand and provide a verbal prompt to stroke the chest. When the participant did not act according to the prompt provided, the researchers would provide a physical prompt and verbal prompt to the participant so that he would stroke his chest.

Modeling prompts and gesture prompts were not provided to the participants because of their limited attention span. This limitation is part of the condition of the ASD that participants have. In addition, the limitations of the participants' intellectual abilities made it difficult for them to understand directions if the directions provided were not concrete. A physical prompt and verbal prompt are considered tools to direct someone in a concrete and very good manner, and have been used with children who have intellectual limitations (Sabielny & Cannella-Malone, 2014). After that, the given prompt is fading to ensure that the participants do not depend on the verbal prompt. In other words, when the participant has fulfilled the session 8 targets, he is immediately provided a fading prompt in the form of a non-prompt.

In the implementation of shaping and DRA, reinforcement becomes a critical aspect to be considered to maintain the desired behavior and eliminate the undesired behavior (Miltenberger, 2012). The reinforcement provided was in the form of positive reinforcement to strengthen the stroking-chest behavior and to minimize the appearance of the hitting-chest behavior. The positive reinforcements provided to participants were a social reinforcer, object reinforcer, and activity reinforcer. The reinforcer provided must be consistent and immediately (immediacy) after the desired behavior is observed. Therefore, the researcher provided a social reinforcer

immediately (immediacy) because the participant liked to receive praise and provided an object reinforcer and activity reinforcer simultaneously after all the sessions were completed (intermittent). The schedule for social reinforcer administration we used is the fixed ratio because reinforcement was provided every time the stroking-chest behavior was observed. The stroking-chest behavior was calculated once when one set of the stroking-chest behavior was observed. One set of the stroking-chest behavior could be in the form of several movements to stroke the chest. Each set of the stroking-chest behavior was calculated after the participant quit doing the stoking-chest movement and the hitting-chest behavior.

The program of behavior modification to decrease the frequency of hitting the chest used on the participant was conducted twice, namely, the first stage for the implementation of shaping method, and the second stage for the implementation of the DRA method. The stage of shaping comprised two sessions, and the stage of DRA comprised seven sessions; thus, the overall program comprised nine sessions of implementation. Each session was conducted for 90 minutes (i.e., at 16:00–17:30 Indonesia Western Standard Time, after the participants came home from school) and based on the results of the assessment; participants were more likely to demonstrate the hitting-chest behavior at that hour than at other times. The implementation was carried out at the client's home without any specific settings. The duration of the 90-minute implementation was considered sufficient for the implementation of the program and not too disruptive to the activities of family members, especially mothers who have to prepare dinner. In addition, the hitting-chest behavior and stroking-chest behavior were also expected to be observed when the exercise was carried out for 90 minutes. During the 90 minutes, participants and researchers carried out joint activities, such as watching television; coloring; cutting; talking; practicing writing, reading, and calculations; and eating. The activities performed were basically according to the daily activities normally performed by the participant; no certain activity was purposively provided to the participant.

The implementation of shaping was conducted when the hitting-chest behavior was observed so that the participant could learn from his experience that the hitting-chest behavior would be changed into the stroking-chest behavior. If the stroking-chest behavior was formed when the participant did not hit his chest, we were concerned that he would have less understanding of the meaning of the stroking-chest behavior as an alternative behavior compared with the hitting-chest behavior. This concern was also related to the limited cognitive ability sir gar each behavior that would be taught must be performed clearly and in a concrete manner. The detail of the program series in this research is presented in the attachment.

Child Outcome Characteristics.

The indicators of success from the program on the basis of the participant are as follows. Each session is declared successful when the participant performed all the required activities according to the target of each session, namely:

- The 1st and 2nd sessions were declared successful when the participant stroked his chest a minimum three times. If less than three times were observed, the session would be repeated in the next session with the same procedure until the participant succeeded. This

target already fulfills the DRA criteria, which require that at least the stroking-chest behavior has already been observed occasionally.

