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| **RESEARCH ARTICLE**

Development of Discrete Trial Training (DTT) Procedure in Smart Applied Behavior Analysis (Smart ABA) for Autism

Arneliza Anwar[1] ✉ **Rudy Sutadi[2] and Chairita Miranda[3]**
[13]Psychology Graduate Student, Persada Indonesia Y.A.I University, Jakarta, Indonesia
[2]Psychology Postgraduate Student, Persada Indonesia Y.A.I University, Jakarta, Indonesia
Corresponding Author: Arneliza Anwar, **E-mail**: liza_rudy@yahoo.com

| **ABSTRACT**

Lovaas was the first professional to use the principle of behavior modification for autism with a technique he called DTT (Discrete Trial Training), which later to be known as ABA (Applied Behavior Analysis). Through his study, Lovaas found that 47% of subjects had excellent results. While 42% with varying degrees, and the other 11% of subjects very little progress. In DTT, there are 2 possible responses, but the researchers' observations do not seem to be just 2 possibilities. This study's goal is to improve discrete trial training (DTT) procedures to increase the effectiveness of Smart Applied Behavior Analysis therapy for autism spectrum disorder. This study uses quantitative methods with a literature review research design. Research data is obtained through interviews, document studies, and literature reviews (journals and websites). The study focused on the researchers' findings that were adapted to earlier theories. The study was conducted at the researchers' autism clinic. During the implementation of therapy using DTT, the researchers observed that the child's response is not only 2, namely correct and incorrect. Based on the study conducted, it was obtained that there were 5 possible responses: Correct, incorrect, partial-correct, off-task, and no-response. Each of which required different feedback and its subsequent sequences, as well as the possibility of different causative factors which require different interventions. Further research with large and multi-center samples will further increase the effectiveness of DTT applications in Smart ABA for autism. This study was based on the researchers' findings while observing, mentoring, and supervising autism therapists.

| **KEYWORDS**

Autism, ABA, Smart Applied Behavior Analysis, Therapy, DTT, Discrete Trial Training, Response, Procedure, SOP

| **ARTICLE DOI:** 10.32996/jpbs.2022.2.1.7

1. Introduction

Autism is a developmental disorder characterized by difficulties in social interaction and communication (American Psychiatric Association, 2013). This disorder is also characterized by differences in the development of intelligence and language (Sun et al., 2019). According to a study's result, the prevalence of people with autism continues to grow; in 2000, there was an estimated 30.8 per 10,000, then increased in 2009 to 157 per 10,000, and increased to 167 per 10,000 in 2018 study (Fombonne, 2018). The prevalence of autistic disorder in Indonesian society also continues to increase, currently at 8 per 1,000 (WHO in Savitri et al., 2020). The disorder is characterized by persistent and diversified changes throughout life, as well as significant disruptions in social, school, and family functioning that require intensive support for children and their families (Morales-Hidalgo et al., 2018).

Problems found in parental communication with children with autism are relatively different for each family, but among them can arise through delays in understanding messages, unstable emotional control experienced by children, children experience decreased confidence, have difficulty communicating verbally and experience delays in maturity in thinking (Kamps et al., 2017). Children with autism find it difficult to express their desires to others. Communication is done one way and can not express to others, and also can not express his desires with speech. If children with autism want something, they do it using body cues (Dadgar

et al., 2017). In special situations, indifference and lack of understanding of the message conveyed by parents to autistic children become a problem for parents. So there needs to be help for parents in understanding children with autism.

One method that is often used to help individuals with autism disorder is Applied Behavior Analysis (ABA). ABA is a science that applies various principles of systematic behavior analysis to significantly improve social behavior through an experiment to determine the variables that influence behavior change (Haymes et al., 2015). The ABA method was first applied by Ivar O. Lovaas, an American psychologist, through his experiments by applying the principles of Behavior Modification which is a combination of two major theories, namely Respondent Conditioning from I. Pavlov and Operant Conditioning theory from B.F Skinner (Baer, 2019). According to Baer (2019), the goal of the ABA approach pioneered by Lovaas is to shape a variety of abilities, reduce and eliminate problematic behaviors in people with autism, direct and change behavior in more meaningful ways, and teach independence. Smart-ABA is a cutting-edge version of the ABA approach for autism that adapts several components of the treatment process to the child's needs, including language, location, time, and instruments (Savitri et al., 2020). According to Savitri's (2020) research, the implementation of the smart-ABA method can improve the likelihood of people with autism being cured.

One technique that is widely used in ABA therapy and is considered an effective technique is Discrete Trial Training (DTT) (National Autism Center, 2015). Discrete Trial Training is an educational strategy based on the principles of applied behavioral analysis. Discrete Trial Training involves breaking a skill into smaller parts/components and teaching each part/component individually. The therapist performs repetitive skill exercises and can combine the necessary prompting procedures. The correct response will be followed by a reinforcer/reinforcement procedure to facilitate the learning process.

This strategy teaches children to gradually master complex skills by breaking them down into simpler skills that are easier for children to practice over and over again (Cardinal et al., 2017). The DTT technique uses an instructional strategy by providing instructions one by one so that children acquire skills/abilities in a planned, controlled and systematic manner through the use of small steps repeatedly with the use of reinforcers (Cardinal et al., 2017). DTT techniques help children with autism in their learning process since they have difficulty in mastering a complex skill/ability that includes multiple stages/phases (Cardinal et al., 2017). As a technique with a good level of effectiveness, DTT can be used as a standard operating procedure when working with children with autism disorders.

2. Literature Review
2.1 Autism
Autism is a developmental disorder caused by a dysfunction or failure of nerve function that manifests as impaired social interaction, verbal and nonverbal communication, and the presence of repetitive behavior (American Psychological Association, 2015). Autism affects a person's ability to express and comprehend their own and others' feelings, and the person is more comfortable being in the same environment all the time. The prevalence of autism disorder in Indonesian society has increased and is currently at 8 per 1000 (Eapen, 2012; Kodak & Bergmann, 2020). The American Psychiatric Association estimates that individuals with autism begin to show symptoms, and their development begins to slow between the ages of 1-2 years. Generally, there is a delay in speech accompanied by a lack of interest in socializing, difficulty making eye contact, and unusual ways of playing (American Psychiatric Association, 2013). More precisely, Kodak & Bergmann (2020) mentioned several symptoms of autism that appear before the child reaches the age of 3 years, including the presence of communication symptoms manifested by difficulties in speaking or only being able to pronounce simple sentences, social interaction symptoms manifested by children's lack of interest in interacting with others, and behavioral aspects manifested by the children's interest in playing alone as if having their own world.

The autistic disorder can be caused by multiple factors, both environmental and genetic. Rowland (2020) mentioned several causes of autism, including drug usage during the first trimester of pregnancy, a longer time of the delivery process, nutritional deficiency during pregnancy, and postpartum ingestion of additives. Parents or caregivers can determine if their child has an autistic disorder, among others, based on numerous features presented by Rowland (2020).

a. Difficulty interacting and socializing.
   Children with autism prefer to remain alone and rarely interact with peers or other people around them.
b. Impairment of communication.
   ASD children frequently talk late or only understand a few simple words or sentences.
c. Repetitive Behaviors or Movements with Limited Interests.
   Children with autism frequently engage in repeated actions such as circling, clutching their hands, and continuously shaking their bodies forward and backwards. Additionally, they frequently exhibit excessive, even obsessive, preferences for an object.
d. Hyperactive and aggressive.

