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## Incorporating Animal-Assisted Therapy (AAT) to Improve Handwriting Skills in Pediatric Occupational Therapy

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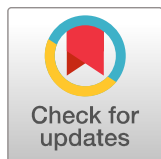
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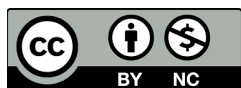
# Incorporating Animal-Assisted Therapy (AAT) to Improve Handwriting Skills in Pediatric Occupational Therapy

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## Abstract

*Within the field of occupational therapy, animal-assisted therapy (AAT) is becoming more widely recognized and utilized as a supplement to traditional therapeutic interventions. As this area is still an emerging area of practice within occupational therapy, research is necessary to better understand the effect of AAT on children's progress toward various goals. The purpose of this research study was to analyze the effectiveness of using Animal-Assisted Therapy to improve children's performance with and engagement in handwriting activities in outpatient pediatric occupational therapy. This study utilized a Quasi-experimental design, assigning participants to two groups. One group participated in handwriting activities while using AAT, and the other participated in handwriting activities via traditional occupational therapy. Each participant completed the Evaluation Tool of Children's Handwriting (ETCH) for a pre-and post-test assessment. For five weeks, each child participated in approximately 15 minutes of handwriting during their occupational therapy sessions. A paired samples t-test found that pre-and post-test assessments indicated significant differences on three subtests on the ETCH for both groups respectively. Additionally, an independent samples t-test determined that both satisfaction scores and time engaged in handwriting activities were significantly different between the AAT group and the therapist-led group. The findings of this research demonstrate that progress toward handwriting-related goals can be made with consistent intervention during occupational therapy sessions regardless of the intervention techniques being used. However, using AAT can greatly increase children's satisfaction and enjoyment with handwriting and increase the time they are willing to engage in these types of activities.*

**Keywords:** Animal-Assisted Therapy, handwriting, occupational Therapy, pediatrics

## **Introduction**

Within the field of occupational therapy, animal-assisted therapy (AAT) is becoming more widely recognized and utilized as a supplement to traditional therapeutic interventions. AAT is formally defined as, “a form of therapy that includes the presence of and/or interaction with an animal to facilitate progress toward some therapeutic goal” (Hardy & Weston, 2020, p. 197). In occupational therapy, AAT has been incorporated in nursing homes and assisted living facilities, hospitals, mental health rehabilitation centers, schools, and various pediatric settings (Graymore, 2021). A certified facility dog and handler can perform AAT in planned, goal-directed, and measurable intervention activities to address a client’s identified goal areas (Winkle & Ni, 2019). Practitioners can address goals in many areas of occupation including activities of daily living (ADLs), instrumental activities of daily living (IADLs), play, leisure, work, and social participation because AAT is considered a purposeful activity that supports occupational engagement (Andreasen et al., 2017; Winkle & Ni, 2019).

The focus of the present research is on the focus of AAT, specifically dogs, in a pediatric setting. As this area is still an emerging area of practice within occupational therapy, research is necessary to better understand the effect of AAT on children’s progress toward various goal areas. AAT in occupational therapy may improve a child’s motivation to participate and make progress in identified goal areas, with this study focusing specifically on handwriting skills. The purpose of this research study is to analyze the effectiveness of incorporating AAT into outpatient pediatric occupational therapy sessions to improve children’s performance with and engagement in handwriting activities. The research study aimed to answer the following research questions: Does occupational therapy incorporating AAT increase a child’s overall handwriting abilities? Does occupational therapy incorporating AAT increase a child’s satisfaction with and engagement in handwriting activities? The investigators hypothesize that the group participating in AAT would demonstrate

increased overall handwriting abilities, increased satisfaction with handwriting activities, and increased time with focused engagement on handwriting tasks.

## **Literature Review**

### **Therapeutic Benefits of Animal-Assisted Therapy in Academics**

Current evidence suggests there are various therapeutic benefits to incorporating AAT in pediatric occupational therapy. Pertaining to academic performance, Brelsford et al. (2017) completed a systematic review yielding 25 articles. Collectively, the results indicated that AAT could lead to many therapeutic benefits for children in an educational setting with the ability to address multiple skill areas including reading abilities, emotional stability, social functioning, interpersonal skills, physiological arousal, motor skills, and adherence to instructions (Brelsford et al., 2017).

In schools, research has been conducted with typically developing children, as well as children with a variety of diagnoses. Anderson and Olson (2006) completed a case study with children with emotional disabilities to determine if the presence of a therapy dog affected emotional stability and learning. The results showed that the presence of a dog contributed significantly to overall emotional regulation, and improved management of behaviors, and attitudes toward school (Anderson & Olson, 2006). Similarly, Kotrschal and Orthauer (2003) found that the presence of a therapy dog in a classroom for eight weeks led to an overall decrease in aggressiveness and hyperactivity, with greater behavioral improvements observed in boys rather than girls.

