Efficacy of Discrete Trial Training in Developing Social-Communication Skills in Children with Autism

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The current study focused on investigating the efficacy of discrete trial training (DTT) program in the development of social initiations and social responding in an adolescent girl with autism spectrum disorder (ASD). A single-subject experimental research design with four treatment phases and two follow-up periods was used for this research to meet the formulated objectives of the current research. Enrolled children with ASD in govt. special education centers across the Punjab province of Pakistan were the population of the study. An adolescent girl of sixteen years diagnosed with ASD was chosen as the participant of the study. The participant was the minimal verbal adolescent with ASD and required support (level 1 of severity) observed on DSM-5 by the psychologist. The researchers planned to execute DTT and therefore manipulated it as an independent variable over developing social initiations and social responding skills taken as dependent variables under specified treatment conditions to investigate the extent of the program and the best-fitted context for developing these skills within the one-on-one structured format of DTT. The researchers employed descriptive analysis to find out percentages and visual analysis such asline charts drawn on Microsoft excel to show skill development for social initiations and social responding. The obtained results indicated that social initiations and social responding can be developed with less or more levels of achievement across all designed treatment conditions but more

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specifically social initiations can be developed during phase E and social responding can be developed during phase C of this study. The study may influence the existing system of dealing with children with ASD inside the premises of Govt. Special Education Centers/Schools across the province of Punjab, Pakistan.
Keywords: Autism spectrum disorder, discrete trial training, social initiations, social responding, context

Autism Spectrum Disorder (ASD) is one of the developmental disabilities. It begins early in childhood and lasts throughout the life span of children with ASD. It affects the social communication and behavior (s)/interest (s) of children with ASD. Both of the areas must have difficulties to be diagnosed with ASD. However, individuals with ASD can be diagnosed at any age of life but symptoms generally appear in the first three years of the life of children (American Psychiatric Association, 2013).

Children with ASD have social communication deficits (American Psychiatric Association, 2013). Social communication deficits may include failing to respond to name, resisting to cuddle, resisting to hold, delayed speech, abnormal voice tone, repeating words or phrases, abnormal conversational patterns, inappropriate social greetings including social initiations and social responding, impaired eye contact, impaired facial expressions, impaired expression of feelings and emotions, impaired sharing of interests, impaired gestures, impaired recognition of non-verbal social cues and others.

It is important to teach social skills to children with ASD. Developing appropriate social skills ultimately promotes natural language among children with ASD (Leaf, 2017). Leaf and colleagues (2017) also explained that social interactions increasethe likelihood of peer approval for children with ASD and hence ultimately increase further opportunities to communicate with others. Here, Leaf and colleagues (2017) added that social skills can lead individuals to learn additional skills without consuming an extra amount of time and cost. Ladd and colleagues (1999) defined that positive relationships with peers and teachers enable children to enjoy participation and thence achievements in school life. Bauminger

and Shulman (2003) stated that social skills enable children to help, share, co-operate and obey societal rules among children with ASD.

Teaching social skills is complex. It includes a multitude of variables (Leaf, 2017). According to Brodheard, et al. (2016) teaching social skills is more complex than teaching skills such as requesting. Likewise, receptive labeling is not as complex to develop as social skills (Grow and Van Der Hijde, 2017). Farber et al. (2016) also defined that matching is a comparatively easy task to develop than to teach social skills. Regardless of its difficulty, it is essential to develop and improve different social skills among children with ASD (Leaf, 2017).

One of the most tremendously studied ABA-based instructional strategies is DTTthat has resulted in significant gains in developing different skills among children with ASD (Smith, 1999, 2001; Tarbox&Najdowski, 2008; Roxburgh& Carbone, 2013). It was first developed by psychologists IvarLovaas and Robert Koegel' in 1970 atthe University of California inLos Angeles. As an instructional method, it was first employed by (Lovaas, 1987) with the children of ASD based on the: 1) Skinnerian principles of operant learning occurring through rewards or punishments for the required behavior (s); and 2) Skinnerian functional account of language (Skinner, 1957& Skinner, 2014), which uses highly structured drill-like activities involving the following strategies: 1) shaping; 2) prompting; 3) prompt fading; and 4) tangible reinforcement to develop new behavior (s) and/or skill (s). It is one of the several structured types of teaching strategies and a highly effective approach to early intervention for teaching and developing a variety of skills such as self-help skills, academic skills, expressive language skills, receptive language skills, communication skills, social skills, fine motor skills, gross motor skills, cognitive skills, recreation skills coupled with the diagnosis of children with ASD (Lerman et al., 2016).