This hyperactive behavior may include endless running, climbing, and circling. When a youngster is requested to stop a behavior, he or she will exhibit aggressive behavior or tantrums.

e. Have an obsession / excessive attachment to something.
    Children with autism may develop an interest and attachment to an object; they spend a lot of time with it and play with it differently, which is often considered as weird.
f. Suffering from sensory problems.
    Children with autism have limited sensory abilities and cause a variety of difficulties academically and non-academically, including the ability to help themselves.
g. Unbalanced development.
    Children with autism experience delay in some aspects of development differently from other children who are the same age.

2.2 Applied Behavior Analysis (ABA)

Applied Behavior Analysis is an applied science that is used to train individuals in mastering abilities using behavior modification procedures. Baer (2019) defines Applied Behavior Analysis conceptually as a procedure of breaking down behavior into simpler parts/components to make it easier to learn and master so that abilities are achieved that meet the standards found in society. Ivar O. Lovaas, an American psychologist, was the first professional to apply Behavior Modification principles to autism, which he called DTT (Discrete Trial Training), which later became known as Applied Behavior Analysis (ABA) for autism. Behavior Modification is a development of two major theories those are Operant Conditioning, from B.F. Skinner and Respondent Conditioning from I. Pavlov. In Behavior Modification, undesirable behavior is eradicated, and the intended behavior is developed and improved so that the behavior of the individual conforms to community standards (Baer, 2019).

Green (2008) stated that the goal of Lovaas's ABA technique for autism is to develop a variety of abilities, reduce and eliminate problematic behaviors in people with autism, direct and change behavior in more meaningful ways, and train independence. In general, this method aims to provide positive reinforcers to children when showing a response that corresponds with the direction given. Green further mentioned that ABA therapy could also assist individuals with autism to develop active two-way communication with other people, socialize with a variety of people, minimize/eliminate unnatural behavior, and improve academic abilities and self-help skills. Some of the principles used in this method are to provide genuine warmth and affection throughout the therapy process, to maintain firmness and avoid compromising when giving instructions without violence, provide help, direction and appreciation through effective rewards such as hugs, kisses, pats, gentle rubbing, or praise (Green, 2008).

2.3 Smart Applied Behavior Analysis

Applied Behavior Analysis is an applied science that is used to train individuals in mastering abilities using behavior modification procedures. Baer (2019) defines Applied Behavior Analysis conceptually as a procedure of breaking down behavior into simpler parts/components to make it easier to learn and master so that abilities are achieved that meet the standards found in society. Ivar O. Lovaas, an American psychologist, was the first professional to apply Behavior Modification principles to autism, which he called DTT (Discrete Trial Training), which later became known as Applied Behavior Analysis (ABA) for autism. Behavior Modification is a development of two major theories; those are Operant Conditioning from B.F. Skinner and Respondent Conditioning from I. Pavlov. In Behavior Modification, undesirable behavior is eradicated, and the intended behavior is developed and improved so that the behavior of the individual conforms to community standards (Baer, 2019).

While observing, mentoring, and supervising autism therapists in applying ABA to children with ASD, researchers identified numerous things that needed to be developed and improved. The researchers then assembled and developed, and/or improved what researchers had already known from various training, workshops, textbooks, journals, literature, and articles. Assembling, developments/innovations, and/or improvements made by researchers such as SOP (Standard Operating Procedure) in the implementation of therapy/teaching sessions, as well as in the curriculum. Intensive assembling, development/innovations, and/or improvement began in 2009. In 2011, researchers launched Smart ABA for ASD. Then in 2016 was duplicated/replicated by Chairita Miranda at Anak Cemerlang Clinic, Pekanbaru, Riau, Indonesia.

The assembling, developing/innovating, and improving include, but are not limited to, the DTT structure/SOP for the non-verbal and verbal programs, initial prompt, immediate prompt, DT (Discrimination Training), EO (Establishing Operation), escalation prompt, shaping/chaining, split prompt, modeling prompt, prompt-delay (delayed prompt), full prompt, partial prompt, verbal prompt, initial visual prompt, immediate visual prompt, visual prompt, the combination of the initial and immediate prompt with or without visual media aid, scoring system (DTT, DT, Maintenance), passed/achieved system (DTT, DT, Maintenance), maintenance system, curriculum block, curriculum systematics, etc. and so forth that require approximately 1,000 pages of explanation, which is certainly beyond the scope of this research discussion.

Researchers define Smart ABA (Applied Behavior Analysis Rudy Sutadi's Method), which is an applied science/method (technical-practical) that uses behavior modification procedures to teach someone (in this case, an ASD child) to master various abilities/activities that conform to the standards/values in the community. By breaking down various complex activities into small parts (if necessary to be the smallest part), according to the ability concerned, which are then taught/trained intensively and systematically (taught/trained in scientific order), structured (the use of standard techniques in teaching/training), and measured (the use of quantitative measurement to determine the success of children), and intervene/modify where necessary (according to the identified problem).

What is meant systematically is that there is a defined curriculum/program that is organized linearly, beginning with the easiest program/activity for children (smallest/simplest that is most likely to be done/achieved by the child according to his ability at that time. If the prerequisites have not been met, then first taught/trained the prerequisites, then after being mastered then furthermore there is a clear what programs/activities are taught/trained later, both as a continuation and combination with other programs/activities to form complex/more complex abilities until finally, the child reaches the abilities that meet with the standards in the community, then they can live independently and work like everyone else in society.

What is meant by structure is that there is a clear and standard structure (based on the child's response to various stimuli/instructions given) for teaching/training various programs/activities ranging from simple to complex.

The development carried out by researchers on the structure/SOP, including but not limited to the DTT Non-Verbal Program, DTT Verbal Program (Vocal Imitation / Syllable / Word / Sentence, Reading Cards of Vocal / Syllables / Words / Sentences, Answering, etc.), Initial Prompt, Initial Visual Prompt, Immediate Prompt, Immediate Visual Prompt, Prompt, Visual Prompt, Split Prompt, Modeling, Prompt, Verbal Prompt, EO (Establishing Operation), DT (Discrimination Training), Time-delay Prompt, etcetera and so on.

The technical structure of teaching/training autistic children with Smart ABA is one of the most important things as a how-to (technical know-how). Whatever curriculum/program/activity that will be taught/trained will be mastered by children if taught with the right techniques according to the correct structure. Thus, not only what-to-teach, but the most important thing is how-to-taught it. Because if the technique is incorrect, then the child may have mastered the wrong concept, which will be more difficult to correct than teaching a new one from the start using the correct technique.

What is meant by measurable is that there are quantified scores and passed/achieved criteria so that it can be easily and clearly stated whether a program/activity has been mastered or has not been mastered by the child.

One study (Savitri et al., 2020) found that Smart ABA was regarded as an effective and efficient method for improving language function and skills, communication, and social skills in children with autism. In addition, in improving the various abilities of children with ASD, the Smart ABA method is also useful for minimizing symptoms experienced by individuals. The Smart ABA method is a fairly representative method to improve these capabilities in a measurable, purposeful, and systematic manner.

