

Developing a Proposed Training Program Based on Discrete Trial Training (DTT) to Improve the Non-verbal Communication Skills in Children with Autism Spectrum Disorder (ASD)

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Abstract

The present study aimed to develop a proposed training program based on DTT to improve the nonverbal communication skills in children with ASD. To achieve the objective of the study, the author developed a scale of non-verbal communication skills consisted of (20 items) measures attention and eye contact, imitation and using the signal, understanding the facial expressions and tones of voice. The author also developed a DTT program by reviewing the previous literature. The study sample consisted of (26) children with ASD aged (6-11) years, were chosen deliberately and divided randomly into two groups: an experimental group consisted of (13) children, and a control group consisted of (13) children. The results showed a statistically significant difference at the level of significance (0.005) between the performance of the experimental and the control groups on the non-verbal communication skills scale in favor of the experimental group. On the other hand, the results indicated that there are no differences in the experimental group between post-test and following up phases.

Keywords: *training program, discrete trial training (DTT), non-verbal communication skills, children with ASD.*

Introduction

Autism spectrum disorder is a complex neurological and developmental disorder that causes lifelong difficulties (the national autistic society, 2012). It is characterized by impaired in two main domains: social-communication and behavior domain (amaze, 2015). The recent estimates issued by world health organization (WHO), indicates that the prevalence of ASD is 1/160 children in the world, this estimate refers to the average and varies a lot by countries and studies (WHO, 2013). Others estimates reached 1/88 upon the center for disease control and prevention (CDC), and autism and developmental disabilities monitoring network (ASSM). In march 2013 (CDC) indicated to new estimates reached to 1/50 individual in the school community (Kira, 2014).

In spite of the great scientific efforts, the causes of ASD are mysterious, so the medical reports indicate that there is no specific and convincing reason to explain the occurrence of the disorder. However, the genetic causes have emerged as a significant. On the other hand, the causes of nervousness play a significant role which indicates that there is some dysfunction in the central nervous system, which confirms that ASD accompanies many neurological disorders. Several studies have linked the relationship between metabolic, chemical and environmental factors and ASD. Although there are many interpretations about the causes of the disorder, but many of them are still hypotheses and controversial among researchers and scientists (Hallahan, Kauffman & Pullen, 2012).

Discreet Trials Training (DTT)

Children with ASD usually do not learn in their environments spontaneously, so they need extra cues, direct and structured teaching of new skills. They must be taught repeatedly, be engaged actively with the environment in order to acquire new skills. DTT is one of the many strategies based upon the principles of applied behavior analysis (ABA) to facilitate learning. It consists of a series of direct, systematic instruction methods, used repeatedly until the child acquires the skill. DTT focuses on the analysis of skills into small elements and units. In this method the skills are individually taught through repeated attempts (Smith, 2001).

DTT is one of the types of interventions and intensive behavioral programs which proved its success for children with ASD. This type of intervention is a systematic process based on the principles of learning theory. It is an attempt to change behavior by evaluation of the functional relations between the target behavior and environmental factors (Gupta, 2004).

This strategy was used to help individuals with ASD to acquire many skills, such as expressive and receptive language, imitation, playing, social, emotional, physical, academic, and daily living skills, etc. (Smith, 2001; Lovaas, 2003). Children with ASD often respond to this type of intervention, so Lovaas study indicated that the young children who have been interfered within this kind of intensive intervention, they had achieved high levels of physical, mental, and academic skills after three years of intervention, and they have continued to generalize the skills for many years (Lovaas, 2003).

These types of strategies assist the teaching of new skills in a conducive learning environment. It includes a series of distinct lessons or the attempts that are taught by a teacher to each child (1:1). Lovas defines this attempt as one unit consisting of a complex behavioral sequence which is broken down into small steps to make it easier for the child to learn and to reach the ultimate goal (Lovaas, 2003). DTT is usually applied in natural environments, such as, the home or the center. The duration of training by using this approach needs of (2-5) seconds in

average between each attempt (Unlu & Vuran, 2012). Moreover, it requires an application period of (30-34) hours a week or (8) hours a day, and it continues for (3) years (Ekeseth Smith, Jahr & Eldivik, 2007). The training on this program also requires providing a special coach, it confirms that the family must be involved and participate in the routines. On the other hand, the training must be implemented within natural environments where the child lives (Unlu & Vuran, 2012).