### **Attention and Active Participation**

AAT can have benefits for children’s attention and active participation in academic activities. Mendoca et al. (2017) studied information registration, attention, initiation, and emotional regulation of students in a school setting. Self-initiation of activities and attention throughout

activities improved during interactions with the dogs (Mendoca et al., 2017). Similarly, Gee et al. (2010) conducted a research study working with a certified therapy dog, a stuffed dog, and a human confederate to determine the effect on preschoolers' adherence to instructions during school-related tasks. Participants completed a forced-choice recognition task with researchers measuring the accuracy and type and frequency of prompts given. Participants completing the activities with the therapy dog demonstrated increased accuracy while requiring significantly fewer prompts which demonstrated the positive benefits of incorporating a therapy dog to assist with academic-related tasks (Gee et al., 2010).

### **Performance of Motor Skills Tasks**

In addition to improving attention, research indicates that AAT may have a positive impact on children's speed and accuracy in the completion of motor skills tasks. Gee et al. (2007) found that the presence of a therapy dog had a significant effect on the children's performance and acted as an effective motivator, and children performed gross motor tasks with increased speed and accuracy. Gee et al. (2009) conducted a similar study aimed to analyze the effect of a therapy dog on preschoolers' adherence to instructions while completing motor tasks. When completing modeling tasks, or tasks where the child was asked to emulate the behavior of a model, the children followed the directions best when the real dog was present (Gee et al., 2009).

Though the evidence is limited about AAT, preliminary research shows that incorporating AAT in pediatric occupational therapy, especially in a school setting, has numerous benefits for children with a variety of diagnoses and can be incorporated to address multiple goal areas. Currently, there is no research specifically addressing the effect of AAT on the development of fine motor skills and handwriting abilities which indicates the need for this study.

## **Methodology**

This study was conducted in an outpatient pediatric occupational therapy setting, and it utilized a Quasi-

experimental design, assigning participants to two groups. One group participated in handwriting activities by partnering with a facility dog, and the other participated in handwriting activities via traditional occupational therapy.

### **Participants**

Research participants included children between the ages of 6 and 12 years old receiving outpatient occupational therapy services. To qualify for the study, children had to be able to read and understand English and demonstrate increased difficulty with handwriting. Similarly, participants were excluded if they were outside the identified age range, unable to read and understand English, or did not demonstrate handwriting challenges. Additionally, participants were excluded if they were allergic to dogs or were uncomfortable with or afraid of dogs. Because the facility dog only works roughly 20 hours per week, participants were assigned to each group based on whether their weekly appointment aligned with the availability of the facility dog.

### **Instruments**

The research study utilized the Evaluation Tool of Children's Handwriting (ETCH) for the completion of the pre-and post-test assessments. The ETCH is a criterion-referenced assessment used to assess manuscript handwriting skills in children between the ages of 6 and 12. It assesses alphabet and numerical writing, both near- and far-point copying, dictation, and sentence generation with scoring targeting both legibility and speed. Additional data was collected to assess the participant's satisfaction with, and time engaged in handwriting activities. The researcher utilized a five-point scale with a visual representation of emotions to ascertain the participant's satisfaction with the weekly handwriting activities (Appendix A). Lastly, the researcher recorded the total amount of time the child was actively engaged in a handwriting activity.

## Procedure

IRB approval was obtained on February 1, 2023. Each caregiver provided consent and children provided assent via a written signature before beginning the research study. To maintain a high level of confidentiality, all data was kept on password-protected computers in a Google Document. Data was only accessible to the principal and student investigators. Participants were recruited from those families that are currently receiving occupational therapy services at the outpatient clinic. The student investigator worked with the therapists at the clinic to review each child's plan of care to identify those within the specified age range and with goals related to improving their handwriting skills.

Initially, each participant completed the ETCH assessment during their weekly occupational therapy session, which took roughly 15-25 minutes. For the following five weeks, each participant completed a handwriting activity during their scheduled occupational therapy session for approximately 15 minutes. All participants were scheduled for one session per week lasting 45-60 minutes. Participants either completed handwriting activities with their therapist alone or with their

therapist and the facility dog based on their assigned group. Activities were standardized to ensure that each participant completed the same type of activity during their weekly occupational therapy sessions (Table 1). However, each activity was adapted slightly based on the participant's assigned group and was modified to the individual skill level of each participant. Participants in the AAT group were also introduced to the facility dog's writing rules, which were named after the facility dog at the clinic to act as additional motivation to produce their best handwriting. The therapist-led group was introduced to the same rules with no association with the facility dog (Appendix B).

Attendance and participation in handwriting activities were tracked during the five weeks of intervention. The researcher tracked the amount of time that the participant engaged in the weekly handwriting activity, and after completion, asked the participant to report their satisfaction with the activity using the Smile Face Survey (Appendix A). At the end of the five weeks, the ETCH was re-administered to each participant to assess their progress with their handwriting skills.

