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The effects of handwriting without tears® and fading prompts on the handwriting of a preschooler with developmental delays

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Abstract
The purpose of this study was to evaluate the effects of Handwriting Without Tears® (HWT®) and fading prompts on the handwriting of a preschooler with developmental delays. HWT® methods and visual prompts were implemented in the study to improve the participant's handwriting on the letters in her first name. The participant was required to form, trace, and copy the letters in her name using HWT® materials and visual prompts. At the end of the study, the visual prompts were faded until the participant was able to write her name independently. The interventions included in the study were overall successful for the participant.

Keywords: Handwriting without Tears, visual prompts, fading, maintenance, name writing.

1. Introduction
Children with a developmental delay show delays in one or more of the developmental domains. These domains are the following: Cognitive, communication, social, adaptive, and fine or gross motor [1]. Petersen defines, "Developmental delay is frequently used to identify children with delay in meeting developmental milestones in one or more streams of development. There is no consensus on the specific definition" [1]. Children with developmental delays often need specialized instruction to support their development.
Handwriting Without Tears® is an educational program that focuses on teaching learners how to write [2]. Several single case research studies have shown that HWT® is a successful program for building early writing skills [3-6]. It appears that Handwriting Without Tears®, may be more effective in improving handwriting legibility than a traditional ball and stick method of instruction [7]. Another study was done with two preschoolers with developmental delays to look at the effectiveness of HWT®. The authors of the study state, "The results of this study indicate that the use of the modeling and tracing procedures from Handwriting Without Tears® [8, 9] increase the legibility of handwriting. The outcome of this study and some other case reports that Handwriting Without Tears® curriculum is effective for preschool aged students with developmental delays [10-12]. Our research with Handwriting Without Tears® provides some evidence that the program uses the appropriate teaching strategies, objectives, learning tasks, and materials for teaching writing skills [3, 7, 5, 12].
The ability to write one's name is a very important skill that is needed every day. Name writing is a skill required throughout school and later in the work force. Name writing is crucial to complete job applications and other official documents [13].
The purpose of this study was to evaluate the effects of *HWT®* and fading prompts with a single preschooler's handwriting. Another purpose was to replicate and extend the efficacy of *HWT®* with another student enrolled in a classroom where a great deal of research evaluating *Handwriting Without Tears®*, has taken place [3, 11, 5].

2. Method
2.1 Participant and Setting
The participant was a 4-year-old female with a developmental delay. She was a preschool student in an integrated classroom that consisted of other children in special education and

many typically developing peers in the Early Childhood Education and Assistance Program (ECEAP). The participant was in the half-day preschool morning session that ran from 9:00 a.m. to 11:30 a.m. on Mondays through Thursdays. The participant was distracted easily and lost focus frequently. The participant was working towards following two-step directions given by adults, one of her IEP goals.

The study took place in a public, suburban elementary school that was located in a large urban school district in the Pacific Northwest. The study was conducted in an integrated preschool classroom that consisted of three other children qualified for special education services and twelve typically developing peers in the ECEAP program.

The study occurred at a table in the school hallway to prevent distraction and avoid noise. At this time, only the researcher and the participant were present. The author, a student teacher from Gonzaga University, administered the study. The researcher met with the participant two times a week at 9:45 a.m. for fifteen minutes. The duration of the study was four months. This classroom has been employed to carry out an evaluate teacher candidate skills in changing student behavior [3, 11, 5].

2.2 Materials

Materials that were used in the study were a piece of paper that contained Name a crayon, *Handwriting Without Tears*® (*HWT*®) *Wood Pieces*, *a Handwriting Without Tears*® *Chalkboard*, and chalk. During baseline and at the beginning of every session, the Name paper made by the researcher and a crayon was given to the participant to write her first name. During intervention, the *HWT*® *Wood Pieces*, *HWT*® *Chalkboard*, and chalk were used. The *HWT*® *Wood Pieces* were used by the researcher and participant to form the letters in the participant's first name, The *HWT*® *Chalkboard* and chalk were also employed by the researcher and participant to trace and copy letters in the participant's first name.

2.3 Dependent Variable and Measurement

The dependent variable that was assessed in this study was the participant's handwriting of her first name. The participant's handwriting was measured using a handwriting point system. The participant's name writing could receive a total of twelve points. There were four letters in the participant's first name, and each letter could receive up to three points; one for correct shape, one for correct size, and one for correct formation. Correct shape was defined as being able to recognize the letter. Correct size was defined as letters that were uniform to the model letter that the researcher used as a scoring guide. Correct formation was defined as using the same lines and steps to form the letter as taught during intervention. Data was collected for three days of baseline and at the beginning of every instruction session. The participant wrote her first name on a strip of paper that said Name The researcher evaluated each letter written and assigned the number of points earned. The number of points assigned to individual letters and the total number of points for the full name was recorded in a data collection form.