There are many advantages for using DTT: it is based on very short teaching units (1-5) seconds, to facilitate and speed up the process of learning and skill acquisition, which provides also more than 200 learning opportunities in one hour (Smith, 2001); it is suitable for children in preschool age who usually have developmental delay and limited capabilities. Moreover, the intervention focuses on using prompting, shaping and positive reinforcement techniques which usually help to acquire the skill, and lead to high levels of interactivity between the teacher/coach and the child. Finally, the use of short learning units in this intervention increase the involvement of teachers' flexibility in learning activities with the child during the school day. This intervention does not only help the child to acquire learning opportunities quickly during the day, but also helps him/her to generalize the acquired skills at different times, in different environments and with different persons (Downs, Fossum and Rau, 2008). DTT intervention is evidence based, as data are collected on every attempt to monitor the child's progress based on continuous assessment. Data are collected on each correct and incorrect response. The correct or incorrect responses are calculated to determine the percentage of the child's performance level. The data collected are analyzed to identify relevant patterns in the response, including increasing or decreasing the target behavior. The data collection provides a basis for selecting effective teaching methods, to specify the beginning of training of skill or new behavior, and to make decisions about the identification of the appropriateness of prompting used to achieve the goal of teaching and when to begin the training for the next sequence of social, verbal, emotional behavior in order to prepare the child towards independence (Smith, 2001).

The basic elements in DTT

Both Al-Shami (2004) and Smith (2001) indicated that DTT includes a set of basic elements, as follow:

- Discriminatory stimulus: is an antecedent stimulus that cues an organism to perform a learned behavior.
- Instructions: a group of stimuli that guides the child's behavior when the response occurs, these instructions must be clear, simple and few.
- Response: is what the child said or done when seeing and hearing the discriminatory stimuli, it is classified as a correct or incorrect response.
- Reinforcement: is any motivation follows the response that increases the probability of occurrence the behavior and repeating it, so it must be delivered directly after the correct attempt, also must be desirable for the child.
- The interval between the occurrence of responses: is the interval between occurrence of the first and second response. The goal is to move the child from the first attempt to the second. During this period, the teacher records and notes the child's response in the previous attempt, and also allows the child to interact with the reinforcement.

Steps of DTT

Bogin, Sullivan, Rogers & Stabel (2010) noted the steps of DTT, as:

1. The teacher identifies what will be taught: in this step, the teacher decides what are the expected goals and discusses the planned objectives with the teamwork, especially the parents, then s/he reviews the chosen objectives and rebuilds them, if needed.
2. The teacher analyzes each skill into sub-skills, then identifies each step in the skill, and arrange it in a sequent and clear manner to makes it easier for teamwork members to implement and monitor the teaching process, if necessary.
3. Selection of the data collection system: the teacher identifies and designs the data collection schedule for skills that are taught, this is done by a specially designed schedule after selecting the teaching plan. The schedule, usually, includes a place dedicated to documenting the prompting level and mastery criterion, and a place to record the data when the child achieves the skill.
4. Designing and organizing the place/location: in this step, the teacher determines a list of potential locations and places to implement the training, it must be quiet, has sufficient space for teaching, rest and playing, has good and sufficient lighting, also must be accessible, then the teacher determines the appropriate places after the assessment, so he usually chooses two or more instead of one site.
5. Collection of materials: the teacher collects materials and tools for using during the training process. One of these materials are: handbook of data collection and communication with the teamwork members, a set of reinforcements, pictures and tools for social activities, teaching materials including shapes, colors, letters, numbers and other things related to materials as a cube, toys, pens, pencils, bullets, boxes for storage, etc.
6. Delivery of attempts: the teacher evaluates and preambles the child to go to the training place, then gets the attention of the child and identifies the necessary reinforcement, after that, he starts teaching by providing discriminatory stimulus, then waits until the response occurs, then he reinforces the correct response and provides feedback for incorrect attempt, and begins to try again (providing the discriminatory stimulus) and provides the necessary prompting or moves to the next attempt.