A social initiation is a skill to begin interactions by emitting verbal or gestural behavior. Individuals with ASD often have deficits either socially appropriate responding to initiations by communicators or initiating social interactions with others.Children with ASD commonly reveal major deficits in reciprocal social interaction (e.g. Koegel et al., 2014), which frequently impede them from getting in on the act of

social initiations and social responding as well. However, there are strategies to help and develop social initiation and social responding among individuals with ASD. Teaching to increase social interactions/social greetings such as social initiations and social responding has been efficiently developed under the structured format of DTT across the world. Social initiations and social responding were developed by different researchers e.g. (Hendrickson et al., 1982; Nientimp & Cole, 1992; Zanolli & Daggett 1998; Stevenson, 2000; Garfinkle & Schwartz, 2002; Whalen, 2006; Carr, 2007; Schrandt, 2009; Yun et al., 2014; Tzanakaki et al., 2014; Garcia-Albea, 2014; Groskreutz, 2015; and Hood, 2015).

But, no significant research study was documented on the efficacy of DTT in developing social initiations and social responding among children with ASD inside the premises of the Govt. Special Education Centers of the Punjab, Pakistan. This gap was needed to be addressed in Pakistani society. Therefore, the execution of DTT on children with ASD and investigating the extent to which it is significant in developing social initiations and social responding under controlled conditions became an attention-seeking question for the researchers. Finally, this need forced the researchers to conduct this research study on the efficacy of DTT in developing social initiations and social responses among children with ASD inside the premises of the Govt. Special Education Centers of the Punjab, Pakistan, and hence to document it under the theoretical perspective first described by Lovaas et al. (1973), derived from the work of W. B. Watson in 1900 based on the principles of learning theory and later the work of B. F. Skinner.

Therefore, the researchers formulated four research questions to answer at the end:

1. What is the extent of developing social initiations in an adolescent girl with autism spectrum disorder by using discrete trial training inside the premises of govt. special education centers of the province of Punjab, Pakistan?
2. What is the best fitted context for developing social initiations in an adolescent girl with autism spectrum disorder inside the

premises of govt. special education centers of the province of Punjab, Pakistan?

3. What is the extent of developing social responding in an adolescent girl with autism spectrum disorder by using discrete trial training inside the premises of govt. special education centers of the province of Punjab, Pakistan?
4. What is the best fitted context for developing social responding in an adolescent girl with autism spectrum disorder inside the premises of govt. special education centers of the province of Punjab, Pakistan?

Method

Nature of Study

The quantitative nature of the current study enabled the researchers to analyze the numerical data and hence interpret the obtained results.

Research Design

A single-subject experimental research design with four treatment phases and two follow-up periods was used for this research to meet the formulated objectives of the current research. DTT was taken as an independent variable and therefore manipulated over developing social initiations and social responding skills taken as dependent variables underspecified treatment conditions to investigate the extent of the program and the best-fitted context for developing these skills within the one-on-one structured format of DTT. Therefore, the dependent variable was the number of correct responding over each task analysis made by PA.

A phase was the baseline. B phase, C phase, D phase, and E phase were the various intervention phases of DTT and related conditions. The researcher conducted ten sessions to determine the steady-state baseline measurements by presenting antecedents based on established tasks of the study. The researchers initiated to take repeated measures with defined conditions across the set four phases of the intervention steps given by Smith (2001).Consequently, the researchers conducted the second A-phase of the study after the completion of the treatment phase in order to investigate the return to the baseline of the chosen participant of the study.

In this phase, the researchers introduced discriminative stimulus and measure the responses in the form of correct or incorrect within the allocated time of five seconds. There were two follow-up sessions. First, follow-up sessions were conducted to know the learning appropriateness across the targeted skill in the presence of new stimuli while second follow-up sessions were conducted to generalize the targeted skills.