**Table 1. Weekly Handwriting Activities.** Activities that were completed each week during the intervention period detailing modifications for AAT Group vs. Therapist-Led Group.

		<i>Animal-Assisted Therapy Group</i>	<i>Therapist-Led Group</i>
<b>Week 1</b>	Make a Valentine	<ul style="list-style-type: none"> <li>Participants were introduced to the facility dog's writing rules</li> <li>Dog delivers the child a Valentine's Day Card</li> <li>Using a writing prompt, the children create their valentine for a person of their choosing</li> </ul>	<ul style="list-style-type: none"> <li>Participants were introduced to the "Handwriting Rules"</li> <li>Using a writing prompt, the children create a valentine for the person of their choosing</li> </ul>
<b>Week 2</b>	Make-A-Sentence Game	<ul style="list-style-type: none"> <li>The dog holds a card with a sentence starter prompt and children lie prone on a scooter board to go retrieve the prompt</li> <li>Walk on steppingstones to reach the table</li> <li>Repeat 3-5 times and have the dog select a prompt to write</li> </ul>	<ul style="list-style-type: none"> <li>Spread out cards at one end of the gym.</li> <li>Children lie prone on a scooter board to retrieve the prompt.</li> <li>Walk on stepping stones to reach the table.</li> <li>Repeat the course 3-5 times, then write sentences.</li> </ul>
<b>Week 3</b>	Tumbling Tower	<ul style="list-style-type: none"> <li>Make cards that have a variety of prompts for making a list of words</li> </ul>	<ul style="list-style-type: none"> <li>Make cards that have a variety of prompts for making a list of words</li> </ul>

		<ul style="list-style-type: none"> <li>• Have the child and dog retrieve a card and make a list of 3-5 words.</li> <li>• Walking sideways on a balance beam, have the child knock over a block with a word on top or have the dog push blocks over.</li> <li>• Have the child and dog work together to gather the words.</li> <li>• Write all the words on paper</li> </ul>	<ul style="list-style-type: none"> <li>• Have the child select a card and make a list of 3-5 words.</li> <li>• Walking sideways on a balance beam, have the child knock over a block with a word on top.</li> <li>• Have the child gather each of the words.</li> <li>• Write all the words on paper</li> </ul>
<b>Week 4</b>	Call It! Game	<ul style="list-style-type: none"> <li>• Children select four categories and place them next to a symbol</li> <li>• The dog holds game cards for the children.</li> <li>• The child completes an animal walk to reach the dog and retrieves the card.</li> <li>• The child names an item in the category and then writes the word on the mirror</li> </ul>	<ul style="list-style-type: none"> <li>• Children select four categories and place them next to a symbol.</li> <li>• The cards are in a pile on the other side of the gym.</li> <li>• The child completes an animal walk to reach the pile and selects a card at random.</li> <li>• The child names an item in the category and then writes the word on the mirror.</li> </ul>
<b>Week 5</b>	St. Patrick's Day	<ul style="list-style-type: none"> <li>• The child hides cards with St. Patrick's Day-themed words for the dog to find.</li> <li>• When the dog brings them to the child, they write them on the paper.</li> </ul>	<ul style="list-style-type: none"> <li>• OT hides St. Patrick's Day-themed words for the child to find.</li> <li>• When the child locates a word, they write it on the paper</li> </ul>

## Data Analysis

Data were analyzed using Statistical Package for Social Science (SPSS Version 28.0) for Mac. Descriptive statistics calculated the frequencies of demographic data to understand the distribution of sex and age of participants. A paired sample t-test was completed to determine if there was a significant difference between the results of the pre- and post-test assessments in both the AAT and therapist-led groups. Additionally, descriptive statistics calculated the mean satisfaction scores and time engaged between the two groups, and an independent samples t-test determined if overall satisfaction scores and time engaged were significantly different between the two groups.

## Results

A total of 13 children participated in and completed the study, 11 boys and two girls (Table 2). There were seven participants in the AAT group and six participants in the therapist-led group. The sample size originally included fifteen participants; however, two participants chose to discontinue occupational therapy services during the intervention period. Their data was not included in the final report. The average age of the participants was 8.77 years. (Table 2). Participants had a variety of diagnoses including autism spectrum disorder (ASD), Attention Deficit-Hyperactivity Disorder (ADHD), Generalized Anxiety Disorder (GAD), Developmental Delay, and Sensory Processing Disorder (SPD) (Table 2).