Literature Review

Awijan (2012) conducted a study aimed to investigate the effectiveness of a training program in the development of non-verbal communication skills (attention, imitation, eye contact, understand some of the physical gestures, facial expressions and voice tones function), in children with ASD in Damascus governorate. The study sample included (20) children, were distributed into experimental and control group. To achieve the aim of the study, the researcher prepared a list of non-verbal communication skills assessment, the researcher also builds a training program to develop those skills. The results indicated the effectiveness of the training program in developing the skills of non-verbal communication skills in children with ASD, as well as the results indicated that the development of non-verbal communication skills has continued after two months except attention and eye contact skills.

According to study of Tsiouri, Simmons & Paul (2012) aimed to evaluate the intervention based on DTT in improving the fast imitation in children with ASD. The researchers used a set of tools to measure the non-verbal cognitive abilities, are the diagnostic observations schedule, and the symbolic behavioral communicative scale to measure communication and using of words. The sample consisted of (5) children with ASD aged from (3-6) years. The results of the survey indicated that three out of five produced and achieved words, good performance and evident in

the early using of spoken language. The results also showed that there has been an increase in the level of performance of all participants in producing the right words.

Turner (2011) conducted a study aimed to compare the two methods of teaching based on DTT and regular teaching. The study was conducted to determine which methods are effective in improving and helping children with mental disabilities in generalizing their acquisition of numeracy. The sample of the study consisted of three children with intellectual disability attend in special education classes in middle public schools in Ohio. Data were collected about their performances twice every week, and it was compared to determine which strategies were more effective in helping children to generalize the acquired skills. The results of the study showed that these methods were effective in helping children with intellectual disability in mastering the skills. However, there was one child had acquired the skill slowly through DTT method, but all the children had been able to apply the skills in different places.

Holding, Bray & Kehle (2011) studied of comparing the effectiveness of training on fluency and DTT in training of children with ASD on expressive language skills including classification names. The sample of the study consisted of (4) children aged (3-6) years, they were taught by intensive training sessions ranged between (20-30) hours a week, they were trained by specialists in ASD. The results showed that the use of fluency training can lead to acquiring and generalizing the skills quickly. Moreover, this method can lead to change the children's treatment and behavioral problems, also can lead to improving their performance and participation in school and with their family.

Downs, et al., (2008) researched in the evaluation of the effectiveness of two models of teaching through using DTT with children with developmental disabilities attending preschool programs with typical children. All children participating in the baseline have been assessed with development delay in many significant functional domains (cognitive, behavioral, adaptive behavior, language and communicative, and motor skills), the intervention continued one year, where each child received the training through individual sessions ranged (10-15) minutes a school day. Results showed that children exposed to both models of teaching have acquired new skills quickly and statistically significant. Results also indicated that the method of training through DTT has the possibility to use it professionally and effectively in public preschool programs with children with developmental disabilities.

Iben Seddeiq's study (2005) aimed to measure the effectiveness of a proposed program on development of non-verbal children with ASD and its impact on social behavior. The study sample included (38) children diagnosed with ASD. The researcher built a scale to assess the non-verbal and the social behavior skills, she also built a training program to improve the non-verbal communication skills. The results of the study found statistically significant differences in non-verbal communication skills between the experimental group and the control group were in favor of the experimental group on the post-test, except that there were no significant differences in the social behavior between the two groups.

Statement of the Problem

The current study came to investigate of effectiveness of a proposed training program based on DTT to improve the non-verbal communication skills in children with ASD, it has attempted to answer the following two questions:

- Are there statistically significant differences at the level of significance ($p < .05$) in improving the non-verbal skills in children with ASD between the experimental and the control group favoring to the training program?

- Are there statistically significant differences at the level of significance ($p < .05$) in the non-verbal communication skills in children with ASD in the experimental group on the post-test and following up phases based on the training program?

Methodology

Population and Sample

The study sample included (26) children with ASD (16 male, 10 female) aged (6-11) years, were selected from two centers and institutions that provide education and training services for children with ASD in Amman city. The participants were selected deliberately based on: first, the diagnostic evaluation and the individual educational programs reports which indicated significant difficulties and problems in the non-verbal communication skills. Second, the teacher students attended in those institutions who will participate in training of the children in the experimental group. To investigate the effectiveness of the training program, the members of the study sample were distributed randomly into two groups: the experimental group enrolled in the training program, consisted of 13 children, and the control group did not enroll in the training program, consisted of 13 children. The parents signed the approval forms for their child to participate in the research.