As the obtained data were discrete in nature and therefore inferential statistics run on the statistical package for the social sciences could not facilitate the researchers to infer properties of the said population of the study. Hence, the response measurements across the phases were descriptively analyzed and drawn line charts with the help of Microsoft excel to provide summaries of the sample and the measures. The descriptive analysis helped the researchers to describe the magnitude of skill development objectively (Kemp et al., 2018) and to display the occurrence of correct responding as a series of data points (Grant, 2018). Finally, the conditions or independent variables under which PA was required to respond are listed below in table 1.

Table 1

Conditions across Phases in which Adolescent Girl was Required to Respond over Presented Cue

Phases	Description
A	Baseline (no treatment)
B	Administering treatment inside the classroom context (participant with researchers and no error correction)
C	Administering treatment inside the classroom context (participant with researchers and error correction)
D	Administering treatment inside the autism-friendly training room (temporarily designed) (participant with researchers and no error correction)
E	Administering treatment inside the autism-friendly training room (temporarily designed) (participant with researchers and error correction)

A	Return to baseline (withdrawing treatment procedures)
Follow up 1	Investigating appropriateness of the skill of coordinated eye contact with vocal respond under novel stimuli (participant with researchers)
Follow up 2	Generalization of the skill of coordinated eye contact with vocal respond(participant with a class teacher)

Note. This table shows conditions across phases in which a child was required to respond over presented cue.

Population

Enrolled children with an autism spectrum disorder in govt. special education centers across the Punjab province of Pakistan were the population of the study.

Participant Selection

An adolescent girl of sixteen years diagnosed with autism spectrum disorder was chosen as the participant of the study.Participant A (a pseudonym) was enrolled at govt. special education, Gojra, Toba Tek Singh district of the province of Punjab, Pakistan. Participant A(PA) had no training of any type under any program since enrolling there. The participant was the minimal verbal adolescent with ASD and required support (level 1 of severity) observed on DSM-5 by the psychologist. She had no social initiation and social responding in her repertoire. A profile of the participant representing clinical characteristics is attached in appendix-A.

Procedure

At the first step, the researchers designed informed consent forms for the parents and teacher; and permission granted letter for the head mistress to conduct the study at Govt. Special Education Centre, Gojra to fulfill the research protocols.

In the second step, the researchers formulated task objectives for the chosen adolescent girl of the current research.

In the third step, the researchers designed DTT sheets to obtain data over dependent variables and later to investigate the efficacy of the program for developing social initiations and social responding.

At the fourth step, the researchers set mastery criteria at 90% correct responses during three consecutive periods. Later, task analysis was completed for developing social initiations and social responding in the chosen adolescent girl of the study. Objectives of task analysis for developing social initiations and social responding were formulated as given below:

The first objective of task analysis for developing social initiations: Look at conversational/communicative partner during 90% correct responding across 3 consecutive DTT sessions.

The second objective of task analysis for developing social initiations: Look at conversational/communicative partner and extend a hand during 90% correct responding across 3 consecutive DTT sessions.

The third objective of task analysis for developing social initiations: Shaking hands independently during 90% correct responding across 3 consecutive DTT sessions.

The first objective of task analysis for developing social responding: Obtain answer on “can you give me your copy” during 90% correct responding across 3 consecutive DTT sessions.

The first objective of task analysis for developing social responding: Obtain answers on "can you show me your nails" during 90% correct responding across 3 consecutive DTT sessions.

The first objective of task analysis for developing social responding: Obtain answers on "can you help me" during 90% correct responding across 3 consecutive DTT sessions.

At the fifth step, the researchers manipulated an independent variable over a dependent variable to know the answers to the research questions. The researchers made an effort to control for all variables except the one being manipulated i.e. independent variable which later facilitated the researchers to make the decision regarding the efficacy of DTT in developing social initiation and social responding in the chosen participant of the study in Pakistani society.

At the sixth step, the researchers set the format of the discrete trials. Chosen adolescent girl of the study observed 3 experimental sessions each day. This training program was spreading over 15 days based on one-on-one discrete trials. Baseline sessions were 10 spreading over 2 minutes of duration. 2 baseline sessions were conducted each day. Total 5 days were allotted to set the baseline. 3 DTT sessions surrounded each experimental session. In this way, there were a total of 45 experimental sessions. Furthermore, 30 discrete trials surrounded each DTT session. 24 minutes were allotted to each experimental session. 3 minutes were allotted as break time within an experimental session after completing each DTT session.4 minutes were allotted to each DTT session. 1 minute was allotted as break time. A total of 5 minutes was allotted to each DTT session. 6 minutes were allotted as intra break time before starting each experimental session. Consequent upon that, 10 return to phase A sessions and 20 follow-up sessions were observed while10 sessions were designed for each follow-up period expanded over 2 minutes to deliver cue of the discrete trial training program.