2.4 Discrete Trial Training (DTT)
Discrete Trial Training (DTT) is the most effective technique in the ABA method, even tending to be identical, so DTT is considered another name for ABA (Lerman et al., 2016). DTT is the product of Lovaas's research. Initially, this technique was used to train children with disabilities at UCLA. DTT techniques serve to simplify a complex skill, making it easier to teach and practice more easily and repeatedly (Downs et al., 2008). DTT is a concept that refers to a type of training that teaches abilities repeatedly in response to provided instructions. When the individual has mastered one simple skill, then the individual will be taught additional/other skills to master the complex skills for which this training is intended. The DTT technique is considered appropriate for children with autism because each child has unique abilities and a varying degree of severity. DTT is an excellent method of developing a new response to a stimulus. Once abilities are acquired through the DTT, it is important to develop a teaching plan with other new skills across environments, materials, and people (Bogin et al., 2010).

The DTT technique is based on behavioristic theory, in which the trainer/therapist gives instructions, and the child responds; if the response corresponds with the instruction, then the trainer/therapist will give a reward or reinforcer for the response shown by the child. But when the response shown by the child is not appropriate, then the trainer will say "no" or will repeat the instructions. Reinforcer should be done as soon as possible when the child responds (Lerman et al., 2016). The goal of DTT is to increase the emergence of desired behaviors, reduce to eliminate unwanted or inappropriate behaviors, and generate new behaviors needed to facilitate the process of individual adaptation (Lerman et al., 2016).

Discrete trial training has been proven effective in teaching children with autism to develop new behaviors and has become the most widely studied approach to teaching important discrimination abilities. Some behaviors that are generally appropriate to be taught using this technique include those behaviors that require fine and gross motor skills, recreation, self-care, cognitive, and academic skills, which are very suitable for DTT (Bogin et al., 2010).

Discrete Trial Training can be used to teach a variety of imitation skills, both physical and verbal. Imitating clap-hand, printing the letter A, or producing a vowel sound are examples of behaviors that can be taught in discrete trial training. Discrete trial training can also be used to teach language skills. A child can be trained to respond to verbal instructions such as "stand up," "touch," "hold the number five," or "show me the cup." (Maurice et al., 1996). Expressive language skills can be taught using a discrete trial format to respond to verbal instructions to identify "nose", "blue", or "book". Discrete trials can also be used to teach a variety of more complex skills, such as dressing or using the phone, by breaking down routines and then merging/chaining the components/steps. These are just a few examples of a variety of skills/abilities and instructional/educational programs that can be implemented in discrete trial format.

Lovaas (1981) mentioned several things that need to be considered in shaping behavior by applying discrete trial training, including:

1. Determine the behavior you want to achieve, then break down the behavior into several parts/components of the response. Determine the most effective way to teach this behavior. The principle is to start with something simple. Select several behavioral goals/objectives for the child, called a target behavior or a target response. The behavior is then broken down into smaller units/parts/components, which are taught separately. When the child masters the unit/part/component, then the therapist helps the child to put it together into a larger or more complex package. When the child demonstrates the right response, then the therapist gives a reinforcer (Mosier, 2011).
2. Assist the child in performing the desired behavior by providing prompts or clues, for example, by providing physical assistance when the child has difficulty carrying out a behavior. Once the child has done the behavior, gradually reduce the aid until the child can perform the behavior independently. Reduction of prompt should also be accompanied by reinforcer administration (Johnson, 2014; Mosier, 2011).
3. Provide clear and consistent instructions so that children can clearly understand what to do, provide guidance and pace so that the child can follow through on the instructions given by providing reinforcers when the child shows his efforts.
4. Use a discrete trial procedure, starting the trial with instructions from the therapist, including prompts given according to the child's needs by paying attention to the child's response. Give reward or feedback when necessary. Reinforcer administration will be more effective if given as soon as possible, whether the child successfully shows the correct response, requires fewer prompts, or completes more difficult tasks than the previous one (Ghezzi, 2007).

2.5 Response in DTT (Discrete Trial Training)
According to the earlier research, when an ASD child is instructed, the child will respond to one of two possibilities, correct or incorrect response `(Grindle & Remington, 2002; Smith, 2001). If the child responds correctly, reinforcers will be given immediately, while incorrect responses will be ignored or given feedback in the form of an informational "no" (Grindle & Remington, 2002).

Thus, there are two possible responses in classical/traditional DTT, namely correct and incorrect responses, Where no response is considered an incorrect response also. But, during the implementation of therapy using DTT in the researchers' clinic, while observing, mentoring, and supervising autism therapists throughout the application of DTT, researchers noticed that the child's response was not only 2, namely correct and incorrect. However, the researchers discovered that children's responses were more varied and could be classified into categories other than correct and incorrect.

3. Methodology
This research uses quantitative methodology with a literature review research design. According to Sugiyono (2017), quantitative methods are research methodologies based on the positivist ideology that are used to investigate populations or specialized samples. Methods of literature study refer to a sequence of tasks involving the collection of library data, reading and recording, as well as the management of research materials (Zed, 2008: 3). The data for this study were obtained through interviews, document examinations, and a review of the literature (journals and websites). The study focused on the authors' findings that were adapted to past theories. The study was conducted at the researchers' autism clinic, which was established in 1999. This research focuses on findings obtained by the author that match with the theory obtained from scientific research.

4. Results and Discussion
4.1 Discrete Trial Training (DTT) for ASD Children
Autism is a developmental disorder caused by a disorder or failure of nerve function characterized by impaired social interaction, verbal and nonverbal communication, and the presence of repetitive behavior (American Psychological Association, 2015). Autism affects a person's ability to express and understand their own and others' feelings and makes it more comfortable to stay in the same setting all the time. According to the American Psychiatric Association, autism symptoms begin to manifest between the ages of 1-2 years, and the individual's development begins to slow down. Generally, there is a delay in speech accompanied by a lack of interest in socializing, difficulty making eye contact, and unusual ways of playing (Stone, 2004; Zimmerman, 2008).

Applied Behavior Analysis is one of the applied sciences that is used to train individuals to master certain abilities using behavior modification procedures (Baer, 2019; Cooper et al., 2014). Baer (2019) defines Applied Behavior Analysis conceptually as the process of breaking down behavior into simpler components to make it easier to learn and change according to the standards found in society. The implementation of this method leads to a behaviorist approach that emphasizes an individual's compliance and the ability to imitate a behavior (Baer, 2019). Ivar O. Lovaas, an American psychologist, pioneered the ABA approach for autism through his experiments using B.F. Skinner's Operant Conditioning Theory and I. Pavlov's Respondent Conditioning. Through this method, unwanted behavior will be eliminated so that the behavior shown by individuals will be more suitable to the standards of behavior in society (Baer, 2019).

According to Green (2008), the objective of Lovaas's ABA approach is to develop a variety of abilities, minimize and eliminate undesirable behaviors in individuals with autism, direct and change behavior in more meaningful ways, and teach independency. In general, this method aims to give a positive reinforcer to the child when showing a response that is corresponded to the direction given. Discrete Trial Training (DTT) is one of the most effective techniques in the ABA method; DTT is sometimes referred to as ABA (Lerman et al., 2016). DTT was also developed as a result of research conducted by Lovaas, who invented the ABA method for autism. Initially, this technique was used at UCLA to train children with disabilities. DTT techniques serve to simplify a complex skill, making it easier to teach and practice more easily and repeatedly (Lerman et al., 2016).

