

# A Comparative Study of the Effectiveness of the “Most to Least” and “Constant Time Delay” Procedures in Training Girls with Moderate and Severe Intellectual Disability on some Independent Skills

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## Abstract

The aim of the study is to recognize and compare the effectiveness of the two procedures (Most to Least Procedure and Constant Time Delay Procedure) in helping girls with Moderate and Severe Intellectual Disability to acquire some independent skills, specifically the tooth brushing skill. The number of trials and the period needed to acquire the skills, as well as the Percentage of Errors will determine the more effective procedure. This study used the semi-empirical research method. The sample study is composed of 6 girls registered and engaged at the General Qualification Center in Malaz, Riyadh city. The girls are divided into two equal groups and are subsequently trained to brush their teeth. The Most to Least Procedure was used with the first group and the Procedure of Constant Time Delay was used with the second group. The study findings showed that use of the Most to Least Procedure was effective, as the girls in the first group acquired the skill (tooth brushing) with a success rate of 100%. In addition, the girls were able to maintain this skill and generalize it. The rate of maintenance reached 100%, and the rate of generalization reached 82% - 94%. The procedure of Constant Time Delay also proved to be effective as the first and third girls acquired the targeted skill with a 100% success rate, while the second girl acquired it with 94% success rate. The ability to maintain this skill ranged between 64% - 100%, whereas the ability to generalize ranged between 88% - 94%. The study shows that the use of Constant Time Delay is more effective than the Most to Least Procedure in terms of the number of trials and time taken to acquire the skills, while maintaining a low percentage of errors. Girls acquired the skill of tooth brushing through use of Constant Time Delay in 64 sessions, while the total time taken to make all the girls acquire the skill was 486 minutes, with a percentage of errors of 5%. In the Most to Least Procedure, girls acquired the skill in 72 sessions and the total time taken for making all girls acquire the skill was 552 minutes with a total percentage of errors of 7%.

**Keywords:** Most to Least Procedure, Constant Time Delay, Independent Skills, Moderate & Severe Intellectual Disability

## 1. Introduction

In recent years, Saudi Arabia has developed an interest in educating and training individuals with special educational needs, thanks to its educational policy emphasizing the right of all persons to education each according to their abilities. People with intellectual disability are one of many categories included in this training process. For intellectually disabled persons to be integrated in the community and become independent, they need to gain different academic skills as well as adaptive behavioral skills through specific educational services and programs applied in the least isolated environments.

However, persons with moderate and severe intellectual disability are the group benefiting the least from these services and educational programs because of their need for specific training and intensive supervision. Members of this group suffer from a clear decline in mental capacity, are unable to learn the same way their peers do, take more time to focus on the different facets of a task and to find appropriate solutions. In addition, they have difficulties in retaining acquired skills, and their ability to make use of them in different situations. They also have difficulty responding adequately to many of the stimuli that frequently occur in their environment (Al-Otaibi 2004), in addition to deficiencies in some physical, motor and health aspects, methods of communication and social interaction, psychological issues and personal problems (Abdel Rahim & Bashay 1991). The members of this group also have deficiency performing adaptive behavior skills, a key component of their curriculum and a prerequisite for independence and acceptance by others. Independent skills are one of the most important aspects of adaptive behavior that individuals with moderate and severe intellectual disability show difficulties performing and practicing in an acceptable manner. The most important of these difficulties are their inability to feed themselves, to observe the etiquette of eating with others, hygiene and clothing, as well as avoiding dangerous situations in public places, moving in public places or using phone in emergencies.

The failure of individuals with moderate and severe intellectual disability to acquire independent skills affects the community's ability to accept them and is a major challenge for their parents and teachers. The process of acquiring these skills requires huge efforts using special educational procedures that take into account

their traits and abilities. Most to Least (MTL) and Constant Time Delay (CTD) procedures are among the most effective educational procedures in providing various skills with minimal errors for individuals with moderate and severe intellectual disability in a short period of time (Wolery, Ault, Doyle & Gast 1986; Demchak 1990).

## **2. Study problem**

The training of individuals with moderate and severe intellectual disability requires the use of educational procedures commensurate with their special needs and provides them with many skills with a few errors within the shortest possible time. However, to-date, there has been limited research on the use of specific educational procedures in the Arab world, thus explaining the absence of theoretical and practical frameworks that enable carers and teachers of such disabled individuals to employ these educational procedures in the fields of education and training (Al-Otaibi 2004).

The MTL prompting and CTD procedures, two of the most important educational procedures for the training of moderate and severe disability groups on the independent skills, were applied to the sample in this study. The aim was to test their effectiveness in equipping individuals with intellectual disability with some independent skills, specifically the toothbrushing skill. The assessment was based on the following general question: How effective is the use of MTL prompting procedure and CTD procedure in training girls with moderate and severe intellectual disability on some independent skills?

## **3. Importance of the study**

### *3.1 Theoretical importance*

The importance of this study lies in the scarcity of experimental studies in the Arab World on the use of educational procedures to provide persons with moderate and severe disabilities with various adaptive skills in general, and independent skills in particular. Therefore, this study is a new scientific addition in the field of special education research, which relies on the semi-empirical method; the single-sample design.