**Table 2. Participant Demographics.** Demographic information of all participants in the study, including the average age, sex, and diagnosis. (n=13)

<b>Average Age</b>	<b>8.77</b>
• Age 6-7	4
• Age 8-9	6
• Age 10-12	3
<b>Sex</b>	
• Male	11
• Female	2
<b>Diagnoses</b>	<ul style="list-style-type: none"> <li>• Autism Spectrum Disorder (ASD) – 5</li> <li>• Attention Deficit-Hyperactivity Disorder (ADHD) – 4</li> <li>• Generalized Anxiety Disorder (GAD) – 4</li> <li>• Developmental Delay – 3</li> <li>• Sensory Processing Disorder (SPD) – 2</li> <li>• Traumatic Brain Injury – 1</li> <li>• Friedreich's Ataxia – 1</li> <li>• Dyslexia – 1</li> <li>• Dysgraphia – 1</li> <li>• Tourette's – 1</li> <li>• Amblyopia - 1</li> </ul>

### Weekly Attendance and Participation

Each participant that completed the pre-and post-test assessment had their data included in the final results. During the five-week intervention period, participants in the AAT group attended 97% of occupational therapy sessions overall, and participants in the therapist-led group attended 93% of occupational therapy sessions overall (Table 3). Across both groups, 10 of the participants attended and completed all five handwriting activities and three attended four out of five sessions.

Additionally, average attendance during each week was recorded and calculated for each group. During Week 1, 86% of the participants in the AAT group and 83% of the participants in the therapist-led group completed the handwriting activity. In Weeks 2 and 3, all participants across both groups completed the handwriting activities (Table 3). During Week 4, 100% of the AAT group and 83% of the therapist-led group participated in the handwriting activity (Table 3). Finally, 100% of participants in both the AAT group and the

therapist-led group completed the final handwriting activity during Week 5 (Table 3).

**Table 3. Weekly Attendance.** Participants' attendance and participation in weekly handwriting activities were recorded throughout the intervention period. Data displayed is the percentage of participants that attended each weekly activity, as well as the overall attendance in each group collectively during the five-week intervention period. In parentheses, the number of participants that completed each activity is displayed.

	<b>AAT Group</b>	<b>Therapist-Led Group</b>
<i>Week #1</i>	86% (6)	83% (5)
<i>Week #2</i>	100% (7)	100% (6)
<i>Week #3</i>	100% (7)	100% (6)
<i>Week #4</i>	100% (7)	83% (5)
<i>Week #5</i>	100% (7)	100% (6)
<i>Overall</i>	97%	93%

## Handwriting Skills

Each participant completed the ETCH assessment initially and again after the five-week intervention period. A paired samples t-test indicated whether the participant's scores across each subtest and overall were significantly different between the pre- and post-test assessments. The first part of the ETCH assesses the participant's ability to write lower and uppercase letters and numbers. For lowercase letters, there was not a significant difference in legibility between the pre- and post-test assessments for the therapist-led group ( $p=0.122$ ), but the assessment scores for the AAT group approached significance ( $p=0.074$ ) (Table 4). Regarding upper case letters, there was not a significant difference in the scores from the AAT group ( $p=0.719$ ), but pre- and post-test assessment scores were significantly different for the therapist-led group ( $p=0.048$ ) (Table 4). Finally, when writing numbers, the pre- and post-test assessment scores were not significantly different in both the AAT group ( $p=0.704$ ) and the therapist-led group ( $p=0.141$ ) (Table 4).

The next section of the ETCH assesses the participant's ability to complete near- and far-point copying of a sentence. The scoring criteria assess both the legibility of the written words, as well as each individual letter. For near-point copying, the scores of the pre- and post-test assessments were not significantly different for both word legibility ( $p=0.736$ ,  $0.235$ ) and letter legibility ( $p=0.604$ ,  $0.175$ ) for both groups (Table 4). Regarding far-point copying, the therapist-led group demonstrated a significant difference in pre- and post-test scores for the legibility of letters ( $p=0.049$ ), but the scores approached significance in the legibility of words ( $p=0.062$ ) (Table 4). Conversely, the AAT group's scores were significantly different for the legibility of words ( $p=0.045$ ), but there was not a significant difference regarding the legibility of their individual letters ( $p=0.224$ ) (Table 4).

Finally, the ETCH assesses both dictation and sentence formation. For dictation, the researcher verbalized two five-letter sequences and one five-number sequence for the participant to copy. The scoring criteria assess the participant's ability to legibly write the entire code and the individual letters and numbers. There was no

significant difference in pre- and post-test scores for the legibility of the three codes for both groups ( $p=0.140$ ,  $0.999$ ) (Table 4). However, when writing the individual letters and numbers, the pre- and post-test assessment scores were significantly different in the AAT group ( $p=0.023$ ) but not significantly different for the therapist-led group ( $p=0.164$ ) (Table 4). The last component assesses the participant's ability to independently think of and write a sentence including at least five words. There was no significant difference regarding the legibility of letters in the sentences for both the AAT group ( $p=0.374$ ) and the therapist-led group ( $p=0.058$ ) after completing the pre- and post-test assessment (Table 4).

**Table 4. ETCH Assessment Subtest Scores.** A paired samples t-test was conducted to determine if pre- and post-test assessment scores were significantly different between the two groups for each of the ETCH subtests.