Instrument

To achieve the aim of the study, the author used the following tools:

The non-verbal communication skills scale.

The author developed a scale of non-verbal communication skills for children with ASD in the age group (6-11) years, included (20) items measure (attention and eye contact=8 items), (imitation and using of the signal=9 items), (understanding facial expressions and tones of voice=3 items). The scale used an interval Likert-type scale (always, often, sometimes, rarely, never). Always indicate that the child performs the skills in (9) correct trails, often means that child performs in (6-8) correct trails, sometimes means that the child performed the skills in (3-5) correct trails, rarely means that the child performs the skills in (1-2) correct trails, never means that the child does not perform the skills correctly.

The author developed the scale by reviewing previous literature from some studies, such as, (Nasr, 2001; Iben Seddeiq, 2005; Sigman, 1990), and from the scales developed a list to examine the non-verbal communication skills in children with ASD such as (CARS-2; GARS-2), the scale was built in initial phase by collecting the items, then it was revised.

To investigate of the validity and reliability indicators, the scale was revised in the initial phase from a group of experts and specialists in the field of special education, working in the field of special education especially in ASD, and educational supervisors and university professors. They revised the scale's content, language, and the appropriateness of the alternatives. After that, the author adopted items agreed to (80%), and taken all amendments relating to the language, merging some items, adding other which indicated by judges.

The author extracted the constructive validity by calculation each item with the total degree of the scale using Pearson coefficient correlation, (Table 1).

Table 1. Pearson correlation values of item with the total degree of the scale of the non-verbal communication skills

Correlation value	Item n	Correlation value	Item n	Correlation value	Item n
89.	15	89.	8	66.	1
82.	16	90.	9	77.	2
76.	17	87.	10	84.	3
90.	18	67.	11	56.	4
68.	19	60.	12	75.	5
78.	20	74.	13	76.	6
0	0	82.	14	81.	7

Table 1 indicates that the values of correlation coefficients ranged (.56-.90) and it was statistically significant at the level ($p < .05$). These values were acceptable for purposes of the study.

Regarding to reliability indicators, it was calculated by the internal consistency method (Cronbach' Alfa Coefficient) which was steadfast in this way (at .92), also by (test re-test), so the author applied the scale on (10) children with ASD from outside of the study sample, after that he applied the scale again on the same sample three days later. The total value of coefficient consistency was (.88), these values are generally accepted for purposes of the study.

DTT Program.

The author built the proposed training program based on DTT by reviewing the previous literature regarded to developing and designing the training programs related to the DTT and the teaching strategies used in this training, as well as the teaching methods used in developing of the non-verbal communication skills, as noted in (Iben Seddeq, 2005; Lynn, 1999). The author also reviewed the books related to development of the non-verbal communication skills. The program adopted the principles and foundations of this type of intervention (individual teaching, providing discriminatory stimuli, using the cues and prompting, reinforcement, feedback, generalization, etc.). The program included a set of long-term objectives is divided into short term goals as follows:

- Objective 1: to improve the non-verbal communication skills (attention and eye contact) in children with ASD in the age group (6-11).
- Objective 2: to improve the non-verbal communication skills (imitation and using the signal) in children with ASD in the age group (6-11).
- Objective 3: to improve the non-verbal communication skills (understanding the facial expressions and tones of voice) in children with ASD in the age group (6-11).

The program included (36) training session, (3) sessions a week, (35) minutes for each session. The sessions included a preparation at the beginning of the session continued (5) minutes, focused on selecting and creating the session place, sitting with the child in the place and on the table of training, welcoming to the child and talking to him about his activities and daily life, and revising the child goals acquired in the training previous sessions. The program also included the actual procedures for training lasted (20) minutes for each session, focused on directing the child attention, and providing the educational objective using the principles based on the training program and method of intervention. It also included final procedures lasted (10) minutes for each session focused on implementing the skill with different individuals and in

different environments to make sure that the child mastered and generalized the skill. The program used a set of tools, methods, and devices such as using the computer, pictures, cards, recorder, toys, using cartoon movies, etc. To investigate the validity of program was achieved.