Conceptually DTT is training that trains skills/abilities repeatedly in response to provided instructions. When the individual has mastered one simple skill, then the individual will be taught additional skills in order to master the complex skills for which this training is intended. The DTT technique is considered appropriate for children with autism because each child has unique abilities and different severity of the disorder. This DTT technique can be adjusted to the basic abilities that have been possessed.

In Classical/Traditional Discrete Trial Training (DTT), the child's response and consequences are divided into 2 categories those are the correct response and the incorrect response. The correct response is defined as when the autistic child performs as instructed or follows the therapist's model/example. The correct response needs to be immediately reinforced with positive reinforcement/rewards in the form of verbal praise and food. Before initiating the DTT procedure, the quantity and type of reward must be specified/determined (Matson, 2009). One example of a correct response is when the child is given the instruction "touch head", the child responds by holding the head. Another example is when the therapist gives instruction "do this" by giving an example of hand movements upwards, then the child does the same.

An incorrect response is when the child gives another response that is not a target response (Applied Behavior Analysis Programs Guide, n.d.). An example of an incorrect response is when the therapist gives instructions "touch head", then the child's hand is pointed to the abdomen; this has been assessed as the incorrect response.

4.2 Development of Discrete Trial Training (DTT)
Lovaas, the Psychology Department of UCLA (University of California, Los Angeles), was the first professional to use the principles of Behavior Modification, which he referred to as DTT (Discrete Trial Training), and later on became known as the ABA Lovaas method for autism. Behavior modification itself is a further development of two major schools of positivist psychology, namely Respondent Conditioning and Operant Conditioning.

From Lovaas' research, in the application of DTT in children with ASD (Autism Spectrum Disorder), Lovaas obtained 47% of the results with full recovery, which in long-term studies, these children are indistinguishable from other children without developmental disorders. While 42% achieved varied levels of success. And the remaining 11% made very little progress. Although the success rate of 47% was fairly good and promising at the time, Lovaas did not know what caused the success rate of only 47%, so further study to enhance the success rate is still highly feasible. Following Lovaas' 1967 publication (which was followed by subsequent studies by Lovaas and colleagues), the ABA was developed by experts and practitioners. Lovaas' DTT, which he called precision teaching or simultaneous prompting, has developed into a technique known as no-no-prompt.

In the DTT applied by Lovaas to children with ASD, when a child with ASD is given instruction, then there will be 2 possible responses, namely correct (right) and incorrect (wrong), where no response is also considered an incorrect response. But during observing, mentoring, and supervising autism therapists in applying ABA to children with ASD, researchers discovered there might be more than 2 possible responses.
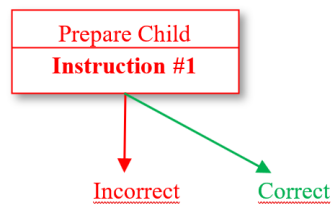

Fig.1. Responses On Classical/Traditional DTT

Originally, there were only two possible responses (Fig.1) in the DTT used by Lovaas and later developed by ABA experts and practitioners for autism (Tender J., 1997), namely correct and incorrect. Correct Response means that the child complies with the instruction. For example, when the instruction is to "touch head," the child touches his head. When the instruction is "do this" with the therapist's model of lifting both hands upward, the child also raises both hands. What is referred to as an Incorrect Response is when the child does differently from the instructed. For example, when the instruction is "touch head", but then the child touches his stomach when the instruction is "do this", along with the model of the therapist raising both hands, then the child performs a movement that is not hands up, for example doing hand-flapping. While the no response occurs when there is no response from the child, which is also referred to as the Incorrect Response.
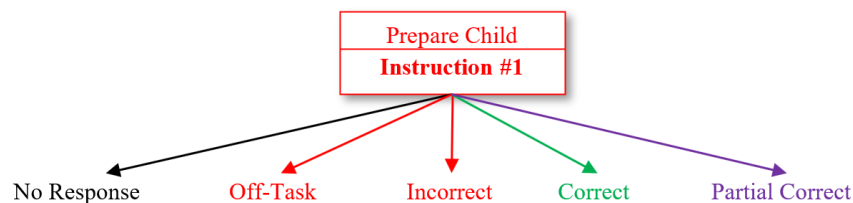

Fig.2. Responses on DTT in Smart ABA

According to the researchers' observations, the child's response to DTT can be divided into five different responses: Correct, Incorrect, Partial Correct, Offtask, and No Response (Fig.2.). This is crucial to be distinguished because further observation reveals that different feedback is required for the five possible responses that are the potential for children to master an ability/skill more quickly. Additionally, the possible causes of the five responses vary, which necessitates further investigation. For example, an Offtask response may occur as a result of instructions from the therapist with an uncomfortable tone of voice to the child due to the hypersensitivity of hearing in the child.

Different types of feedback are required for each of these five possible responses, which researchers combine using a no-no-prompting and simultaneous prompting procedure. Simultaneous prompting and no-no prompting are two frequently used prompting strategies for children with autism. Simultaneous prompting is a procedure designed to minimize errors. This involves the use of a controlling prompt (i.e., a prompt that results in the child performing the correct response 100% of the time) immediately after the instruction. Thus, children do not have the opportunity to do incorrect and are constantly rewarded/reinforced. The second frequently used prompting procedure is no-no-prompting. No-no-prompting involves giving instructions followed by an opportunity for the youngster to respond independently. The therapist then gives positive reinforcement following the correct response and corrective feedback (e.g., "no" or "try again") to incorrect or no responses and then repeats the trial. After two consecutive "no" feedback, the therapist gives instructions then, followed by a prompt. Therefore, the third trial of no-no-prompting is identical to simultaneous prompting. So, no-no-prompting may not minimize errors but, on the contrary, can correct errors after two consecutive errors have occurred. (Leaf J.B. et al., 2010).

According to the researcher's observations, No Response must be distinguished from Incorrect Response since if a time delay of 3-5 seconds is applied; there are five additional possible responses: Correct, Incorrect, Partial Correct, Offtask, and No Response. Without any doubt, it is a disadvantage if No Response is also considered as an Incorrect Response which is then given informational feedback "no" because after being given a time delay of 3-5 seconds, then there will be 5 possible responses. As a result, for the first trial, the researchers developed the Structure / SOP DTT, as illustrated in Fig.3.
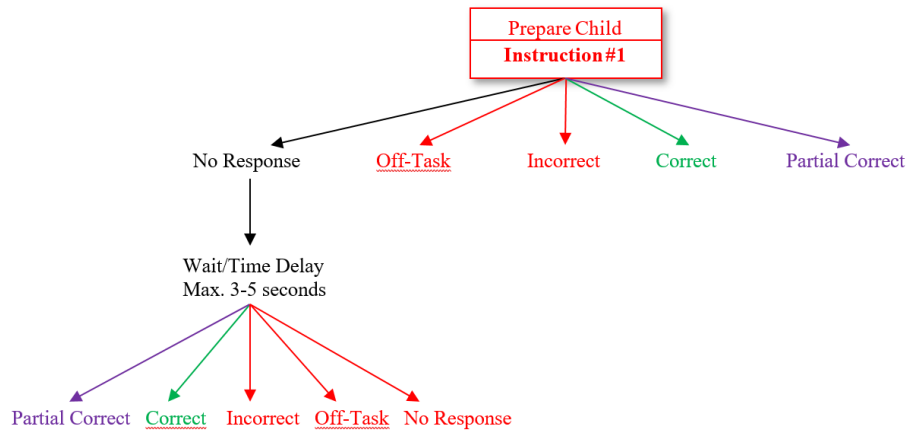
Fig.3. Further Development of Response on DTT in Smart ABA