Individual Subtests	AAT Group	Therapist-Led Group
Lower Case Letters	0.074	0.122
Upper Case Letters	0.719	0.048*
Numbers	0.704	0.141
Near-Point Copying		
<i>Letter Legibility</i>	0.604	0.175
<i>Word Legibility</i>	0.736	0.235
Far-Point Copying		
<i>Letter Legibility</i>	0.062	0.049*
<i>Word Legibility</i>	0.045*	0.224
Dictation		
<i>Word/Code</i>	0.140	0.999
<i>Letter/Numeral</i>	0.023*	0.164



Sentence Formation	0.374	0.058
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\*p<0.05

Additionally, the ETCH includes a section for calculating each participant's total legibility for all words, letters, and numbers written on the assessment. Scores for total word legibility were not significantly different between the pre-and post-test assessments for both the AAT group ( $p=0.117$ ) and the therapist-led group ( $p=0.122$ ) (Table 5). Similarly, for the AAT group ( $p=0.360$ ) and the therapist-led group ( $p=0.151$ ), the total legibility of numbers written was not significantly different between each assessment (Table 5). However, regarding the legibility of total letters written, there was a significant difference in pre-and post-test assessments for both the AAT group ( $p=0.040$ ) and the therapist-led group ( $p=0.015$ ) (Table 5).

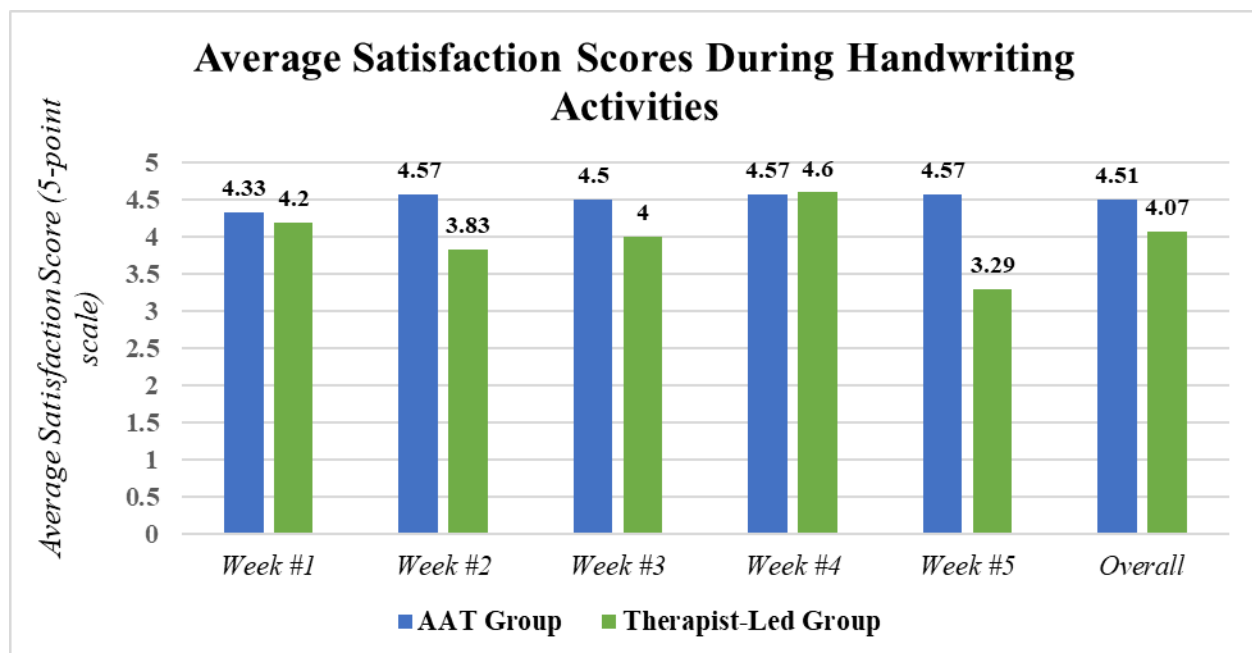
**Table 5. ETCH Assessment Overall Scores.** A paired samples t-test was completed to determine if there was a significant difference in pre- and post-test assessment scores between the two groups for the total legibility components.

Overall Scoring	AAT Group	Therapist-Led Group
<i>Total Word Legibility</i>	0.117	0.122
<i>Total Letter Legibility</i>	0.040*	0.015*
<i>Total Numerical Legibility</i>	0.360	0.151