The Program Module

In the beginning, the author reviewed the previous literature related to the developing of training programs using DTT, also the training programs related to the development of non-verbal communication skills. The training program is designed in the first phase, so the author developed the long and short-term objectives of the program, and he wrote the training sessions for each objective which included the steps of teaching, tools, reinforcement, methods and procedures used in teaching. The program is offered in the initial phase to a group of judges to make the necessary amendments. The author adopted all the amendments and the notes indicated by judges.

Procedures of Application of the Program

The author developed the non-verbal communication skills scale and the proposed training program, then he sent it to a group of experts to revising. After that, he applied the scale on all the study sample, then divided the sample into two group.

To apply the training program, the author presented a workshop for (5) of the teacher students attended in the practical training program in department of special education in the university of Jordan in the second semester 2015-2016. The teacher students already were distributed within two institutions which provide services for children with ASD in Amman city (the institutions which included the study sample). The author discussed the teacher students about the purpose of the program and its objectives, content, and sessions, also he presented an ideal model about training session for them to clarify the steps and the procedures they will use in the program. After that the student teachers were asked to provide a training session to assess their competencies, then they were asked to start the training sessions for children participating in the experimental group. The author followed up implementing the training sessions to monitor the children performance progress and to provide feedback to the students. teachers

In the end of the training sessions, post-test was applied to all the children participating in the study (both the experimental and the control group) to examine the effect of the training program. Also, a following up test was used to determine the differences in the experimental group scores after two weeks from receiving the training program. The data were analyzed using SPSS.

Study Design

The quasi-experimental was utilized in this study which aimed to develop a proposed training program based on DTT to improve the non-verbal communication skills in children with ASD. The study used the equivalent groups design, pre- and post- test and following up test were used. The study included an independent variable (the proposed training program), and a dependent variable (non-verbal communication skills).

Results

Results related to the first question:

To answer this question means and standard deviations were used to compare the performance of the study sample in the experimental group who enrolled in the training program on DTT and the control group who didn't enroll in the training program. Table 2 shows means

and standard deviations of the experimental and the control group on each of pre- and post-test.

Table 2. Means and standard deviations of the experimental and control groups on each of pre- and post-test.

Standard deviation	Pre-test		Post-test
	Means	Standard deviation	
0.10	3.34		0.09
0.24	2.44		0.11

Table 2 shows that the means of the experimental group reached (2.60) on the pre-test and (3.34) on the post-test, while the means of pre -test for the control group reached (2.34) and (2.44) on the post-test. These results indicate that there are apparent differences in the non-verbal communication skills between the two groups on post-test, so the mean of the experimental group was higher than the control group. In order to examine if there are significant differences at ($p < .05$) between the two groups on the post-test, analysis of co-variance was conducted. Table (3) presents that:

Table 3. Results of analysis of co-variance on post-test (non-verbal communication skills) between the experimental and control groups.

Recourse	.Type iii sum of squares	Df	Means square	F	.Sig
Pre-test	.005	1	.005	312.	.000.
The training program	14.32	1	14.32	923.67	.007.
Errors	0.356	23	0.356		
Total	14.681	26			

(*) statistically significant differences at $p < .05$

Table 3 shows statistically significant differences at the level of ($p < .05$) between the experimental and the control groups performance on the non-verbal communication skills scale refer to the effectiveness of the training program, $f = (923.67)$ is a statistical significant at the level of ($p < .05$). The adjusted means was extracted for the experimental group which enrolled in the training program and the control group to determine the recourse of the differences. Table 4 shows that:

Table 4. Adjusted Means of experimental and control groups

Group	Adj. Means	Standard errors
Experimental group	3.34	5.11
Control group	2.44	5.44

Table 4 indicates that the adjusted means of the experimental group was (3.34) is higher than the mean of the control group (2.44), this indicates that the training program based on DTT had an impact in the experimental group on the non-verbal communication skills. To measure the effect size, Eta-squared is calculated by (0.181), this indicates that the variance in the performance of the experimental group enrolled in the training program on the non-verbal communication skills returns to the training program.