2.4 Experimental Design and Conditions

A dismantling strategy [14] was used as the design of this study. There were seven conditions in the experimental design, which included ABCDEFG.

2.4.1 Baseline (Condition A)

Baseline data was taken for three sessions. During baseline, the participant was given a strip of paper that said Name and instructions from the researcher. The researcher told the participant "Write your name on the line." No further instructions or procedures were allowed in baseline.

2.4.2 HWT® Wood Pieces, HWT® Tracing, Copying with Dot Prompts (Condition B)

Condition B took place for four sessions. One letter of the participant's name was introduced during each session. The letters were introduced in the *HWT*® letter learning sequence. Within a session, the learner would form the letter with *HWT*® *Wood Pieces*, trace the letter on the *HWT*® *Chalkboard*, and copy the letter on the chalkboard with visual dot prompts. Transitioning from tracing to copying was too big of a jump for the learner at that point. The participant's learning style requires a lot of practice and repetition before performing the task completely on her own. Therefore, the researcher drew dots on the chalkboard as a visual prompt for the participant to connect her lines within the letter. For each part of Condition B, the researcher said, "My turn" and modeled the task. Then, the researcher said, "Your turn" and the participant completed the task also.

2.4.3 Copying with Dot Prompts (Condition C)

The duration of Condition C was three sessions. The participant copied her full name with dot prompts on the chalkboard when the researcher said, "Write your name with the dots." When the participant showed a pattern of copying the letters in her name with ease, the researcher continued on to Condition C.

2.4.4 Fade Dot Prompts on Letter "o" (Condition D)

Condition D took place over two sessions. The researcher removed the dots one at a time and instructed the participant by saying, "Make an 'o' with pretend dots."

2.4.5 Fade Dot Prompts on Letter "e" (Condition E)

Condition E lasted for two sessions. The researcher removed the dots one at a time and instructed the participant by saying, "Make an 'e' with pretend dots."

2.4.6 Fade Dot Prompts on Letter "Z" (Condition F)

The duration of Condition F was two sessions. The researcher removed the dots one at a time and instructed the participant by saying, "Make a 'Z' with pretend dots."

2.4.7 Fade Dot Prompts on Letter "y" (Condition G)

Two sessions were devoted to Condition G. The researcher removed the dots one at a time and instructed the participant by saying, "Make a 'y' with pretend dots."

3. Inter-Observer Agreement

Reliability was taken for 100% of the sessions, which was 19 out of 19 sessions. The researcher was the primary data collector and another teacher who knew the handwriting scoring system took data for reliability. For each session, the smallest number of handwriting points given by the primary data collector or reliability was divided by the bigger number and multiplied by 100 to find the inter-observer agreement percentage. The average percent of inter-observer agreement was 95% with a range of 0% to 100%.

4. Results

Overall, the interventions used in this study were effective for the participant. During baseline, the participant was not able receive more than 17 percent of the handwriting points possible. Over the next four sessions using different *HWT®* materials and dot prompts to form letters in Condition B, the learner was able to increase her percent of handwriting points to 75 percent. In Condition C, the participant reached 100 percent when writing her name with dot prompts only. When the researcher began to fade the dot prompts provide (Conditions D-G), the learner maintained her handwriting points above 80 percent until the last session when it dropped to 75 percent. On the day of the last session, the participant was distracted and very eager to play with toys at center, so this may have affected her handwriting performance. As a whole, the study showed an increasing trend in data collected of handwriting points.