- The 3rd session was declared successful when the comparison of the occurrence percentages of hitting the chest and stroking the chest was 60%: 40%.
- The 4th session was declared successful if the comparison of the occurrence percentages of hitting the chest and stroking the chest was 50%: 50%.
- The 5th session was declared successful if the comparison of the occurrence percentages of hitting the chest and stroking the chest was 40%: 60%.
- The 6th session was declared successful if the comparison of the occurrence percentages of hitting the chest and stroking the chest was 30%: 70%.
- The 7th session was declared successful if the comparison of the occurrence percentages of hitting the chest and stroking the chest was 20%: 80%.
- The 8th session was declared successful if the comparison of the occurrence percentages of hitting the chest and stroking the chest was 10%: 90%.
- The 9th session was declared successful if the comparison of the occurrence percentages of hitting the chest and stroking the chest was 0%: 100%.

The program was declared as successful when during the follow-up session; the participant did not demonstrate the hitting-chest behavior at all and replaced it with the stroking-chest behavior.

Results

The data collection was divided into three stages: pretest, intervention stage, and posttest stage. In the pretest stage, the data collection was performed on 3 consecutive days through the observations and the interviews with the mother. The intervention session was conducted in 18 days (2 days of the shaping stage and 16 days of the DRA stage). The posttest was conducted on 3 consecutive days within one month after the session ended.

The implementation of shaping was conducted over 2 days and stated as successful because it has fulfilled the target of stroking the chest three times. In this stage, the stroking-chest behavior had been formed in the participant but was observed only three times. The participant followed the instruction from the researchers when the instruction was provided with the physical prompt or verbal prompt.

The implementation of DRA was conducted over 16 days through seven sessions of intervention. On the 1st and 4th days, the participant showed an increase in the percentage regarding stroking the chest and a decrease in the percentage regarding hitting the chest, despite the repetition in the presentation of the session. However, on the 5th day, the participant experienced a decrease in the result. The percentage of hitting-chest behavior increased by 3%, and the percentage of stroking-chest behavior decreased as much as 3%. On the 6th day, participants again experienced an increase in the percentage of stroking the chest until the 16th day. We thought that the decrease that occurred in the participants was due to the lack of repetition of the learning process outside the intervention session. After being evaluated from

the results of the assignment sheet that was filled in by the mother and interviewing the mother, information was obtained about how the mother was not correct when training F to stroke the chest. According to the results of a study conducted by MacDonald (2010), the repetition of learning performed at home or outside the therapy session can lead to good development in children and affect the success of the therapy program. By contrast, if there was no repetition of practice at home or outside the therapy session, there was a higher possibility of not achieving the designed program target. Accordingly, the repetition practice was needed by the child according to the planned program.

The improvement of the participant occurred gradually, the hitting-chest behavior did not decrease directly as much as 10% and the stroking-chest behavior did not increase directly as much as 10%. This result caused the repetition of providing the 4th, 5th, 6th, 7th, and 8th sessions. Nonetheless, the qualitative results still showed that the participants experienced a decrease in the percentage of hitting-chest behavior and an increase in the percentage of stroking behavior, except on the 5th day. In addition, participants also experienced a gradual increase in the ability to stroke their breasts with a chest stroke without being provided a verbal prompt since the 5th day. Each day, the number of chest strokes without a verbal prompt increased until the success was achieved in the 9th session, which targeted the participant to fully perform the chest stroke without a verbal prompt (non-prompt).

The increased percentage of stroking-chest behavior and the decreased percentage of hitting-chest behavior occurred gradually and were caused by the existence of the intelligence limitation on the participant. This ability affected the time spent to learn new things. In a study conducted by Morano and friends (2017) in children with intellectual impairment (IQs below 70) and ASD conditions, it was found that children with such conditions needed more time to learn new things compared with children with an IQ of more than 70 and the development produced in each trial was 1%–10%. Eventually, what happened to F was something normal. F was able to show development each day with the increased percentage of stroking-chest behavior as much as 1%–7%.

The comparison of frequency and percentage of hitting-chest and stroking chest behaviors on the overall session is presented in Fig. 1 and 2.