Results related to the second question:

To answer this question means, Standard Deviation and (t) value was calculated to determine the differences in the experimental group on the post-test and following up phase. Table 5 clarifies that:

In Table 5, By looking to (t) to examine the effect of continuation of the training program on the total score of the non-verbal communication skills scale, it shows that there are no significant differences at the level (0.05) in the non-verbal communication skills between the post-test and following up phase, so (t) reached (0.750) and means of post-test (3,34), whereas means of following up (3,22). These results indicate to the effect of continuation of the training program in improving the non-verbal communication skills.

Table 5. Means, standard deviation and (t) value in the experimental group on the post-test and following up phase.

Sign. Level	T	Df	Standard Deviation	Means	Sample	Test	Variable
0.301	0.750	12	0.09	3.34	13	Post-test	Non-verbal Communication skills
			0.08	3.22	13	Following up	

(*) statistically significant differences at $p < .05$

Discussion and Recommendation

The current study aimed to develop a proposed training program based on DTT to improve the non-verbal communication skills in children with ASD. The results showed on the first question "Are there statistically significant differences at the level of significance ($p < .05$) in improving the non-verbal communication skills in children with ASD between the experimental and the control group return to the training program?". The results indicated statistically significant differences at the level of ($p < .05$) between the experimental and the control groups in the performance of non-verbal communication skills, due to the impact of the training program $f = (923.67)$ is a statistical significant at the level ($p < .05$). The results also indicated that adjusted mean of the experimental group was (3.34) is higher than the mean of the control group (2.44). on the other hand, the findings indicated that there are no significant differences at the level ($p < .05$) in the non-verbal communication skills between the post-test and following up phase. This clarifies that the training program had an effect even after stopping the application.

The author attributed these findings to the role and effectiveness of the training program based on DTT to improve the non-verbal communication skills in children with ASD. The program worked on improving the skills of attention and eye contact, imitation and using the signal, understanding facial expressions and tones of voice. The results showed that the performance of children in the experimental group was weak and inability to develop such those skills effectively before involving in the training program, but after receiving the training program they were able to perform those skills in a significant. This result confirms that the

training method based on DTT was effective. It is the inevitable result, because this method focuses on employing short teaching units, and it's a style of direct and systematic teaching methods using repeatedly for many times to master a skill. The method also focuses on task analysis which uses small instruction units and elements, also which uses one by one (1:1) style and focuses on the use of instructional methods and procedures based on prompting (Smith, 2001). Moreover, this method focuses on using intensive behavioral interventions (Gupta, 2004). It also uses methods of repetition and positive reinforcement which usually result to acquire the skill inevitably (Downs, et al., 2008). Whatever, the results of this study on the first and second questions are similar to the results noted by (Awijan, 2012; Holding et al., 2011; Iben Seddeiq, 2005) which indicated to the effectiveness of the training programs used in developing of the non-verbal communication skills in children with ASD and others in all even in the following up phase after the end of application.

The result of study also similar to results of Tsiouri, et al., (2012) which indicated that the intervention based on DTT led to improvement of rapid imitation skills for children with ASD, it also showed that there was an increase in the level of performance of all sample members in using the right words. The results also similar to the results of Turner's study (2011) which indicated that the systematic teaching method and the training using DTT were effective in helping children with intellectual disabilities in mastering and generalizing the acquired skills. It also agreed with the results of Downs, et al., (2008) which indicated that the children enrolled in the teaching method using DTT, have acquired new skills in a statistically significant and quickly. This proves that the DTT has a great teaching effectiveness when it is provided for children with ASD, also has the possibility to use effectively and professionally in public preschool programs with children with developmental disabilities.

Finally, although the findings of the current study showed an improvement in the non-verbal communication skills for children with ASD even in the following up phase, it did not present long time strong evidence to prove that the method has helped these children to continue and generalize to acquire the training program skills in different environments and times and with different persons after receiving the training program, principally that the period between the end of application of program and following up phase is short (only two weeks), so it may be hadn't enough in determining the effectiveness of the continuation of the program.

Mohauture's studies have to investigate whether this intervention leads to long time results in improving the ability of those children to generalize the acquired skills in the training program. The future studies also have to investigate the effectiveness of this type of intervention with different age groups and with children with other developmental disorders and have to examine various other variables. Eventually the researcher could use other methodology especially the single-case study design which depends on using of base line design.

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