### *3.2 Practical importance*

The results of this study will contribute to determining the effectiveness and feasibility of the procedures used to provide individuals with moderate and severe intellectual disability with some independent skills, thereby encouraging their parents and teachers to teach such adaptive or academic skills. This study is therefore of important applied significance.

## **4. Study questions**

The present study attempted to answer the following questions:

- How effective is the use of MTL prompting procedure and CTD procedure in providing girls with moderate and severe intellectual disability with some independent skills?
- How effective is the use of MTL prompting procedure and CTD procedure in having girls with moderate and severe intellectual disability retain some acquired independent skills?
- How effective is the use of MTL prompting procedure and CTD procedure in teaching girls with moderate and severe intellectual disability with some independent skills in other situations?
- Which of the two procedures is more effective in providing girls with moderate and severe intellectual disability with some independent skills? Is it the MTL procedure or the CTD procedure? Answers should be given in terms of the number of attempts required to acquire the skill, the time spent, and the percentage of errors.

## **5. Study terminology**

### *5.1 Most to Least Prompting Procedure*

To perform this procedure, the teacher determines different levels of assistance ranging from the most helpful to the least helpful; partial physical, modeling, verbal, and finally independent, in which the student can perform the target skill independently.

### *5.2 Constant Time Delay*

With this procedure, the teacher provides the skill instruction to the student. He/she then provides a response interval of four seconds. After this, he performs the modeling to ensure the student's correct response, and by extension the student's performance of the target skill independently.

### *5.3 Independent skills*

The independent skill in this study is that of teaching tooth brushing, where the teacher asks the student to brush his tooth using a brush and a paste to ensure the preservation of personal cleanliness and safety.

#### 5.4 Moderate and severe intellectual disability

The term is used to describe the girls residing in the General Qualification Center in Malaz, Riyadh. Their IQs range from 36 to 54 according to Wechsler Adult Intelligence Scale, the Stanford–Binet Intelligence Scale, or the equivalent of either (General Secretariat of Special Education 2001). This group also suffers from deficiencies in performing independent skills, according to the results of the American Association on Intellectual and Developmental Disabilities’ (AAIDD) Diagnostic Adaptive Behavior Scale (DABS) (the school image - Part I) on the Saudi environment.

#### 5.5 Educational Procedures

##### Most to Least Procedure (MTL)

It is a multi-step procedure that depends on the teacher’s gradually reduced assistance to students in learning situations – from the most to the least helpful – in order to have the student achieve a correct and independent response to the performance of the targeted behaviors. This is called “most-to-least prompting procedure” (Al-Otaibi 2004). The procedure is used to teach both simple and complex behaviors. For example, it has been used to train students with Myelomeningocele on how to clean the catheter (Duker & Michielson 1983).

##### Constant Time Delay (CTD)

Due to its uniquely errorless method of teaching, CTD is one of the most important educational procedures for individuals with moderate and severe intellectual disabilities. The use of this procedure contributes to preventing students from making errors during training sessions. This is possible with the use of a fixed response interval – usually three, four, or five seconds – between task instructions and the student response (Al-Otaibi 2004). Houston and Thomas (2002) have pointed out that if the teacher uses the time delay procedure, the student is expected to make one of five possible responses:

- Unprompted Correct Response: The correct responses that are made by the student without prompts from the teacher. It is called *correct anticipation*.
- Prompted Correct Response: The correct responses that are made by the student after being prompted by the teacher. It is called *Wait*.
- Unprompted Incorrect Response: The wrong responses that are made by the student before the teacher’s prompt. It is called *incorrect anticipation*.
- Prompted Incorrect Response: The wrong responses that are made by the student after being prompted by the teacher. It is also called *Error Wait*.
- No Response: The student's lack of response to the teachers' prompt.

## 6. Study method and procedures

### 6.1 Study method

The researcher used the semi-empirical method of single-sample designs (SSDs) to compare the effectiveness of Most to Least Prompting (MTL) procedure and the Constant Time Delay (CTD) procedure (as two independent variables) in tooth brushing training (as a dependent variable). The effectiveness of the two independent procedures was also measured in terms of the number of attempts to acquire the skill, the time spent, and the percentage of errors.

### 6.2 Study design

The Multiple Probe Design (MPD) was used to ensure the effectiveness of both the MTL and the CTD procedures in tooth brushing training of a sample of girls with moderate and severe intellectual disability. The “multiple baseline design across individuals” was chosen because it clarifies the functional relationship of a single independent variable across a number of individuals in a specific educational place. The design is appropriate for this case-by-case training, accurate and also time- and effort-saving during application.

### 6.3 Study population and sample

The study population, on the one hand, included all the 175 girls with moderate and severe intellectual disability residing in the Malaz’s General Qualification Center in Riyadh city. On the other hand, the study sample consisted of six girls with moderate and severe intellectual disability who have been enrolled in the General Qualification Center for females in the Malaz neighbourhood during a period of one to seven years. Their IQs ranged from 36 to 74 according to the results of applied intelligence scales and tests such as Stanford–Binet Intelligence Scale, Wechsler Adult Intelligence Scale, Vineland Adaptive Behavior Scale, Goddard Form Board Test). The information was collected from the files of the girls’ psychologists, physiotherapists, doctors and teachers, as well as the researcher’s personal observations and her application of the American Association on Intellectual and Developmental Disabilities’ (AAIDD) Diagnostic Adaptive Behavior Scale (DABS).