As seen in Fig. 3, The researcher then developed the No Response; when a time-delay is applied, then there will be 5 possible responses, namely Correct, Incorrect, Partial Correct, Offtask, and No Response.
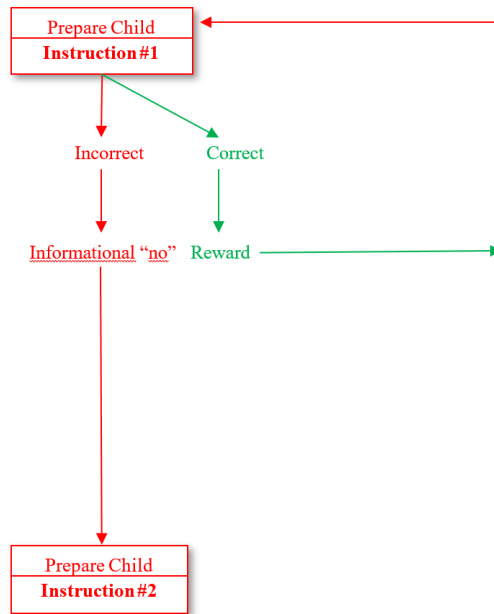

Fig. 4. Response, Feedback, and It's Subsequent on Classical/Traditional DTT

In the classical/traditional DTT in the form of No-No-Prompt that when a child is given instruction, then there are 2 possible responses, namely Correct and Incorrect Response. On Correct Response, the child is then given a Reward / Reinforcer, and then the next trial is carried out, which is the 2nd package of DTT. While in the incorrect response, given feedback in the form of informational "no", then the child is prepared again for the next trial in the same cycle (Fig.4.).
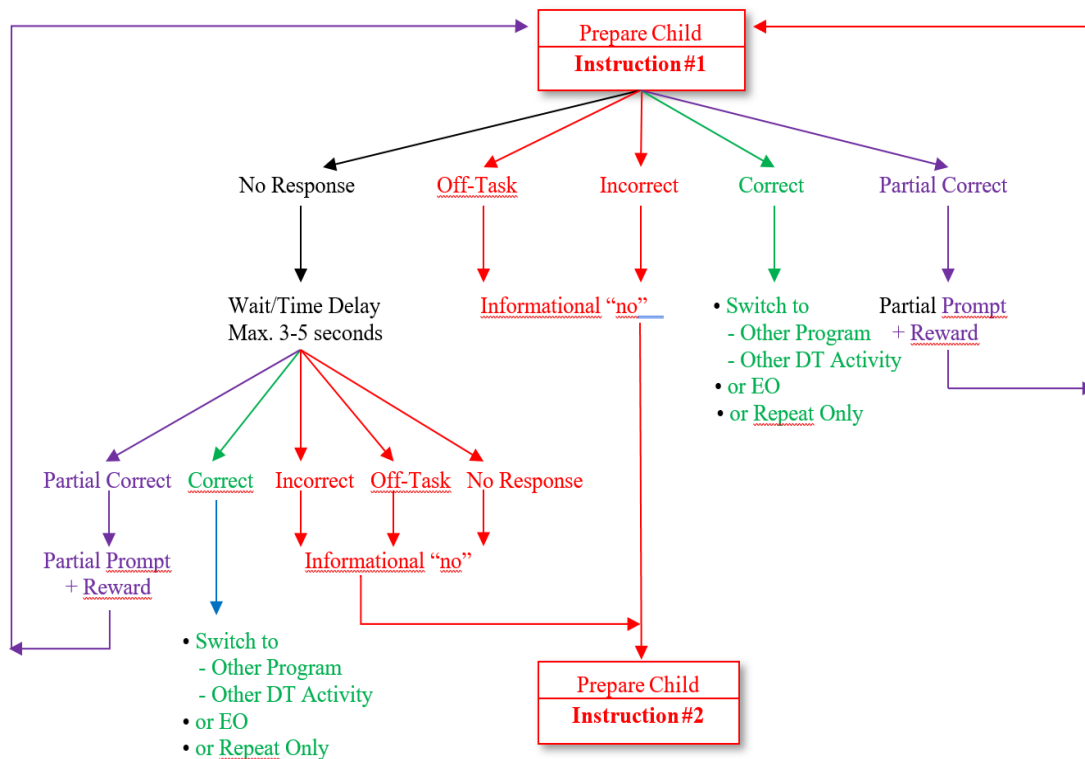
Prepare Child
Instruction #1

No Response   Off-Task   Incorrect   Correct   Partial Correct

Wait/Time Delay
Max. 3-5 seconds

Informational "no"

• Switch to
  - Other Program
  - Other DT Activity
• or EO
• or Repeat Only

Partial Prompt + Reward

Partial Correct   Correct   Incorrect   Off-Task   No Response

Partial Prompt + Reward

Informational "no"

• Switch to
  - Other Program
  - Other DT Activity
• or EO
• or Repeat Only

Prepare Child
Instruction #2

Fig. 5. Trial #1.   Response, Feedback, and Its Subsequent on DTT in Smart ABA

In contrast to the classical/traditional DTT, in developing of No-No-Prompt in Smart ABA (Fig.5.), only Offtask and Incorrect Response received Informational "no" feedback, and the next step is to prepare the child again for a second trial in the same cycle. It is called an Offtask Response when the child is no longer paying attention, which can range from subtle to obvious. For example, a subtle Offtask occurs when the child looks in the other direction (no longer makes eye contact with the therapist or no longer looks at teaching material). An example of an obvious Offtask Response is when the child throws a temper tantrum. It is called an Incorrect Response if the child responds differently than what is instructed. For example, when the instruction is "touch head", but the child's hand holds the stomach. It is called a Partial Correct Response when the child has made a partial response. For example, in the "do this" instruction with the therapist model raising both hands, then both of the child's hands have traveled towards the upward hand but stopped in part of the journey. For this response, the therapist assistant then performs a Partial Prompt which is different from a Full Prompt which is a hand-on-hand prompt. In Partial Prompt, for example, the therapist assistant simply needs to push the child's elbows up to produce a Correct Response according to the Target Response. After the therapist's assistant gives a Partial Prompt to the child's Partial Correct Response, then the therapist gives a Reward/Reinforcer. Afterwards, prepare the child again for the next trial in the next cycle. If the child immediately performs a Correct Response on the first trial of the first cycle, then the therapist has 4 options. Those are, move to another program or to another activity which is the DT (Discrimination Training) activity if the DT program has been carried out, or EO (Establishing Operation) is performed, or just repeat 1-3 times randomly. The researchers developed and defined EO (Establishing Operation) as a series of activities carried out by the therapist to establish confidence that the child has begun to master an activity during a series of DTT.