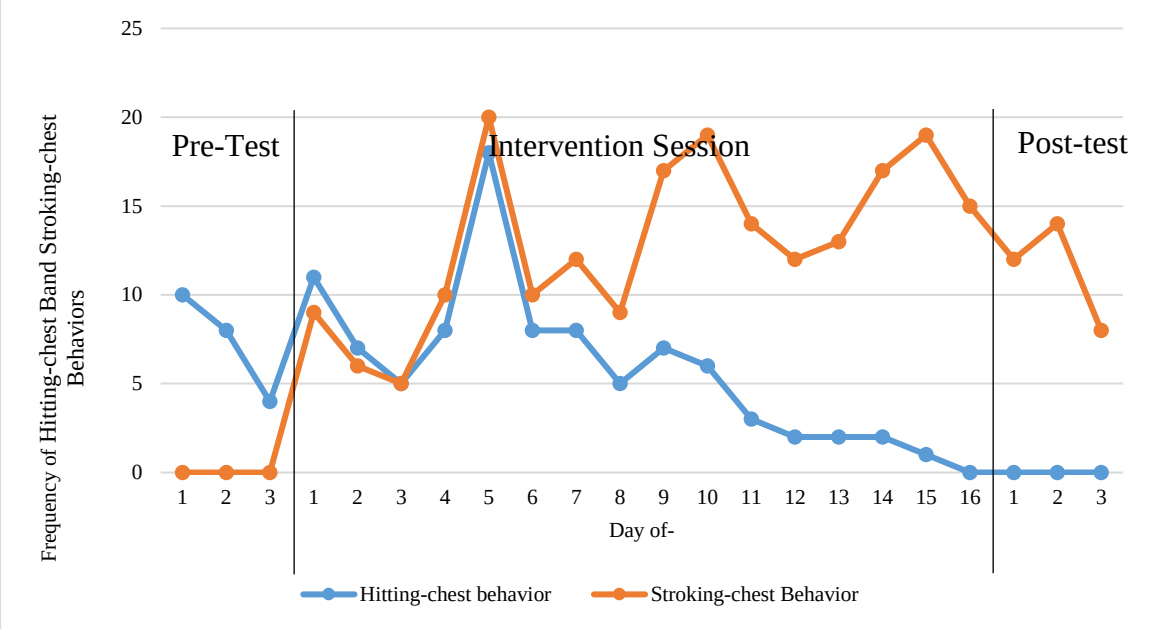

Fig. 1. Frequency Comparison of Overall Hitting-chest and Stroking-chest Behaviors