## 6.4 Study procedures

### 6.4.1 MTL prompting procedure

Several steps were followed to apply the MTL prompting procedure. The researcher trained three girls with severe intellectual disability on tooth brushing using the MTL prompting procedure. The three girls are G1, G2 and G3 with the training taking two sessions a day, i.e. 10 a week, in five basic phases as follows:

- Preparation phase of the training program for the MTL prompting procedure

A training program was prepared to gradually reduce the prompting of each girl. It included the following steps: (a) general information about each girl. (b) Choice and description of the targeted behavior in terms of setting the overall goal of “having each girl brush her teeth with a brush and paste when asked to do so with 100% success during three phases”. (c) Breaking down this skill into simple behavioral sub-goals that correspond to the abilities of the sample members, as well as (d) identifying the target stimulus or “antecedent”; asking the girl to brush her teeth using the following phrase: “Brush your teeth”. (e) Choosing four hierarchical levels from the most to the least prompting; “partial physical, modeling, verbal and independent”. (f) Determining response intervals for each girl to perform the skill and the criterion of transition to the least prompting level after each “three sessions”. (g) Making a table to evaluate the performance of each girl in the less prompting levels and determining the “teacher’s reaction” to the girls’ false and correct responses. (h) Selecting a data collection system that includes a table showing the steps to analyze tooth brushing skills, girl responses during training sessions, the ratios, and finally a chart to monitor independent correct responses for each girl.

- Baseline data recording phase

The baseline data for girls was recorded by requesting each girl individually to brush her teeth using a paste, and recording her response for three consecutive attempts using the “baseline data registration form”.

- The researcher conducted an initial measurement of the tooth brushing skill of each of the girls in the first group (G1, G2, G3) to ensure that they did not master the skill.
- The researcher recorded baseline data for the G1 during 4 consecutive sessions.
- A survey of baseline data for G2 was conducted over 5 sessions while G1 had achieved the specific criterion.
- A survey of baseline data for the G3 was conducted over 6 sessions while the G2 had achieved the specific criterion.

- Intervention phase

At this phase, the researcher trained the girls through individual sessions for each girl respectively as is the case in single-sample designs. The training took two sessions a day, 10 a week. The first session was at 8:30 am and the second session was at 12:00 pm.

#### Partial Physical

The researcher began the training at first, most prompting level by attracting the attention of the girl with the question: “How are you today, so and so?” and gently rubbing her head, with an appropriate tone of voice to get her attention. Then, the researcher asked the girl to stand before the washbasin, with the question: “Come, so and so, stand before the washbasin please” and then instructed the girl towards the washbasin, with her hand on the girl’s shoulder. When the girl made a correct response, the researcher reinforced that by saying “well done, good job, so and so!” and put a smiley face sticker brushing its teeth on the magnetic board. As show in Figure 1. If a girl made an incorrect response, the researcher immediately provided (partial physical) assistance, holding the girl from the back and directing her towards the washbasin while saying: “here so and so, stand before the washbasin”. The researcher then moved to the next skill and repeated the same steps. After 3 sessions – which is the transition criterion to the less prompting levels following the girl’s correct response to the partial physical level – the researcher probed the other less prompting levels of learning (modeling, verbal, or targeted stimulus). Since the girl has responded to the most prompting level, the researcher excluded those less prompting ones. For example, in case the girl responded to the verbal level, modeling which is explained below was excluded.

Figure 1: Magnetic board for reinforcement



### Modeling

If the girl did not respond correctly, the researcher would move gradually to the second less prompting level (modeling). In this level, the researcher asked the girl to stand before the washbasin saying: “Stand before the washbasin please,” and the researcher performed the step herself before the girl. When the girl made a correct response, the researcher provided reinforcement by saying “Good work!” and put a smiley face sticker brushing its teeth on the magnetic board. When the girl’s response was wrong, the researcher acted the required skill before the girl while saying, “Here we stand so and so, before the washbasin.” After three sessions, the researcher repeated the response prompting as in the first level.

### Verbal

In the third level - the least prompting - the researcher asked the girl to stand in front of the washbasin by saying: “Stand in front of the washbasin, please.” The researcher explained then to the girl by saying, “Walk to the washbasin and then stand in front of it.” When the girl made a correct response, the researcher provided reinforcement by saying “well done so and so” and put a smiley face sticker brushing its teeth on the magnetic board. When the girl responded incorrectly, the researcher explained the step verbally saying “walk so and so a little to the washbasin and stand there.”

### Independent

In the final level, the researcher asked the girl to clean her teeth saying “Please, brush your teeth so and so”. The girl responded without prompts from the researcher, and thus received the same reinforcement.

It should be noted that when the girl responded incorrectly for three times, the researcher returned to a more prompting level and provided help until the girl mastered the step. This strategy has been followed across all levels and with all girls as set in the MTL prompting procedure to ensure accuracy during the application of this procedure.