As mentioned previously, when no response occurs, then a time delay of about 3-5 seconds is applied to give an opportunity for the child to respond. While waiting for 3-5 seconds, there will be 5 more possible child responses, namely Correct, Partial Correct, Incorrect, Offtask, and No Response. This time the child gets informational "no" feedback whether there is an Incorrect Response, an Offtask Response, or still No Response. Then the child is prepared again for a second trial in the same cycle. If Partial Correct Response happens after the partial prompt is delivered, then Reward / Reinforcer is given. Then prepare the child again for the first trial in the next cycle. And if at this time a correct response occurs, then the same as above, that is, there are 4 options for therapists, whether to move to another program or to another activity that is a DT (Discrimination Training) activity if it has been done DT program, or done EO (Establishing Operation), or just Repeat only 1-3 times randomly.

If the informational "no" is given on the first trial, then proceed with the second trial on the same cycle, as can be seen in Fig.6.
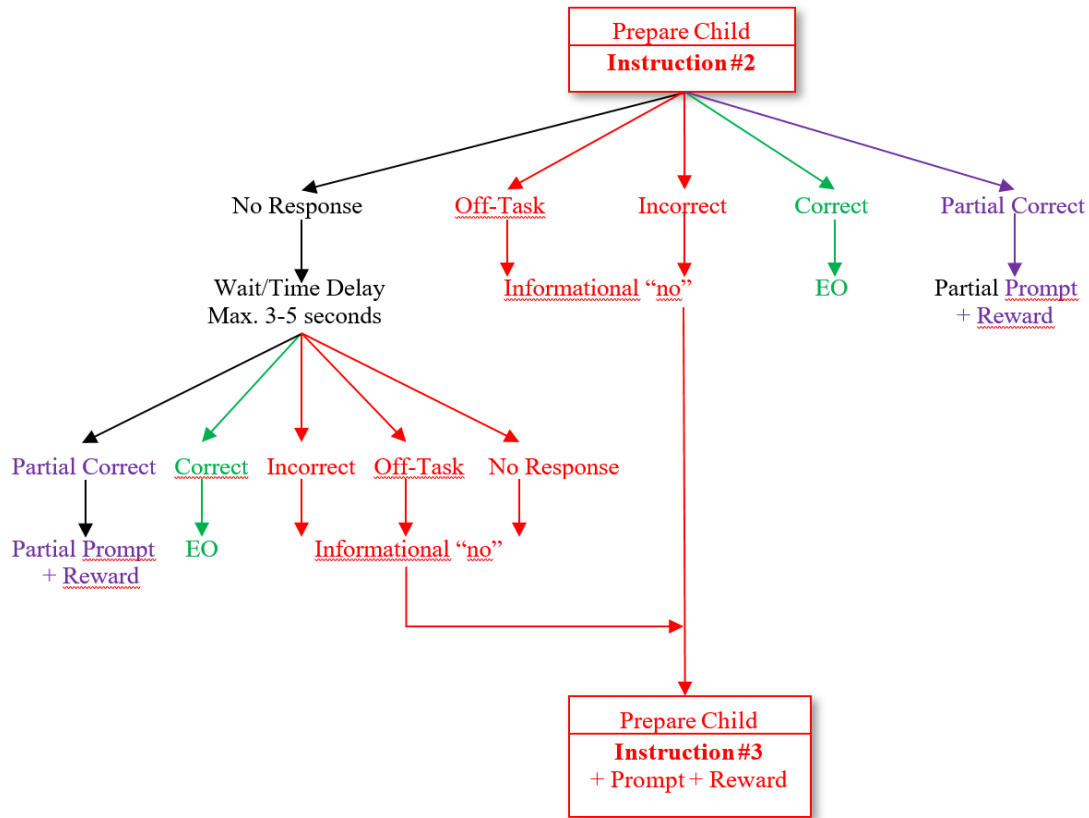
Fig. 6. Trial #2.   Response, Feedback, and Its Subsequent on DTT in Smart ABA

In Fig.6., after informational feedback, "no" then continue with the second trial on the same cycle. In the second trial, the possibilities of the response that occurred and the feedback as well are almost identical to those explained in the first trial, but with one difference. Instead of four alternatives for therapists as in the previous first trial, there is now only one option for the therapist, which is EO (Establishing Operation) only. The purpose of EO, as previously explained by researchers, is to gain confidence that the child has begun to master the skill/ability.

Just like in the first trial, after the child is given instructions, then there are 5 more possible responses, namely Correct, Partial Correct, Incorrect, Offtask, and No Response. Children receive the identical feedback as in the first trial, with the exception that when a Correct Response occurs, unlike what has been explained above. If there is a Correct Response this time, whether it occurs immediately after the Instruction or after 3-5 seconds time delay performed, then the therapist no longer has 4 options; instead, there is only 1 option, and that is EO (Establishing Operation) must be performed. If the child responds with Partial Correct, then a Partial Prompt is conducted, and then the child is given Reward / Reinforcer. If the child responds with an Incorrect or Offtask response, the child is given an Informational "no" and re-prepared to continue with the third trial. If no response occurs, then apply the time delay for 3-5 seconds, allowing the child to respond. If a Correct Response occurs after 3-5 seconds, a Reward / Reinforcer is provided, and then EO is performed. When there is a Partial Response, then a Partial Prompt and Reward / Reinforcer are provided. If there is an Incorrect Response, Offtask Response, or No Response, whether it occurs immediately after the Instruction or after 3-5 seconds time delay performed, then the child receives an Informational "no" feedback. Afterwards, prepare the child again for the third trial.

In the third trial, the child is not allowed to respond; instead, after the therapist gives instructions, then the child is immediately prompted by the therapist's assistant. The child is then prepared again for the first trial but in the subsequent cycle.