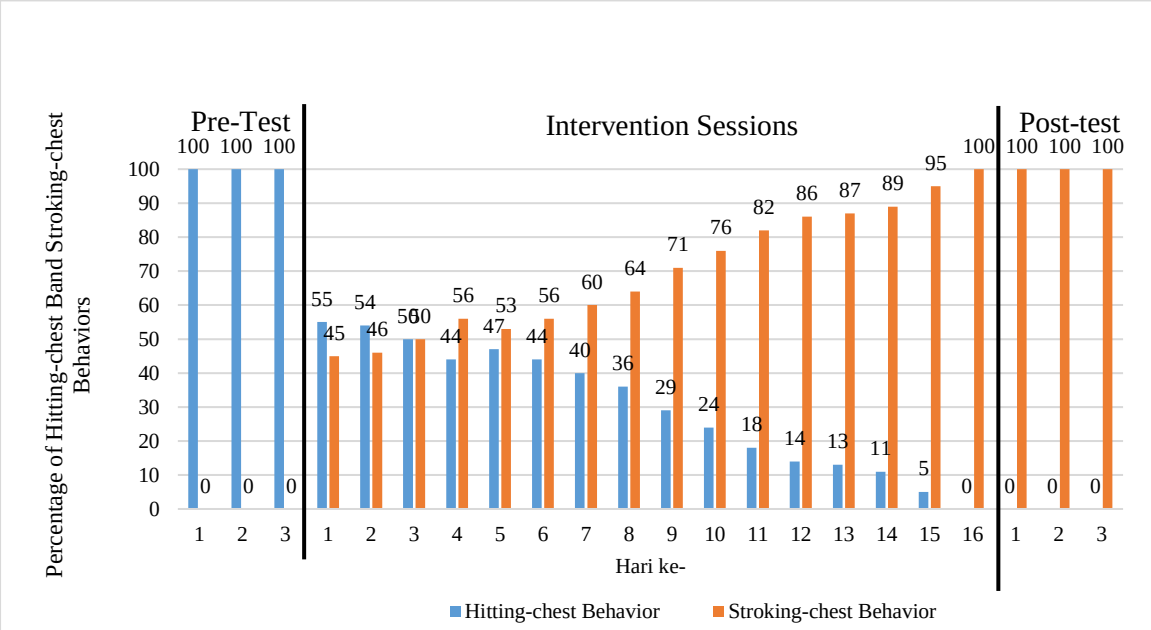

Fig. 2. Percentage Comparison of Hitting-chest and Stroking-chest Behaviors

Discussion

Based on Figure 1 and 2, we concluded that there was a change from the hitting-chest behavior to the stroking behavior in the participant. Generally, the decrease in the hitting-chest behavior could be consistently observed on from the 6th to the 16th day. The comparison of baseline data and follow-up shows that a positive change, that is, from the initial chest-hitting behavior that was observed at 100% and then at the follow-up session when the result was 0%. Similarly, the frequency of stroking the chest increased in percentage every day. In addition, the diagram also shows that participant behavior persists even in the 1st, 2nd, and 3rd follow-up sessions. Additionally, an increase in a stroking-chest behavior in which at the beginning there was no

appearance at all, then the appearance increased up to 100%. This result shows that the hitting-chest behavior was no longer performed by the participant and replaced with the stroking-chest behavior.

The presentation of the results after the implementation of the intervention showed the implementation of a behavior modification program was effective to eliminate the hitting-chest behavior in a child with ASD with the intelligence limitation of being aged 10 years and 8 months. The results were in line with the literature that had stated that the intervention of a behavior modification was proven scientifically effective to be used to eliminate SIB in children with ASD (Matson and LoVullo, 2008).

The selection of a method is the most critical factor that could affect the results. In this program, the method used was the DRA method. The DRA method was perceived as the most effective method to decrease SIB due to the implementation of reinforcement-based treatments (Morano, *et al*. 2017). In the application of DRA techniques, behaviors considered problematic are eliminated by exchanging these behaviors for more meaningful alternative behaviors. In participants, the hitting-chest behavior is diverted by other behaviors considered safer by participants, namely, stroking the chest. In the initial observation session and baseline, participants very often hit their chest to make themselves feel pain in that area of the body. Thus, chest punches carried out by the participants can endanger their health. Therefore, with the assistance of the DRA technique, which switched the hitting-chest behavior into a stroking-chest behavior, can make the participant eliminate his hitting-chest behavior.

Besides additionally, good developments were associated with the stroking-chest behavior, and there was a decrease in the level of prompt-giving to the level of non-prompt, which is from the physical to be verbal prompt, and lastly non-prompt. The participant could still increase his ability, although the number of times the prompt had to be provided was decreasing and, sometimes, no prompt was provided.

The reinforcer provided to the participant was perceived as effective in maintaining his behavior. Notably, the form of social reinforcement provided must be diverse to ensure that the participant was not bored and to maintain the effectiveness from the effect of the reinforcer provided. The type and time of giving the reinforcer are other factors that contribute to the effectiveness of the program. In this program, the implementer used and provided a reinforcer in accordance with the plan, which was to provide a social reinforcer in the form of praise immediately after the participant successfully displayed the expected behavior according to the target and to provide the activity and reinforcer object after the participant successfully completed session 9 (*immediate*). According to Martin and Pear (2015), provision of an immediate reinforcer (*immediate*) is more likely to maintain the desired behavior.

The other factor that can affect the implementation of the program was a conducive environment for the learning process, namely, the parents' behavior displays cooperation and a willingness to teach the participant outside the intervention session. This is monitored through a task sheet filled in by the mother. A mother's positive attitude during the intervention process result in

positive development in the participants. According to Moes and Frea (2002), the context of the family environment can contribute to behavioral development that occurs in children with ASD. The debriefing conducted by the researchers with the mother at the end of each session assisted the mother to be able to understand the participants' development and the aspects that can be applied outside the intervention sessions.