During the training process, the researcher used Continuous Reinforcement Schedules (CRS), which consisted of social reinforcement, symbolic reinforcement and food reinforcement, taking into account individual differences in the type of stimulus for each girl. Variable-Ratio Reinforcement Schedules (VRS) were also used to maintain the target behavior.

- Retention of acquired skill phase

After the intervention phase, the researcher conducted a testing session to maintain the acquired skill, using a special form prepared for that. This was done during every four sessions after the girl achieved the specific skill criterion. The probing sessions for the three girls were conducted as follows:

- The extent of retention of the tooth brushing skill was examined for G1 during 9 sessions. The examination was conducted while G2 was in the intervention phase.
- G2 was observed to have possessed the tooth brushing skill during 4 sessions during the intervention of the G3.
- The researcher continued to probe the extent of retention by both G1 and G2 during the intervention of G3. After four sessions of the acquisition of the skill, the extent of retention was examined during one session.

- Generalizing the acquired skill phase

At this phase, the researcher probed the extent to which the three girls had mastered the tooth brushing skill. After three weeks of acquiring and maintaining the skill, the generalized data were recorded by authorizing the person responsible for each girl to ask the girl after lunch to brush her teeth with a brush and a paste without any help. The researcher observed from a distance and recorded the data in a skill distribution form.

### 6.4.2 The CTD procedure

The researcher trained 3 girls with moderate and severe intellectual disability using the CTD procedure. These

girls were G4, G5 and G6 and the training was carried out in two sessions a day, i.e., 10 sessions per week, in five basic phases as follows.

- Preparation of the training program to conduct the CTD procedure

A training program was set up to conduct the CTD procedure on each girl. It included a number of steps: (a) general information about each girl. (b) Choice and description of the targeted behavior in terms of setting the overall goal of “having each girl brush her teeth with a brush and paste when asked to do so with 100% success during three phases”. (c) Breaking down this skill into simple behavioral sub-goals that correspond to the abilities of the sample members, as well as (d) identifying the target stimulus or “antecedent”; asking the girl to brush her teeth using the following phrase: “Brush your teeth”. (e) In addition, determining the controlling prompt (modeling) and determining the waiting trials before prompts as well as the number of sessions, which was three for all girls. (f) Setting the length of the response intervals as four seconds to perform the skill. (g) Also, determining the teacher's reaction to the five responses that may be made by the girl, be it unprompted correct response, prompted correct response, unprompted incorrect response, prompted incorrect response, or no response. (h) Selecting a data collection system that includes a table showing the steps to analyze tooth brushing skills, girl responses during training sessions, the ratios, and finally a chart to monitor independent correct responses for each girl.

- Baseline data recording phase

The baseline data for girls was recorded by requesting each girl individually to brush her teeth using a paste and recording her response for three consecutive attempts using the “baseline data registration form”.

- The researcher conducted an initial measurement of the tooth brushing skill of each of the girls to ensure that they did not master the skill.
- The researcher recorded baseline data for the G4 during four consecutive sessions.
- A survey of baseline data for the G5 was conducted over five sessions while the G4 had achieved the specific criterion.
- A survey of baseline data for G6 was conducted over six sessions while G5 had achieved the specific criterion.

- Intervention Phase

At this phase, the researcher trained the girls through individual sessions for each girl respectively as is the case in single-sample designs. The training took two sessions a day, 10 a week. The first session was at 8:30 am and the second session was at 12:00 pm, before lunch for the reasons already explained. When applying the CTD procedure, the researcher followed two basic trials:

#### 0-Second Trial

It has no time delay between presenting the task direction and the researcher's controlling prompt. This trial aimed to train the girls on skill steps and to ensure that correct responses occur in the training sessions.

#### 4-Second Trial

It presents a 4-second time delay between the task direction and the researcher's controlling prompt. The researcher attracted the girl's attention using the same method of 0-second trial, and then asked the girl to stand in front of the washbasin guiding her through the way, with the phrase “stand in front of the washbasin please so and so to brush your teeth.” The researcher provided a response interval of four seconds, counting them in a low voice “1001 2001 3001 4001”.

During the training process, the researcher used Continuous Reinforcement Schedules (CRS), namely social reinforcement, symbolic reinforcement, food reinforcement – taking into consideration individual differences in the type of stimulus for each girl. The Variable-Ratio Reinforcement Schedules (VRS) were also used in the maintenance phase of the target behavior.

- Retention of acquired skill phase

After the intervention phase, the researcher conducted a testing session to maintain the acquired skill, using a specific form. This was implemented during every four sessions following the girl's accomplishment of the specific skill criterion. The investigation sessions for the three girls were conducted as follows:

- The extent of the retention of G4 tooth brushing skill was examined in 10 sessions during the intervention phase for G5.
- The extent of retention of the tooth brushing skills for G5 was examined in 5 sessions during the intervention of G6.
- The researcher continued to probe the extent of retention of G4 and G5 during the intervention of G6. After four sessions following G6 acquisition of the tooth brushing skill, the extent of retention of skill was examined during one session.

- Generalizing the acquired skill phase

At this phase, the researcher probed the extent to which the three girls had mastered the tooth brushing skill. After three weeks of acquiring and maintaining the acquired skill, the registration data were conducted by authorizing the person responsible for taking care of each girl to ask the girl after lunch to clean her tooth with a

brush and paste without any help. The researcher observed from a distance and recorded the data in a skill distribution form.