Fig.7. and Fig.8. are a complete comparison between classical/traditional DTT before modification (Fig.7.) and DTT on Smart ABA (Applied Behavior Analysis Rudy Sutadi's Method), that is, DTT after modification.
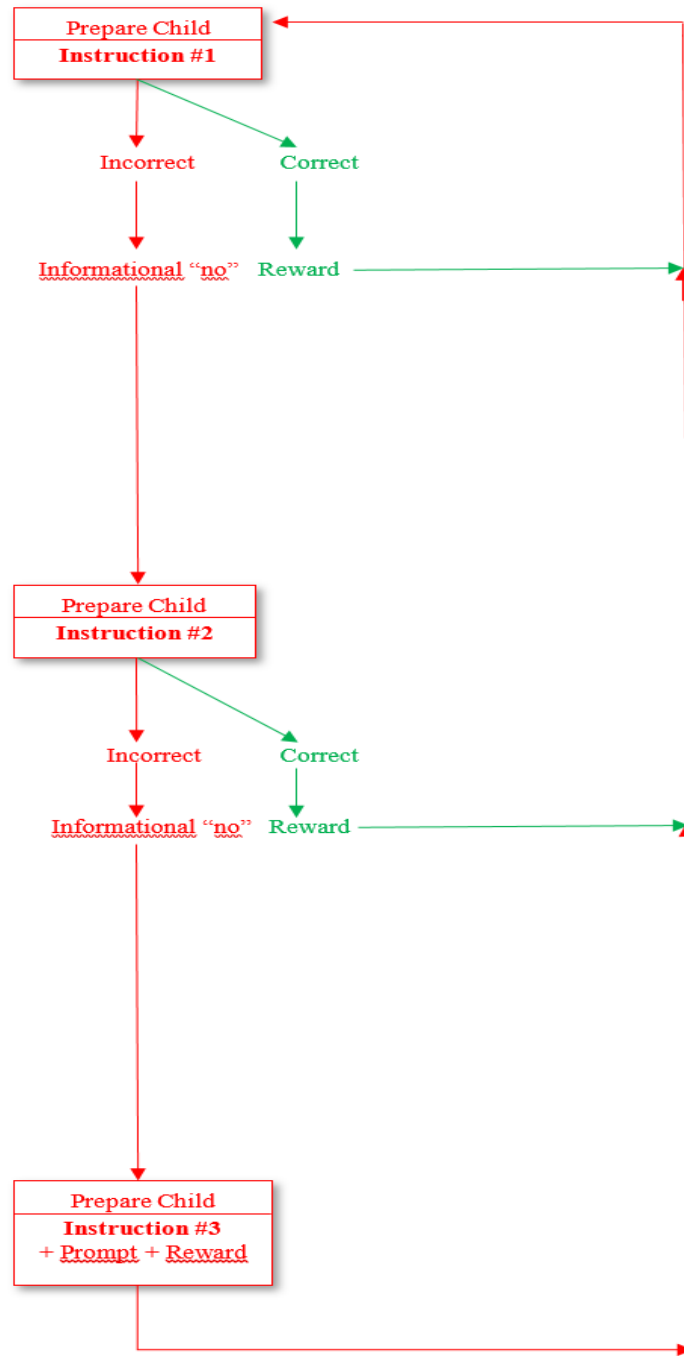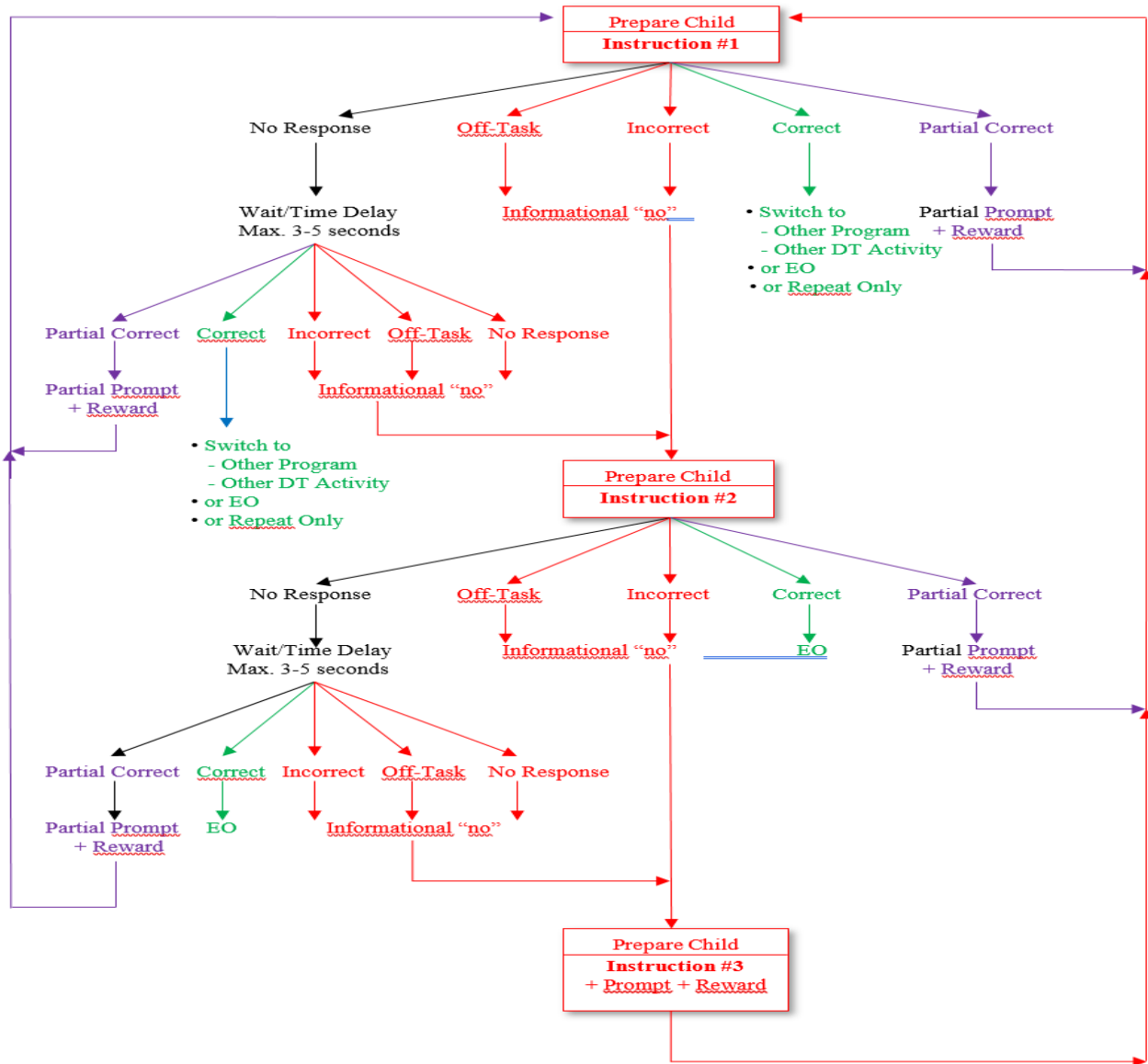
Fig. 7. SOP of Classical/Traditional DTT

Fig. 8. SOP of DTT in Smart ABA

According to Leaf (2010), researchers also include an Initial Prompt at the beginning of a DTT cycle. The term Initial Prompt in a Non-Verbal Program is a prompt given/done to a child at the beginning of the DTT Procedure that will be done/performed by the Therapist (before starting with DTT). But the Initial Prompt that the researchers do is not done routinely, just when indicated only, which the researchers then develop the indication. Initial Prompt is performed only if the therapist estimates that the child is not / has not been able to do/carry out what is instructed by the Therapist, namely in the following things/circumstances:

1. In the beginning of a new program/activity.
2. In activities whose the last score in the previous drilling history (series of cycles), the response is other than Correct or Partial Correct.
3. In contrast to the second criterion mentioned above, even if the last response to the previous drilling was Correct or Partial Correct, in the previous 3 consecutive drillings, the result was that the child always responded incorrectly on every first trial of DTT.

After developing the SOP of DTT in Smart ABA, researchers then implement it in teaching sessions. The results of the execution of DTT Procedures in Smart ABA are shown in Fig.9., Fig.10., and Fig.11. In each teaching session, a child's success is calculated as a percentage, i.e. the number of Correct Responses divided by the number of Opportunities, multiplied by 100 percent. Opportunity is the chance for a child to respond, whether the result is Correct or Partial Correct or Incorrect or Offtask or No Response. So neither initial prompt nor prompt is included in the calculation because the child is not given the opportunity at that time.

$$Successfull\ Rate = \frac{CR}{PCR + ICR + OTR + NR}\ X\ 100\%$$

CR = Correct Response; PCR = Partial Correct Response; ICR = Incorrect Response;
OTR = Offtask Response; NR = No Response