\*p<0.05

### Satisfaction With Handwriting Activities

Participants' satisfaction with handwriting activities was recorded during the intervention period using a five-point Smile Face Survey (Appendix A). For each activity, the average satisfaction among all participants was calculated for each group. Additionally, the average satisfaction score of each group during the entire intervention period was calculated. During Week 1, the AAT group reported an average satisfaction score of 4.33, and the therapist-led group reported an average satisfaction score of 4.20 (Figure 1). In the second week, participants in the AAT group reported an average satisfaction score of 4.57 and the therapist-led group reported an average satisfaction score of 3.83 (Figure 1). The participants completed the Week 3 handwriting activity, and the AAT group rated their satisfaction as 4.5 and the therapist-led group rated their satisfaction as 4 (Figure 1). During Week 4, the AAT group reported an average satisfaction score of 4.57, and the therapist-led group reported an average satisfaction score of 4.60 (Figure 1). Finally, the AAT group reported an average satisfaction score of 4.57 and the therapist-led group reported an average satisfaction score of 3.29 after completing the Week 5 handwriting activity (Figure 1). Overall, the AAT group's average satisfaction score was 4.51, and the therapist-led group was 4.07 (Figure 1). Collectively, an independent samples t-test found that satisfaction scores between both groups during the intervention period were significantly different ( $p = 0.027$ ).

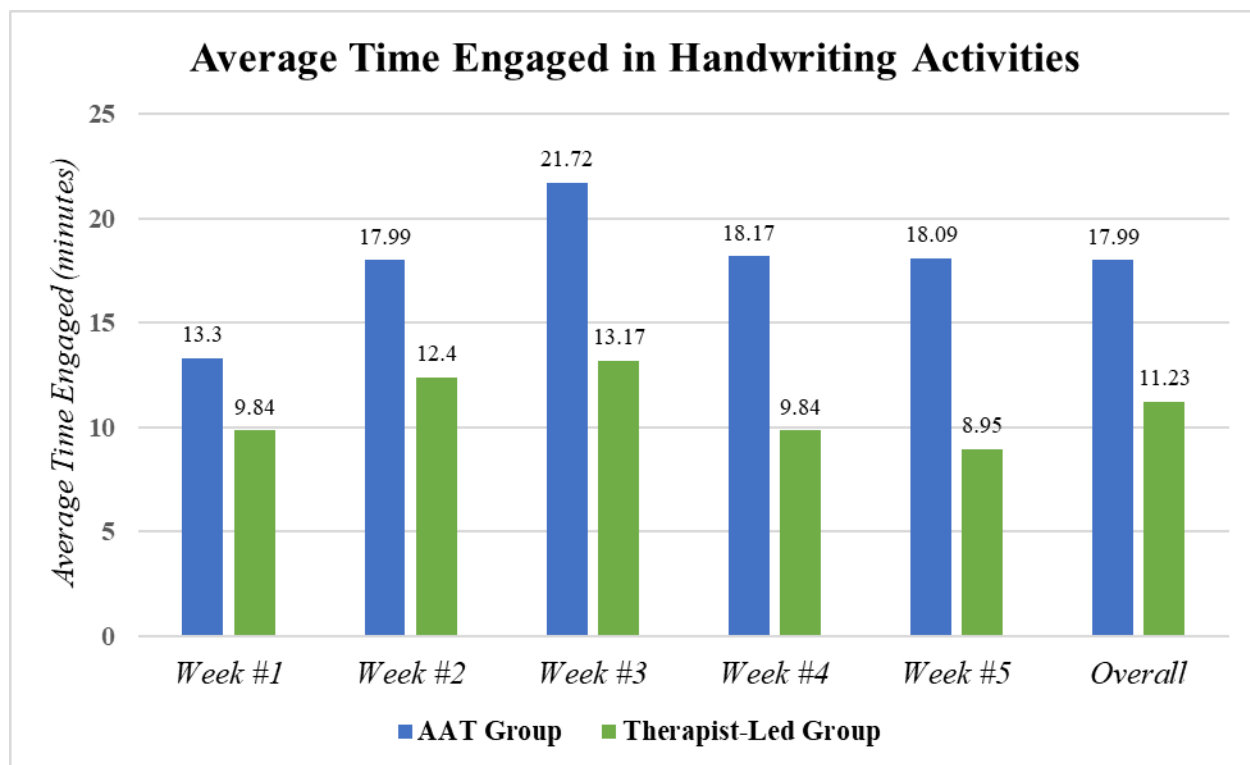


**Figure 1. Average Satisfaction with Handwriting Activities.** Using the Smile Face Survey, children rated their satisfaction with handwriting activities from 1 to 5 and average satisfaction scores among each group were calculated based on the weekly activity and for the five-week intervention period overall.