### 6.5 Reliability and validity of study procedures

#### 6.5.1 Reliability of study procedures

The reliability of the procedures (i.e., the degree to which the researcher applied the MTL and the CTD procedures as required) was measured by making one of the teachers responsible for the girls as an “independent observer” from within the center. To perform this, the researcher prepared a form of the most important steps for the implementation of each of the above-mentioned procedures. It contained a total of 12 steps for each.

#### 6.5.2 Reliability of data presented by all observers

Using MTL and CTD procedures, reliability of the data presented by both observers (the researcher and the independent observer) was measured to ensure correct recording of the responses of the girls in the two groups during their tooth brushing training.

#### 6.5.3 Validity of study procedures

To ensure the internal consistency of study procedures, the researcher did the following:

- Divide the girls into two groups based on advice of the teacher responsible for them and the researcher’s observations.
- Apply one independent variable (MTL) to the first group of the study sample as well as another independent variable (CTD) to the second group.
- Choose one independent skill common between the two groups, namely the tooth brushing skill based on their teacher’s opinion, filled in her questionnaire to determine the study’s targeted skill.
- Ensure that the girls in the sample of the study had never trained on tooth brushing skill.
- Choose girls who lack family visits, to ensure the lack of any training effects other than those of the study process.
- Choose girls from different dormitories and rooms (not sharing the same room or dorm), and not have them together during the training period, in order to isolate the impact of past experience among them on the target skill.
- Emphasize that all teachers and personal care supervisors in the center do not provide any training interventions on the skill, for the same reason above. A notice by the dorms’ manager was placed in each girl’s room to prevent intervention.
- Ensure the presence of the teacher (independent observer) with the researcher during the application of the study procedures, following up the researcher’s adherence to the steps specific to the application of procedures. They have also recorded girls’ responses during training sessions.

## 7. Results and discussion

### 7.1 The first question

The first question is: How effective is the use of the MTL and CTD procedures in providing girls with moderate and severe intellectual disability with some independent skills?

#### 7.1.1 Results of the performance of the first group using the MTL procedure

Implementing the MTL prompting procedure, the results showed that girls in the first group have achieved the specified criterion with a 100% success over 3 consecutive sessions. The number of sessions they took to gain the skills ranged from 16 to 32 sessions, as shown in Table 1. This variation is due to individual differences among members of the group based on their own traits and circumstances.

Table 1. Number of days and sessions taken by the first group to acquire the skill

Group		Number of Days	Number of Sessions
First	G1	16	32
	G2	12	24
	G3	8	16

G1 was able to acquire the tooth brushing skill during 16 days in 32 sessions. She topped her group in sessions number because during the training process she made some undesirable behaviors such as swallowing some toothpaste and wiping it with her hands, among other behaviors. The researcher was forced to provide verbal alerts, especially in the first few training sessions until such behaviors were no longer present. G1 also swallowed water while rinsing out her mouth after brushing, which forced the researcher to return to the second level of prompting, i.e., “modeling”, and the third level, i.e., verbal. These errors have led to dropping her independent performance from 64% in the 23rd session to 58% in each of the sessions 24, 25 and 26.

G2 gained the tooth brushing skill during 12 days in 24 sessions. Unlike her group peers, her performance during the training was marked by great motivation and rapid learning from the prompting steps. However, she suffers from health problems (epileptic seizures) that affected her daily performance during the training process. It showed a stable rate of performance in the training sessions and the repetition of errors as in the 44th, 45th and 46th sessions, where her performance stabilized at 5%, in the 47th, 48th and 49th sessions at 11%, and the 51st, 52nd and 53rd sessions at 52%. In the 56th and 57th sessions, her performance stabilized at 88%. Therefore, the researcher has taken into consideration her health condition during the training process.

G3 gained the tooth brushing skill during eight days in 16 sessions. She took the least number of training sessions due to her correct responses during the transition between the levels of prompting and the small number of errors, which spared the researcher the effort of returning to the more prompting levels by implementing increased training sessions. Such performance has been clear during the 75th session, where G3 achieved an 82% success for carrying out all steps except for soaking the brush with some water, brushing in different directions, and rinsing out her mouth, which require a third level of prompting (verbal). Having said that, success increased to 100% during the 76th, 77th and 78th sessions where G3 achieved independent performance of tooth brushing skills with a minimal number of sessions.

These results – which confirmed the girls' acquisition of the tooth brushing skill following the MTL procedure – were consistent with the results of several studies that demonstrated the effectiveness of the procedure to teach individuals a number of independent skills according to their age and disability levels (Horner & Keilitz 1975, Thompson *et al.* 1982). These two studies have indicated that students with moderate intellectual disability gained the targeted independent skills (such as washing and tooth brushing) thanks to the use of MTL prompting procedure. The success rate was 100%, with two sessions a day. The researcher herself has followed the same steps and the specific criterion with regards to the number of sessions during her application of the procedure. Similar results were obtained by Betu *et al.* (2004), Duran (1985) and Colozzi and Pollow (1984), who all confirmed the effectiveness of the MTL procedure, with individuals with moderate and severe intellectual disability gaining the targeted skills at 100% success rate.