At the seventh step, the researchers chosethe least to most hierarchical physical prompt levels to get the participant alert and hence to ensure compliance with instructions in order to obtain a response. Least to most hierarchical physical prompt levels include: 1) light touch/raise finger; 2) manual guidance at hand; and 3) manual guidance at the wrist

At the eighth step, the researchers observed the treatment integrity and inter-observer reliability of the program. The speech therapist of the chosen adolescent of the study measured inter-observer reliability over 50% random sessions.

At the ninth step, the researchers run the statistical analysis to reach the results of the study.

At the tenth step, the researchers obtained inter-observer reliability systematically over the dependent variable. It was calculated for 50% of each phase including follow-up phases for the dependent variable. 50% of sessions were randomly chosen from each phase and each follow-up session.

Analysis Techniques

The researchers employed descriptive analysis and visual analysis such as line charts drawn on Microsoft excel for the current research. It enabled the researchers to find out percentages of skill development for social initiations and social responding.

Assumptions of the Study

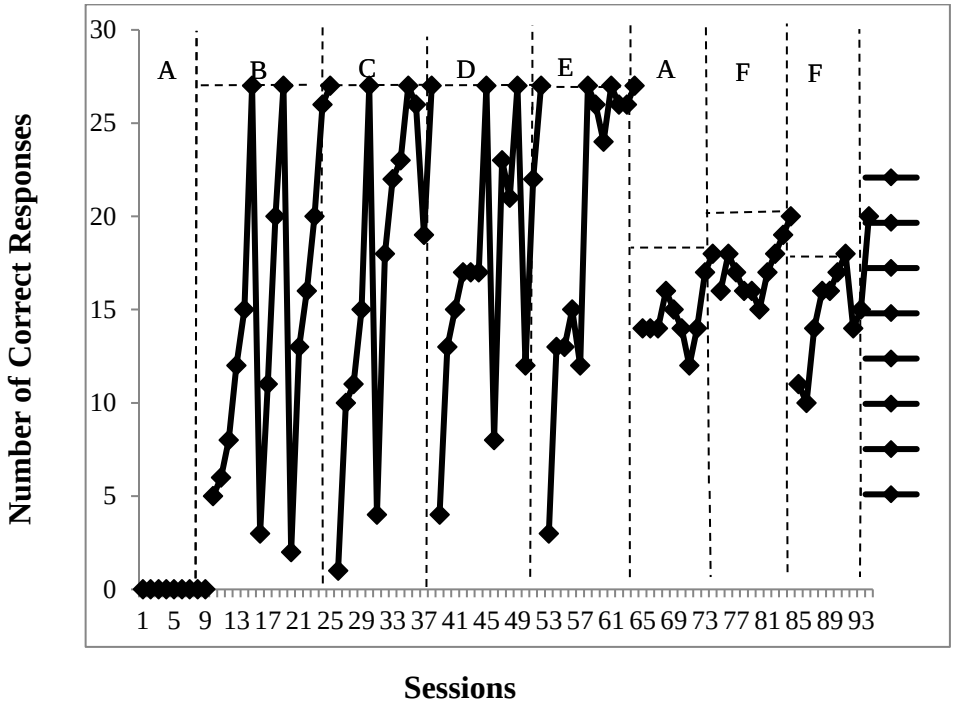
1. Bulky discrete trial data may not be supported by the Statistical Package for the Social Sciences to run any statistical test.
2. Based on assumption one, hypotheses may not be formulated to be tested.
3. Research questions may be satisfied by using descriptive analysis and visual analysis such as line charts drawn on Microsoft Excel.

Results

The researchers analyzed the obtained data and later presented the results of the study. Figure 1 presents number of correct responding of social initiations across experimental sessions.