### Time Engaged in Handwriting Activities

Lastly, the time each participant was actively engaged in a handwriting activity was measured. The average time engaged among all participants was calculated for both the AAT group and the therapist-led group. The average time engaged for each group across the five-week intervention period overall was also calculated. During the first week of intervention, the AAT group engaged in the handwriting activity for an average of 13.3 minutes, and the therapist-led group for an average of 9.84 minutes (Figure 2). For the second week of handwriting, the AAT group spent an average of 17.99 minutes engaged in handwriting and the therapist-led group spent an average of 12.40 minutes engaged (Figure 2). The AAT group engaged in the activity for 21.72 minutes, and the

therapist-led group engaged in the activity for 13.17 minutes during Week 3 (Figure 2). During Week 4, the AAT group engaged for an average of 18.17 minutes, and the therapist-led group engaged for an average of 9.84 minutes (Figure 2). Lastly, each group completed the Week 5 handwriting activity, and the AAT engaged for an average of 18.09 minutes while the therapist-led group engaged for an average of 8.95 minutes (Figure 2). For the entire intervention period, the AAT group engaged in handwriting activities for an average of 17.99 minutes while the therapist-led group engaged for an average of 11.23 minutes (Figure 2). An independent samples t-test determined that the time engaged in handwriting activities was significantly different between the two groups ( $p = <0.001$ ).



**Figure 2. Average Time Engaged in Handwriting Activities.** The average time engaged in the handwriting activities was calculated for each weekly activity and the five-week intervention period overall.

## Discussion

### Handwriting Skills

Based on the results of the pre-and post-test assessments, both the AAT group and the therapist-led group demonstrated significant improvement in three out of 13 areas of the ETCH, respectively. Most notably, both the AAT group and the therapist-led group demonstrated significant differences in the total percentage of legible letters written across the entire ETCH assessment. This result indicates that both groups demonstrated improved letter formation skills, as evidenced by a significantly higher percentage of their letters being able to be read on the ETCH. After scoring the assessments, the researchers noted improvement across subtests. However, the progress was not statistically significant. The short duration of the intervention period may have impacted the participant's ability to make significant progress within the five-week time frame. Additionally, all

participants attend occupational therapy sessions one time per week for forty-five to sixty minutes, and this limited frequency may have also impacted their ability to make significant progress during the intervention period. These results indicate that consistent handwriting intervention is necessary to see improvements in legibility, regardless of the intervention technique being utilized.

### Satisfaction With Handwriting Activities

Based on the results, participants in the AAT group reported increased satisfaction with handwriting activities, and these satisfaction scores were significantly different between the two groups ( $p=0.027$ ). The AAT group reported an average satisfaction score of 4.51 indicating a high satisfaction with all of the handwriting activities, and these values remained relatively consistent throughout the five-week intervention period. The therapist-led group reported an average satisfaction score of 4.07, but their weekly averages were much more variable each week. The largest difference in

satisfaction scores occurred during Weeks 2 and 5. During Week 2, the participants completed a gross motor obstacle course and retrieved sentence starter prompts from the facility dog. The facility dog was also involved in helping the participants choose which order to write the prompts. It is possible that participants in the therapist-led group did not enjoy retrieving prompts from the researcher to write sentences, and this activity was more enjoyable for the AAT group because the facility dog was directly involved throughout the activity. Similarly, during Week 5, the participants completed a St. Patrick's Day-themed word puzzle. The participants in the therapist-led group completed a scavenger hunt and then sat at the table to complete the worksheet. The AAT group took the facility dog on the scavenger hunt before completing their worksheet, and it appears that having this direct interaction with the facility dog initially increased their enjoyment of this specific activity. For the therapist-led group, this activity became more of a true tabletop handwriting task in which the child was seated in a chair at the table with the investigator.

Additionally, satisfaction scores were very similar across both groups during Weeks 1 and 4. During Week 1, the activity was Making a Valentine, which was more of a seated, craft activity where each participant was instructed to write a Valentine's message for someone special. The average satisfaction scores between both groups were very similar indicating that AAT did not seem to impact children's enjoyment of this specific activity. Similarly, in Week 4, the average satisfaction score from the therapist-led group was slightly higher than the AAT group. The activity completed during this week used a board game that challenged the participant to think of words in specific categories. To incorporate handwriting, the participants wrote all the words they thought of during the game. It is possible that both groups were satisfied with this activity because it included a game component rather than just focusing on handwriting. The activities that received the highest satisfaction scores from the AAT group were the ones that included more active, gross motor components and incorporated more direct interaction with the facility dog.

It is important to note that some participants in the control group have never worked with the facility

dog and rated their satisfaction with weekly handwriting activities highly. In some ways, these participants are unaware of how the activity could be more enjoyable when it is conducted by partnering with a facility dog. The facility dog is only at the clinic part of the time, so unfortunately, these participants have appointments during times when the facility dog is not typically at the clinic. Therefore, their satisfaction scores are based purely on their own experiences with handwriting activities completed via traditional occupational therapy interventions only. However, when combining AAT with handwriting activities, there were observable differences in behavior between the two groups. Participants in the AAT group appeared excited and motivated to interact with the facility dog, and this excitement appeared to continue into the handwriting portion of each activity. On multiple occasions, the participants in the AAT group would arrive at their occupational therapy session and ask when they would get to complete their activity with the facility dog.