#### 7.1.2 Results of the performance of the second group using the CTD procedure

The results showed that the girls in the second group have gained the desired skill, with G4 and G5 achieving success at 100% rate, while G6 achieved success at 94% rate. They have gained the skill in a variety of sessions ranging from 18 to 28 sessions as shown in Table 2. This variation is due to individual differences among members of the group based on their own traits and circumstances.

Table 2. Number of days and sessions taken by the second group to acquire the skill

Group		Number of Days	Number of Sessions
Second	G4	9	18
	G5	14	28
	G6	9	18

G4 gained the tooth brushing skill during nine days in 18 sessions. She has demonstrated some good responses as shown during the training with her unprompted correct responses. Compared to her peers, she has shown some delay while responding to the first step in acquiring the skill, that of “standing in front of the washbasin”. Instead of doing that, she stood beside the washbasin despite being taught by the researcher. The reason behind this behavior is possibly motivated by her tendency to stay away from others without participating with others.

G5 gained the skill during 14 days in 28 sessions, where she topped her group in the number of sessions. G5 has achieved a success rate of 100% during the 49th and 50th sessions. Her performance was reduced by 94% in the 51st session because she did not perform the rinsing. The reasons for this drop was a sudden health problem that prevented her from completing the third session. Because of her poor health, anxiety and the lack of responsiveness to those surrounding her (i.e., the researcher, the teacher, the sitter and the therapist), the researcher was forced to stop the training sessions and try to follow up the results of her acquisition of the skill through retention sessions. Doing this has kept her from losing the already acquired skill steps. In addition, the researcher was able to maintain the systematic application of the steps of multiple probe design, while G6 was still in the baseline probing phase which was begun in the first session. Meanwhile, G5 achieved the specified criterion with 100% success in the 94th session. During the training sessions, the researcher noticed that G5 did not perform the rinsing step independently, despite her ability. This may be due to her feeling of choking caused by the amount of water in her mouth, which stimulated her desire to vomit. The researcher has come to this conclusion by observation during the generalization phase while she was brushing with the presence of the sitter.

G6 gained the skill during nine days in 18 sessions. Despite her excessive activity, she was disciplined

while performing the skill steps in an organized manner. This is due to the girl's understanding of the CTD procedure steps, her satisfaction with the time-based training process and the reinforcement delivered by the researcher.

The results of this study were consistent with the results of several studies, such as Schuster *et al.* (1988), Snell (1989), Griffin *et al.* (1992), Wolery *et al.* (1991), Fiscus *et al.* (2002), Collins and Griffen (1996). These studies have all confirmed the effectiveness of the use of the CTD procedure for individuals with moderate and severe intellectual disability to gain independent skills and achieve the specified criterion with a success rate of 100% regardless of their differing ages. Winterling *et al.* (1992; Wall and Gast 1997) also confirmed the success of modeling as a “controlling prompt” during the use of the CTD procedure.

### 7.2 The second question

The second question is: How effective is the use of the MTL and the CTD procedures in retaining some acquired independent skills for girls with moderate and severe intellectual disability?

To answer this question, the researcher measured the possibility of maintaining the tooth brushing skill through probing sessions after every four sessions following a girl's meeting of the specified criterion in three consecutive sessions, with success rate of 100%.

The results showed that the girls in the first group were able to retain the skill gained after each session. The retention rate for all the girls in the first group was 100%. This finding is consistent with the results of several studies that have concluded that individuals with moderate and severe intellectual disability can retain the skills acquired during the MTL procedure with 100% success. Such studies include Duran (1985) and Thompson *et al.* (1982) who showed that students with moderate intellectual disability were able to retain the washing skill but with a success rate of 95%.

The results of the second group showed that the girls were able to maintain the tooth brushing skill at a percent range between 64% and 100%. The results of G5 showed a different effect on the overall percentage of the group's retention, with the percentage of retention at 64% during the first session. The researcher noticed that following G5's fatigue for two weeks with the end of training sessions, her performance gradually improved, as a result of the retention sessions based on her previous achievement of the skills steps in the second session with a success rate of 94%. However, in the third, fourth and fifth sessions, success increased to 100% because of her independent performance of all skill steps. This finding is in line with the findings of some studies that used the CTD procedure to provide many independent skills. The subjects studied achieved high and varying retention rate. Winterling *et al.* (1992), Schuster and Griffen (1991), Gast *et al.* (1992), Fiscus *et al.* (2002) have all showed that the students' skill level was 95%, while Schuster *et al.* (1988) showed a level of 85%. This variation in the retention ratio between the two groups of studies is due to the nature and number of skills targeted by the training. For example, the researchers in these studies have trained the sample members on more than one skill in the training process. This definitely affected the retention rate of students gaining those targeted skills.

### 7.3 The third question

The third question is: How effective is the use of MTL and CTD procedures in generalizing girls with moderate to severe mental retardation to some independence skills in other situations?