Although the intervention program of behavior modification for hitting the chest can be declared a success, there was a limitation related to the method and the techniques of implementation. Based on the method of implementation, program compilers do not include the generalization phase or maintenance phase in the program. According to Martin and Pear (2015), these phases are useful because the behavior taught can persist and be applied in various situations. Another limitation related to implementation techniques is that the researcher acts as an interventionist and an observer at the intervention session. This situation could have resulted in the administrators being focused on presenting the teaching, which could have affected the preciseness of the calculation the number of hitting-chest and stroking-chest incidences in each session.

Conclusion

Based on the obtained data, we conclude that the modification program of hitting-chest behavior with the shaping technique, DRA, various types of prompts, and positive reinforcement with fixed ratio and was effective to eliminate the hitting-chest behavior and replace it with a stroking-chest behavior in children with ASD with accompanying intellectual impairment aged 10 years and 8 months. Those techniques were used to eliminate the hitting-chest behavior, and this result required an 18-day period. After this program was provided, the participant succeeded in eliminating the hitting-chest behavior and replacing it with a stroking-chest-behavior without directions from others.

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Appendix 1. Observation sheet

Table I. Recording sheet for stroking-chest shaping technique

Session	**Date**	**Successful**	**Failed**	**Results of observation**
1				
2				

Filling out guideline:

Fill in the date according to the implementation of the session. Make a check mark (√) on the successful part or failed part according to the target listed on the program series. Then, write the results of the observation qualitatively during the implementation. The written observation is the frequency of the child performing the hitting-chest behavior and stroking-chest behavior and their causes.

Table II. Recording sheet for Differential Reinforcement of Alternative Behavior (DRA) Technique

Session	**Date**	**Hitting the chest**		**Stroking the chest**		**Description (successful/fail)**	**Observation results**
		Frequency	***Percentage***	***Frequency***	***Percentage***		
3							
4							
5							
6							
7							
8							
9							

Filling out guideline:

Fill out the date according to the implementation of the session. Calculate the frequencies of the hitting-chest behavior and the stroking-chest behavior in each session. Write in the form of a table, and then calculate the obtained percentage using the following equation:

$$\text{Percentage of hitting-chest} = \frac{\text{total frequency of hitting chest}}{(\text{total frequency of hitting chest} + \text{total frequency of stroking chest})} \times 100$$

$$\text{Percentage of stroking-chest} = \frac{\text{total frequency of stroking chest}}{(\text{total frequency of hitting chest} + \text{total frequency of stroking chest})} \times 100$$

After that, make a check mark (√) in the description section to show the session was achieved according to the target listed in the program series. Make a cross (X) in the description section to show that the failed session was achieved according to the target listed in the program series. Then, write, qualitatively, the results of the observations at the time of implementation. The written observation was the reason the child hit the chest and stroked the chest.

Appendix 2. Recording sheet of Hitting-chest and Stroking-chest behaviors

Table III. Recording sheet of Hitting-chest and Stroking-chest behaviors

Date:

Hour (*):

- ☐ 06.00 – 09.00
- ☐ 09.01 – 12.00
- ☐ 12.01 – 16.00
- ☐ 16.01 – 18.00
- ☐ 18.01 – 21.00
- ☐ 21.01 – 24.00

The cause of hitting-chest behavior (*):

- ☐ Due to desiring something (stuff, food, or activity)
- ☐ Seeking for attention

The efforts performed by the mother (*):

- ☐ Giving something requested by Fadhil (stuff, food, or activity)
- ☐ Giving attention
- ☐ Teaching the stroking-chest behavior
- ☐ Letting or ignoring
- ☐ Others: ……

(* check one of the items)

Total number of incidences of hitting-chest behavior (fill in with the table):

Total number of incidences stroking-chest behavior (fill in with the table):

Filling out guideline:

The mother filled out this form. The mother was asked to fill out the form every day to supervise the development of the child's behavior. Make check mark (√) on each choice showing the child's behavior. If in one day the child does hit the chest at different hours, the mother must write this information on the next sheet to ensure that the frequency of the child clearly hitting the chest and stroking the chest for a certain period of time can be noted. Specifically, the causes and efforts can be checked against more than one item based on the child and mother's activities.