Figure 1

Number of Correct Responding of Social Initiations across Experimental Sessions



Note. This figure illustrates the development of social initiations across four treatment conditions within the format of the DTT program spreading over three months of period. Social initiations weredeveloped across three formulated steps of task analysis with varying degrees of mastery achievement for each core area of deficit in each experimental phase of the study which provides a comparative analysis of the particular contexts designed to investigate the efficacy of the DTT program in Pakistani society.

Descriptive Statistics of Results

Table 1

Skill Development of Social Initiations across Four Treatment Conditions

Phases of the Experiment	Skill Development
A	0.00%
B	49.5833%
C	58.9743%
D	60.8888%
E	66.3888%
A	50.67%
F1	57.33%
F2	52.66%

Note. This table shows skill development in percentage across the phases of the experiment. The researchers measured 49.5833%, 58.9743%, 60.8888%, and 66.3888% skill development across four treatment conditions. Generally, the researchers recorded a distinctive skill development in PA's responding over sustained eye contact across four treatment conditions as compared to the performance level recorded at baseline. This achievement may be attributed to the DTT sessions. Moreover, the researchers measured 50.67%, 57.33%, and 52.66% skill development across return to A phase, follow-up 1, and follow-up 2 respectively.

3.4 Treatment Integrity

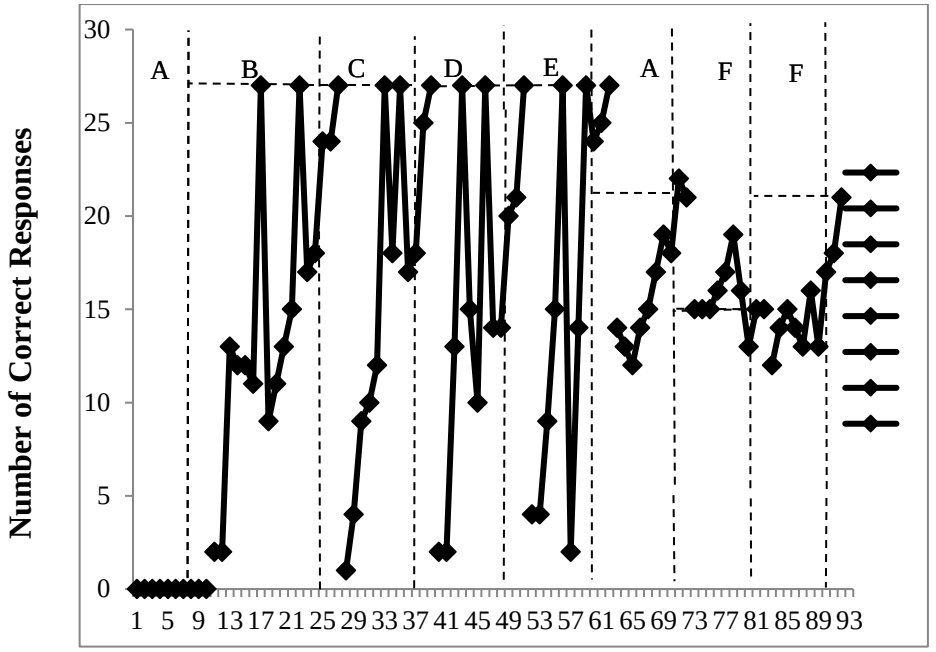
The extent of treatment integrity was observed 100%.

3.5 Inter-observer Reliability

Inter-observer reliability was observed at 85.1%.

Figure 2

Number of Correct Number of Responses across Experimental Sessions



Note. This figure illustrates the development of social responding across four treatment conditions within the format of the DTT program spreading over three months period. Social responding was developed across three formulated steps of task analysis with varying degrees of mastery achievement for each core area of deficit in each experimental phase of the study which provides a comparative analysis of the particular contexts designed to investigate the efficacy of the DTT program in Pakistani society.

Table 2

Skill Development of Social Responding across Four Treatment Conditions

Phases of the Experiment	Skill Development
A	0.00%

B	51.7647%
C	54.1666%
D	53.3333%
E	53.9393%
A	45.00%
F1	52.00%
F2	51.00%

Note. This table shows skill development in percentage across the phases of the experiment. The researchers measured 51.7647%, 54.1666%, 53.3333%, and 53.9393% skill development across four treatment conditions. Generally, the researchers recorded a distinctive skill development in PA's responding over sustained eye contact across four treatment conditions as compared to the performance level recorded at baseline. This achievement may be attributed to the DTT sessions. Moreover, the researchers measured 45.00%, 52.00%, and 51.00% skill development across return to A phase, follow-up 1, and follow-up 2 respectively. researchers researchers

Treatment Integrity

The extent of treatment integrity was observed 100%.