Three weeks following the girls' acquisition of the skill, the researcher observed and recorded the girls' general skill data with the help of an external examiner (i.e., the personal sitter for each girl). These examiners have not been part of the measurement process or application procedures. After lunch, they asked each girl to brush and paste without help. The researcher deliberately observed the process and performance from a distance to ensure careful implementation of the steps of the tooth brushing skill. The details are shown in Table 3.

These results show that the girls in both groups have the ability to generalize the tooth brushing skill appropriately and with high success rates, which confirms the effectiveness of the use of the MTL and CTD procedures. The first group of girls who were trained using the MTL procedure were gradually able to generalize the skill by 82% to 94% success. The result of this study is consistent with the results of the studies that used the CTD procedure in training on a number of independent skills. Such studies include that of Schuster *et al.* (1988). The students achieved a generalization rate of 94 to 99%. In a study by Griffen *et al.* (1992), the generalization rate was 95% while Schuster and Griffen's study (1991) showed a generalization rate of 81%.

Table: 3 Percentage of correct responses during the generalization phase of skill acquired by both groups

Group	Sample	Generalization Percentage
<b>First (MTL Procedure)</b>	G1	82%
	G2	94%
	G3	94%
<b>Second (CTD Procedure)</b>	G4	94%
	G5	94%
	G6	88%

#### 7.4 The fourth question

The fourth question is: Which of the two procedures is more effective in providing girls with moderate and severe intellectual disability with some independent skills? Is it the MTL procedure or the CTD procedure? Answers should be given in terms of the number of attempts required to acquire the skill, the time spent, and the percentage of errors.

To answer this question, the researcher extracted the results using both the MTL and the CTD procedures in terms of the number of attempts to acquire the skill (per session), the time spent to acquire them, and the percentage of errors. The results of both procedures are shown in Table 4. The number of attempts/session the first group took using the MTL procedure was 72, the total time required to acquire the skill was 552 minutes, and the total percentage of error was 7%. The second group was trained using the CTD procedure. The total number of attempts to acquire the skill was 64 sessions, the total time required to acquire the skill was 486 minutes and the total error percentage was 5%. These results show that the MTL and CTD procedures are effective since both have been successful in having the girls acquire the desired skill.

Comparing the effectiveness of both procedures, the study has shown that the CTD procedure has been more effective in terms of the number of attempts to acquire the skill and the time spent to acquire it, in addition to the percentage of error during training sessions. The study has also shown that it is easier, more rapid and more accurate to use the CTD procedure, since it uses one level of prompting and its method of application is the same in all sessions, in addition to having a constant time, which further helped the girls to respond with minimal errors. The researcher was also given a fixed time to implement the training as well as response intervals that helped the girls give correct responses. The MTL procedure needed to change the level of prompting used during the training sessions according to the criteria for transition, which took longer. This result is consistent with Miller and Test (1989) and McDonnell (1987), where the CTD procedure was more effective than the MTL procedure in terms of time to acquire the skill and the minimum percentage of errors.

The results of this study however are different from McDonnell and Ferguson's study (1989), where the researchers found that the MTL prompting procedure was more effective than the CTD procedure in providing banking skills for four students with moderate intellectual disability in terms of both the time spent to acquire the skill and the small percentage of errors. This may be due to the fact that the CTD procedure requires a lot of training and practice to be used to attain accuracy either in the application or recording of students' data. This has been confirmed by the researchers in their studies. The following Table 4 compares the results of the two procedures.

Table: 4 Comparison of the results using the MTL and CTD procedures

Group	Procedure	Number of Sessions	Time Spent	Percentage of Error
First	MTL	72	552 minutes	7%
Second	CTD	64	486 minutes	5%

## 8. Summary of study results

Based on what was reached during the presentation of the study results, we conclude the following:

- The results of the study show that the use of the MTL and CTD procedures has contributed to the achievement of the tooth brushing independent skill by girls with moderate and severe intellectual disability.

- The results of the study show that girls with moderate and severe intellectual disability were able to retain the acquired skill (tooth brushing), while using both the MTL and the CTD procedures.
- The results of the study also show that girls with moderate and severe intellectual disability were able to generalize the skill acquired with other individuals and in similar learning situations, based on the use of both procedures.
- The results of the study found that the CTD procedure is more effective than the MTL procedure in terms of the number of attempts to acquire the skill, the time spent to acquire it, and the percentage of error.

## 9. Recommendations

Given the results of the current study, the researcher suggests the following recommendations:

- There is a need to use educational procedures such as MTL and CTD in training individuals with intellectual disability on acquiring adaptive skills, thanks to their proven accuracy and organization.
- Training workshops should be provided for those who take care of or are close to intellectually disabled persons on how to use the educational procedures in the educational and training process.
- These educational procedures should be used by workers in general qualification centers to help individuals with moderate and severe intellectual disability to become independent and welcomed by their communities.
- The educational procedures should be included in the curricula of special education departments in the Arab universities.
- Researchers in the Arab world are encouraged to carry out pilot studies aimed at using educational procedures in the field of education for people with special needs.