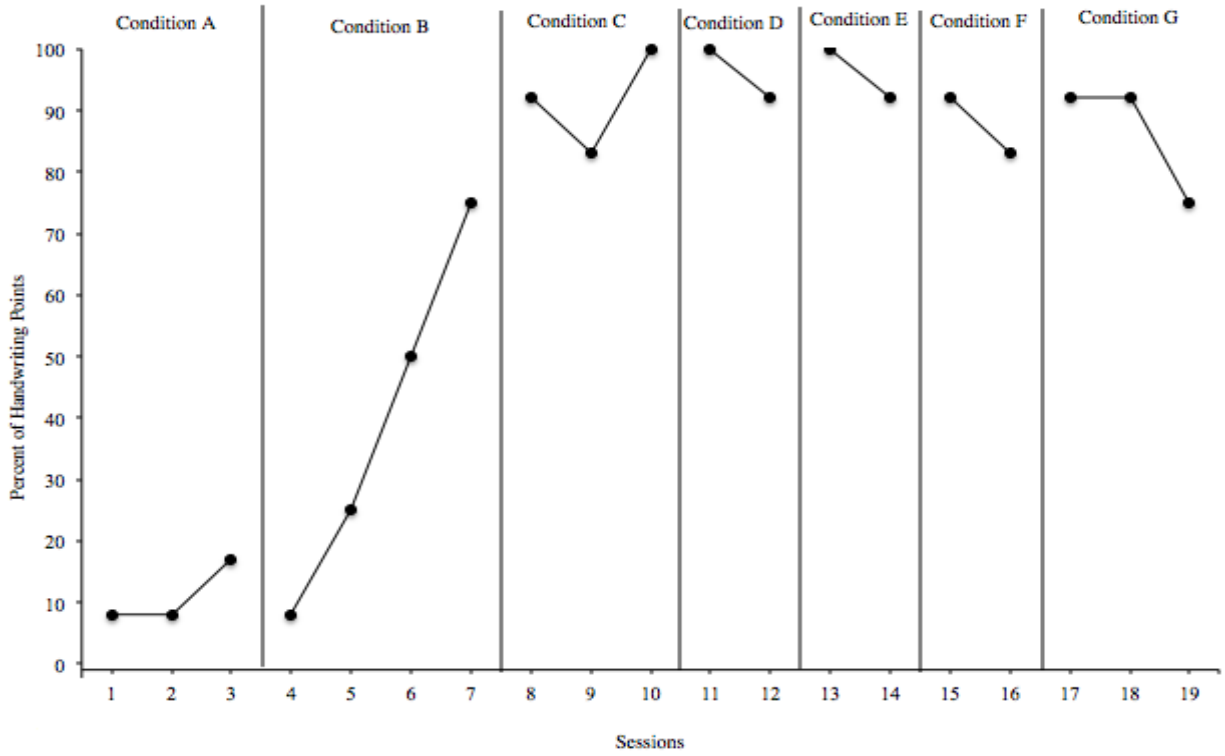

Fig 1: The percent of handwriting points earned per session for each condition by our participant.

5. Discussion

Overall, both of our interventions were effective for the participant. Our data found an increasing trend the number of handwriting points our participant was able to earn. The outcomes of employing part or a great deal of *HWT®* replicates much of our previous research [15, 3, 10, 4, 11, 7, 5, 12]. In addition is provides another replication as to the efficacy of combining dot to dot tracing with handwriting instruction. We have employed dot to dot tracing with older students [16]. In the present case report a young preschool child also benefitted from dot-to-dot tracing.

A strength of this study was the participant improved in her ability of writing her name with correct size, shape, and formation. The case report was important for the child since it targeted handwriting, which is a functional skill that will be used for the rest of the participant's life [17]. Another strength of this study was its efficiency. The first author only met with the participant to work on her handwriting for 15 minutes each session. This was an easy intervention that the special education teacher can implement in her classroom. It was noted by the instructional staff that our participant enjoyed handwriting again, because she was able to use the *HWT® Wood Pieces* and chalkboard [18].

The use of dot-to-dot tracing and tracing itself has been shown to improve handwriting [16, 19, 20, 21]. Tracing provides additional practice [17].

A major difficulty of this study was three weeks of winter break and parent conferences that prevented the first author and participant to meet. Sometimes other classes or teachers would walk by in the hallway during instructional time and the participant would get distracted and lose her focus, which was a complication in this study. The use of some form of reward system such as a token economy for attending would have been beneficial [22, 23]. It would be beneficial to continue the Condition G, and have the participant write her name independently until she received 80 percent of handwriting points or more for at least two consecutive days. However, due to time constraints, the first author was unable to carry this out.

The use of the single case research design [14, 24] allowed the first author to make data based decisions regarding the use of each of the procedures implemented as well as when each was faded. This allowed the researchers to determine during fading dot to dot tracing on our participant's performance. This could be carried out with a single preschool student. As we have seen in recent research in special and remedial education, single case research designs are now widely employed. Part of teacher training at the undergraduate as well as the graduate level should include experience employing and evaluating data [25]. Finally, several states are implementing the use of the edTPA [26] which allows for the use of such designs as part of the evaluation process.

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