Appendix 3. The series of the intervention program

Table IV. The series of the intervention program

Stage	Session	Target	Program Administrator	Type of Reinforcer	Evaluation
Pre-intervention, description of the program series that will be implemented		Mother understands the program's path that will be implemented. Mother understands the contribution of this program. Mother understands how to fill out the recording sheet of hitting-chest and stroking behaviors.	Researchers	-	-
Implementation of the shaping technique	***1***	Forming the stroking-chest behavior in the participant when he wants to perform the hitting-chest behavior with the help of a physical prompt and verbal prompt. The participant performs the stroking-chest behavior at least three times.	Researchers	Social reinforcer is provided immediately when the stroking-chest behavior is observed	Sessions can be continued if the participant successfully strokes his chest at least three times. If stroking the chest was observed less than three times, then this session is repeated at the next meeting with the same procedure until the participants succeed.
	2	Forming the stroking-chest behavior on the participant when the participant wants to hit the chest with the help of a verbal prompt. The participant does at least three times of stroking-chest behavior.	Researchers	Social reinforcer is provided immediately when the stroking-chest behavior is observed	Sessions can be continued if the participant successfully strokes his chest at least three times. If stroking the chest was observed less than three times, this session is repeated at the next meeting with the same procedure until the participants succeed.
The implementation of DRA technique	***3***	Participant hits the chest maximum 60% appearance and stroking chest with the help of a verbal	Researchers	Social reinforcer is provided immediately when the	Sessions can be continued if the participant successfully

Appendix 3. The series of the intervention program

		prompt minimum 40% of appearance.		stroking-chest behavior is observed	strokes his chest at least 40%. If stroking the chest was observed less than 40%, this session is repeated at the next meeting with the same procedure until the participants succeed.
	4	Participant hits the chest with a maximum of 50% appearance and stroking the chest with verbal prompt help of at least 90% occurrence.	Researchers	Social reinforcer is provided immediately when the stroking-chest behavior is observed	Sessions can be continued if the participant successfully strokes his chest at least 50%. If stroking the chest is less than 50%, this session is repeated at the next meeting with the same procedure until the participant succeeds.
	5	Participant hits the chest with a maximum of 40% appearance and stroking the chest with verbal prompt help of at least 60% occurrence.	Researchers and mother	Social reinforcer is provided immediately when the stroking-chest behavior is observed	Sessions can be continued if the participant successfully strokes his chest at least 60%. If stroking the chest is less than 60%, this session is repeated at the next meeting with the same procedure until the participant succeeds.

Appendix 3. The series of the intervention program

	6	Participant hits the chest with a maximum of 30% appearance and stroking the chest with verbal prompt help of at least 70% occurrence.	Researchers and mother	Social reinforcer is provided immediately when the stroking-chest behavior is observed	Sessions can be continued if the participant successfully strokes his chest at least 70%. If stroking the chest is less than 70%, this session is repeated at the next meeting with the same procedure until the participant succeeds.
	7	Participant hits the chest with a maximum of 20% appearance and stroking the chest with verbal prompt help of at least 80% occurrence.	Researchers and mother	Social reinforcer is provided immediately when the stroking-chest behavior is observed	Sessions can be continued if the participant successfully strokes his chest at least 80%. If stroking the chest is performed less than 80% of occurrences, then this session is repeated at the next meeting with the same procedure until the participants succeed.
	8	Participant hits the chest with a maximum of 10% appearance and stroking the chest with verbal prompt help of at least 90% occurrence.	Researchers and mother	Social reinforcer is provided immediately when the stroking-chest behavior is observed	Sessions can be continued if the participant successfully strokes his chest at least 90%. If stroking the chest is less than 90%, this session is repeated at the next meeting with the same procedure until the participant succeeds.

Appendix 3. The series of the intervention program

	9	Participant no longer hits the chest and 100% stokes the chest without verbal prompt help.	Researchers and mother	Social reinforcer is provided immediately when the stroking-chest behavior is observed Object reinforcer and activity reinforcer are provided in intermittent after the nine sessions have been completed	Sessions can be continued if the participant successfully strokes his chest at least 100%. If stroking the chest is performed less than 100%, this session is repeated at the next meeting with the same procedure until the participants succeed.