## References

- Abdul Rahim, F. & Bashay, H. (1991), *The Psychology of Unusual Children and the Strategy of Special Education - Part I*. Kuwait: Dar Al-Qalam for Publishing and Distribution.
- Al-Otaibi, B. (2004), "The Psychometric Characteristics of a Saudi Image of the Vinland Scale of Adaptive Behavior Exploratory Study", *The Arab Journal of Special Education*, **5**, 13-64.
- Batu, S., Ergenekon, Y., Erbas, D. & Akmanoglu, N. (2004), "Teaching Pedestrian Skills to Individuals with Developmental Disabilities", *Journal of Behavioral Education*, **13(3)**, 147-164.
- Collins, B. & Griffen, A (1996) "Teaching Students with Moderate Disabilities to Make Safe Responses to Product Warning Labels", *Education and Treatment of Children*, **19(1)**, 30-45.
- Colozzi, G., Pollow, R. (1984), "Teaching Independent Walking to Mentally Retarded Children In Public School", *Education and Training of the Mentally Retarded*, **19**, 97-101.
- Demchak, M. (1990), "Response Prompting and Fading Methods: A Review", *American Journal of Mental Retardation*, **94(6)**, 603.
- Duran, E. (1985), "Teaching Janitorial to Autistic Adolescents", *Adolescence*, **20(77)**, 32-225.
- Duker, P. C., & Michielsen, H. M. (1983). Cross-setting generalization of manual signs to verbal instructions with severely retarded children. *Applied Research in Mental Retardation*, **4(1)**, 29-40.
- Fiscus, R., Schuster, J., Morse, T. & Collins, B. (2002), "Teaching Elementary Students with Cognitive Disabilities Food Preparation Skills while Embedding Instructive Feedback in the Prompt and Consequence Event", *Education and Training in Mental Retardation and Developmental Disabilities*, **37(1)**, 55-69.
- Gast, D., Winterling, V., Wolery, M. & Farmer, J (1992), "Teaching First-Aid Skills to Students with Moderate Handicaps in Small Group Instruction", *Education and Treatment of Children*, **15(2)**, 24-101.
- General Secretariat of Special Education (2001), *Regulations of Special Education Institutes and Programs*, Riyadh: Riyadh General Secretariat for Special Education Prints.
- Griffen, A., Wolery, M. & Schuster, J. (1992), "Triadic Instruction of Chained Food Preparation Responses: Acquisition and Observational Learning", *Journal of Applied Behavior Analysis*, **25**, 193-204.
- Horner, R. & Keilitz, I. (1975), "Training Mentally Retarded Adolescents to Brush Their Teeth", *Journal of Applied Behavior Analysis*, **8**, 301-309.
- Houston, D., & Thomas, J. (2003). *Translating Research into Practice for Instruction of Students with Moderate Disabilities*.
- McDonnell, J. (1987), "The Effects of Time Delay and Increasing Prompt Hierarchy Strategies on the Acquisition of Purchasing Skills by Students with Severe Handicaps", *Journal of the Association for Persons with Severe Handicaps*, **12(3)**, 227-236.
- McDonnell, J., Ferguson, B. (1989), "A Comparison of Time Delay and Decreasing Prompt Hierarchy Strategies in Teaching Banking Skills to Students with Moderate Handicaps", *Journal of Applied Behavior Analysis*, **22(1)**, 85-91.
- Miller, U. & Test, D. (1989), "A comparison of Constant Time Delay and Most-to-Least Prompting in Teaching

- Laundry Skills to Students with Moderate Retardation”, *Education and Training in Mental Retardation*, **24(4)**, 70-363.
- Schuster, J., Gast, D., Wolery, M. & Gultinan, S. (1988), “The Effectiveness of a Constant Time Delay Procedure to Teach Chained Responses to Adolescents with Mental Retardation”, *Journal of Applied Behavior Analysis*, **21(2)**, 169-178.
- Schuster, J., & Griffen, A. (1991), “Using Constant Time Delay to Teach Recipe Following Skills”, *Education and Training in Mental Retardation*, **26(4)**, 19-411.
- Snell, M. (1989), “Acquisition and Maintenance of Tooth brushing Skills by Students with Cerebral Palsy and Mental Retardation”, *Journal of the Association for Persons with Severe Handicaps*, **14(3)**, 216-226
- Thompson, T. J., Braam, S. J., & Fuqua, R. W. (1982). Training and generalization of laundry skills: A multiple probe evaluation with handicapped persons. *Journal of Applied Behavior Analysis*, 15(1), 177-182.
- Wall, E., Gast, D. (1997), “Caregivers' Use of Constant Time Delay to Teach Leisure Skills to Adolescents or Young Adults with Moderate or Severe Intellectual Disabilities”, *Education and Training in Mental Retardation and Developmental Disabilities*, **32(4)**, 340-356.
- Winterling, V., Gast, D. L., Wolery, M., & Farmer, J. A. (1992). Teaching safety skills to high school students with moderate disabilities. *Journal of Applied Behavior Analysis*, 25(1), 217-227.
- Wolery, M., Ault, M., Doyle, P. & Gast, D. (1986), *Comparison of Instructional Strategies: A Literature Review*, Washington DC: Department of Education.
- Wolery, M., Ault M., Gast, D., Doyle, P. & Griffen, A. (1991): “Teaching Chained Tasks in Dyads: Acquisition of Target and Observational Behaviors”, *The Journal of Special Education*, **25**, 198-220.

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