Inter-observer Reliability

Inter-observer reliability was observed at 88.8%.

Discussion

The purpose of the study was to investigate the efficacy of the discrete trial training program in social initiations and social responding in an adolescent girl diagnosed with ASD. There were four research questions to be answered. The researchers discussed each question below:

Question 1: What is the extent of developing social initiations in an adolescent girl with autism spectrum disorder by using discrete trial training inside the premises of govt. special education centers of the province of Punjab, Pakistan?

Yes, social initiations can be developed within the format of discrete trials in children with autism spectrum disorder inside the

premises of govt. special education centers of the province of Punjab, Pakistan as is clear by figure 1.

Literature also supports the results of thisresearch e.g. social interactions and social greetings were developed by different researchers under varying procedures of DTT e.g. (Hendrickson et al., 1982; Nientimp & Cole, 1992; Zanolli & Daggett 1998; Stevenson, 2000; Garfinkle & Schwartz, 2002; Whalen, 2006; Carr, 2007; Schrandt, 2009; Yun et al., 2014; Tzanakaki et al., 2014; Garcia-Albea, 2014; Groskreutz, 2015; and Hood, 2015). Furthermore, DTT was implemented to many academic, learning, and other skills as well (Smith, 2001). Simply, appropriate social responding and social initiations were the earliest targets of behavioral and social interventions.

Question 2: What is the best fitted context for developing social initiations in an adolescent girl with autism spectrum disorder inside the premises of govt. special education centers of the province of Punjab, Pakistan?

The best-fitted context was observed during phase E of the study to develop social initiations in the chosen adolescent girl of the study. Literature does not significantly support such results of this research.

Question 3: What is the extent of developing social responding in an adolescent girl with autism spectrum disorder by using discrete trial training inside the premises of govt. special education centers of the province of Punjab, Pakistan?

Yes, social responding can be developed within the format of discrete trials in children with autism spectrum disorder inside the premises of govt. special education centers of the province of Punjab, Pakistan as is clear by figure 2.

Literature also supports the results of this research e.g. social interactions and social greetings were developed by different researchersunder varying procedures of DTTe.g. (Hendrickson et al., 1982; Nientimp & Cole, 1992; Zanolli & Daggett 1998; Stevenson, 2000; Garfinkle & Schwartz, 2002; Whalen, 2006; Carr, 2007; Schrandt, 2009; Yun et al., 2014; Tzanakaki et al., 2014; Garcia-Albea, 2014; Groskreutz, 2015; and Hood, 2015). Furthermore, in an early exhibition of the systematic implementation of DTT to address social responding, Nientimp

and Cole (1993) executed a constant time delay within the format of DTT to develop vocal responds to social greetings among three participants. Acombination of modeling, prompt delays, behavioral rehearsals, manual prompts, and reinforcement was also executed within the format of discrete trials to develop empathy responses (Schrandt et al., 2009). Time delay prompts have also been shown to be beneficial in developing intraverbal responses. Likewise, the acquisition of intraverbal responses using a discrete trial format and a progressive prompt delay (Ingvarsson & Hollobaugh, 2010).

Question 4: What is the best fitted context for developing social responding in an adolescent girl with autism spectrum disorder inside the premises of govt. special education centers of the province of Punjab, Pakistan?

The best-fitted context was observed during phase C of the study to develop social responding in the chosen adolescent girl of the study. Literature does not significantly support such results of this research.

Conclusion

The researchers concluded that social initiations and social responding can be developed within the format of discrete trial training with less or more levels of achievement in all designed contexts of the study. Social ignition can be developed more specifically during phase E and social responding can be developed during phase C of this study.

Implications

The study will be helpful for special educationists and practitioners to introduce this strategy by implementing and executing the DTT program inside the premises of govt. special education centers of the province of Punjab in the best fitted context for the betterment of this special segment of the population with ASD. The study may influence the existing system of dealing with children with ASD inside the premises of Govt. Special Education Centers/Schools across the province of Punjab, Pakistan.

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