Then the child is declared to pass/achieve on an activity if in 3 consecutive teaching sessions gets a score greater or equal to 80%.
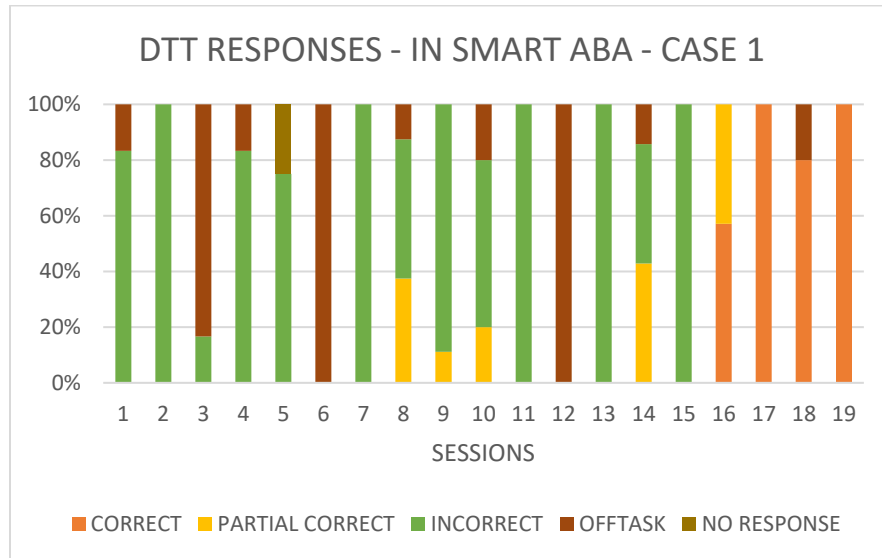

Fig. 9. Responses on DTT in Smart ABA – Case 1

In the first case in Fig.9., between the first and nineteenth teaching sessions, there were 5 types of responses occurred. Throughout the early teaching sessions, teaching sessions 1-7, the child tended to show more incorrect or off-task responses, but in the 8th teaching session, the child began to show partially correct responses. And in the last four teaching sessions, the child showed more correct responses. In the 16th session, a correct response began to emerge. Then in the 17th session up to the 19th, the successful rates exceed 80%, and the child is then declared to pass/achieve on the activity after the 19th teaching session.
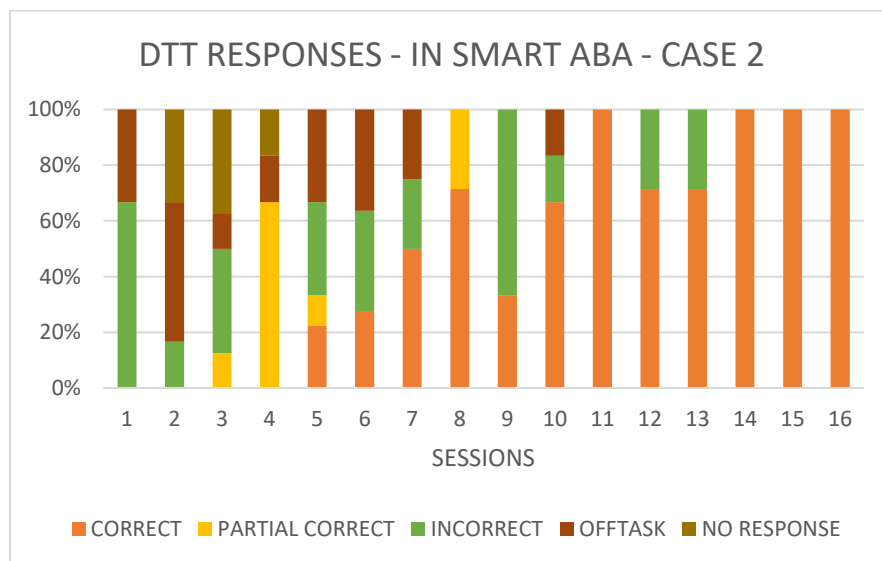

Fig. 10. Responses on DTT in Smart ABA – Case 2

In the second case in Fig.10, At the beginning of the teaching session, in the first teaching session, the child shows an incorrect and off-task response, then the child begins to show a more diversified response, including Incorrect, Off-task, Partial Correct, and

No Response. From the 10th teaching session to the end, the dominant child response is Correct Response, but the pass criteria are achieved in the 14th to 16th teaching session.
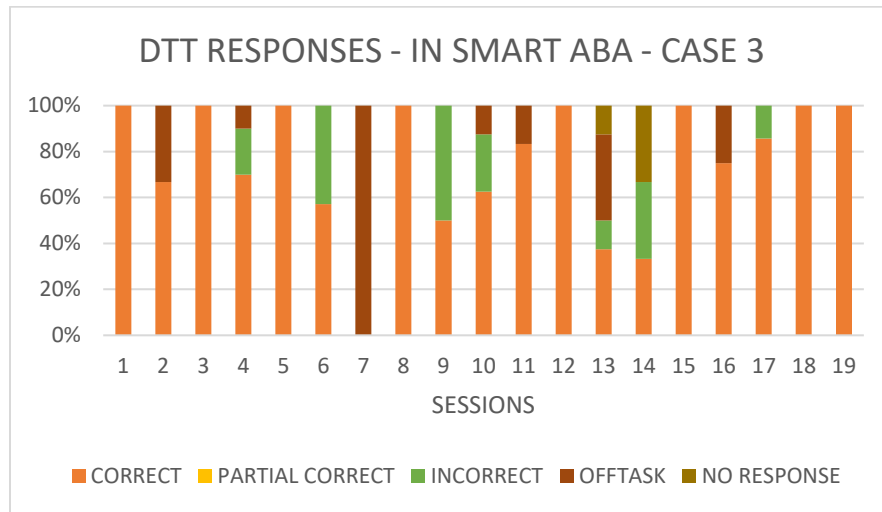

Fig.11. Responses on DTT in Smart ABA – Case 3

In the 3rd case in Fig.11. the child has demonstrated a lot of Correct Responses since the beginning of teaching sessions. Even in the first teaching session, the child gets a score of 100%, but in the subsequent teaching session, there is a slightly varied response so that the score fluctuates, which is generally below the 80% limit. Only in the 17th to 19th teaching session does the child reach the pass/achieve criteria of 3 consecutive teaching sessions greater than 80%.

5. Conclusion
From the above explanation, it can be concluded that Discrete Trial Training (DTT) procedure can help autistic children in developing their abilities. According to Lovaas' study on ASD children, who used Discrete Trial Training (DTT), if ASD children were given instructions by a therapist, the child's possible responses were Correct and Incorrect only. But in the implementation of therapy, researchers discovered that there were not only two possible child responses but there were five possible child responses. The five responses are Correct, Incorrect, Partial Correct, Off task, and No Response, where each response requires different feedback and its sequence, as well as different possible causative factors and follow-up interventions.

According to the data collected in this study, the most frequent response is the incorrect category, followed by the Correct response and Off-task response categories. While Partial Correct and No Response are the least appeared categories. The more trials are conducted, then the more Correct response displayed by the children will emerge often. This is one of the pieces of evidence that DTT that has been modified in Smart ABA can help children with autism develop desirable behaviors.

6. Limitation and Further Research
This research is limited to a few subjects. Further research needs to be done with other methods, such as experimentation or Research and Development (R&D), with larger and multi-center samples so that it will further increase the effectiveness and efficiency of DTT applications in autism therapy.

This study is limited to a small number of subjects. Further research is needed to be done using various approaches such as experimentation or Research and Development (R&D) study, using large samples and a multi-center approach to increase the effectiveness and efficiency of newly/modified DTT procedure on Smart ABA in autism therapy.

Conflicts of Interest: The authors declare no conflict of interest.

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