Additionally, the researcher utilized the facility dog's writing rules for the participants in the AAT group, and participants in this group appeared to look forward to showing the dog their handwriting after completing each activity. Each participant received a pawprint sticker, representing the dog's stamp of approval, and this seemed to be a satisfying reward after completing a handwriting task. During handwriting activities, if participants were cued to "remember the writing rules" this seemed to improve their performance and improved their effort and focus during the task. Participants in the AAT group appeared to enjoy having the facility dog review their work and provide constructive feedback on things to fix or what to keep in mind for next week's handwriting activity. They appeared to be more willing to receive feedback when it was coming from the facility dog, compared to observations made of children in the therapist-led group.

Participating in AAT appeared to act as an effective motivator for getting children to engage in handwriting activities. Also, when rating their satisfaction with each handwriting activity, some participants in the AAT group remarked that the facility dog makes occupational therapy fun, and they love any activity in which they get to work

with the facility dog. Overall, AAT increased participants' satisfaction with handwriting, and this technique should continue to be utilized as an intervention technique to make handwriting enjoyable.

### **Time Engaged in Handwriting Activities**

Similar to satisfaction scores, the amount of time that participants engaged in handwriting activities was significantly different between the two groups ( $p = <0.001$ ). Participants in the AAT group were observed to require fewer verbal cues and redirections to attend to the weekly handwriting activities when compared to observations made of participants in the control group. It is important to note that completing activities with AAT takes longer than completing an activity with a therapist alone. It takes extra time to get the dog into position and complete specific commands based on the specific activity being completed. However, the participants were observed to demonstrate a noticeable increase in attention and engagement during AAT activities when compared to observations made of the therapist-led group. Additionally, these participants were willing to complete more handwriting during a single activity than participants in the therapist-led group. When the facility dog was involved, the AAT group displayed a willingness to spend longer amounts of time working on handwriting which demonstrates why AAT could be beneficial for addressing handwriting.

### **Strengths and Limitations**

The strengths of the present research study lie within the study design. This study utilized a Quasi-experimental design with both an experimental and control group. Using a control group allowed the researcher to determine whether or not incorporating AAT was effective in improving children's handwriting skills. Additionally, the researcher used standardized activities for all participants in both groups. Each activity was modified slightly to effectively utilize the facility dog for participants in the AAT group, but overall, all participants completed the same type of activity each week. Lastly, the study used a criterion-

referenced assessment, which measures the percent of legibility of letters and words on various tests. With this assessment, the researcher was able to track each participant's progress individually to measure the development of their handwriting skills. This was beneficial as skill levels varied greatly among participants.

Some limitations may have impacted the results of this study. First, the study included a relatively small sample size and a short time period for the completion of interventions. Future research should aim to include a larger number of participants to better understand the effects of incorporating AAT in occupational therapy. Additionally, future research studies should look to expand the intervention period to allow for more time for handwriting skill development. With participants only attending occupational therapy sessions one time per week for five weeks, this did not allow for a substantial amount of time to make progress. Lastly, future studies should aim to truly randomize the experimental and control groups. The availability of a certified handler and the facility dog impacted the researcher's ability to truly randomize each group.

### **Implications for Occupational Therapy Practice**

The findings from the research study have implications for occupational therapy practice. Due to the potential for therapeutic benefits and progress that can be made toward goals, occupational therapy practitioners should continue to expand AAT within pediatric occupational therapy and across multiple other practice settings. This research shows that occupational therapy practitioners must continue to explore new ways to make occupational therapy meaningful for children and adults alike. Previous studies had not explored incorporating AAT to promote skill development in handwriting, and these results indicate that involving AAT can promote increased legibility when writing, increase a child's enjoyment with handwriting, and a child's time engaged in handwriting activities. This study indicates that there may be benefits to AAT for helping children improve both fine motor and visual motor skills for handwriting. Similarly, when occupational



therapists partner with facility dogs across all areas of occupational therapy practice, clients can make progress across multiple skill areas and develop the skills necessary to be independent in their daily lives.

## Conclusion

This research study contributed meaningful data to a limited body of knowledge regarding working with facility dogs in pediatric occupational therapy. This study aimed to investigate whether incorporating AAT in an outpatient pediatric setting improved children's overall handwriting abilities, their satisfaction and enjoyment with handwriting, and their time engaged in handwriting activities. Additional research should be conducted to explore how AAT can be incorporated effectively within pediatric occupational therapy. Future studies should aim to address other goal areas that can be positively impacted by partnering with facility dogs. Moreover, these studies should also continue to explore different practice settings where AAT can positively impact clients.

The findings of this research demonstrate that progress toward handwriting-related goals can be made with consistent intervention during occupational therapy sessions regardless of the intervention techniques being incorporated. However, AAT can greatly increase children's satisfaction and enjoyment with handwriting and increase the time they are willing to engage in these types of activities. This research indicates that AAT is a viable therapeutic approach for pediatric occupational therapy, and it can be effectively utilized to promote skill development in a variety of areas including handwriting.

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**Appendix A**

**How did you feel about today's activity?**



**1**



**2**



**3**



**4**



**5**