



**Implementation of an Adapted Handwriting Without Tears®
Programme for Children with Developmental Disabilities in
a Special Education Setting**

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Structured Abstract

2 Purpose

3 Children with developmental disabilities (e.g., learning disability, autism) often struggle with
4 handwriting skills. This study aimed to implement an adapted handwriting programme for
5 children with developmental disabilities to improve their handwriting skills.

6 Methodology

7 Six children with developmental disabilities aged 9-15 years received an adapted
8 Handwriting Without Tears® programme in small groups over eight weeks. The programme
9 was delivered by typical teaching staff (i.e., paraprofessionals) at a special education school
10 following a brief training session and with ongoing supervision. A range of measures
11 assessed the children's handwriting and related skills. Social validity interviews were
12 conducted with school staff following the intervention to evaluate the programme's
13 acceptability.

14 Findings

15 Typical teaching staff implemented the handwriting programme with 92.3% average fidelity
16 and delivered a minimum of three sessions per week. Social validity interviews demonstrated
17 the acceptability of the intervention to school staff. After eight weeks of intervention, all
18 children improved their handwriting on various assessments. Improvements were only
19 partially maintained at follow-up.

20 Originality

21 This study supports the feasibility of using an adapted Handwriting Without Tears®
22 programme to teach handwriting to children with developmental disabilities in special

1 education settings. Typical teaching staff can be trained to support the delivery of the
2 programme to children in small groups.

3 **Keywords:** Fine Motor Skills, Developmental disabilities; Learning disabilities; Intellectual
4 disabilities; Handwriting

5 **Article Classification:** Research Feature

Tizard Learning Disability Review

Introduction

Children with developmental disabilities (e.g., learning disability, autism) often struggle with academic subjects due to associated learning difficulties. Learning difficulties can contribute to specific difficulties with handwriting through dysfluencies in fine motor control (i.e., manual dexterity), visual perception, visual-motor integration, and kinaesthesia (Kushki *et al.* 2011). For fine motor control, numerous studies have shown that autistic children have poorer fine motor skills than their non-autistic peers (Choi *et al.*, 2018; Green *et al.*, 2009; Kushki *et al.*, 2011; Vascelli *et al.*, 2020; 2022). Visual perception and visual-motor integration include the ability to discriminate letters, determine where on a page to write, and identify errors in writing. There is some evidence for different visual processing for children with developmental disabilities (Kushki *et al.* 2011). Booth *et al.* (2003) asked autistic children with attention deficit hyperactivity disorder (ADHD) to copy several drawings. When analysing the ‘initial feature’ (where each child began their drawing), they found autistic children were likelier to begin with a ‘local’ rather than a ‘global’ feature. For example, they were more likely to begin a drawing of a house with a window (local) rather than the walls (global).

Proprioception can be defined as “the awareness of body position in space.” (Kent, 2023). Blanche *et al.* (2012) found that autistic children scored higher on an observation-based assessment indicating the presence of proprioceptive difficulties than children with other developmental disabilities, and children without developmental disabilities. Developmental disabilities may therefore implicate proprioceptive differences that likely impact handwriting ability.

Handwriting Without Tears® (HWT) is a comprehensive handwriting curriculum for children aged 4-11 in mainstream education settings (Olsen, 2013; Olsen and Knapton,

1 2016). Developed by occupational therapists, HWT incorporates a range of developmentally
2 sequenced handwriting skills, including pre-writing, drawing, letter formation, later cursive
3 writing, and writing paragraphs. The HWT programme also incorporates specific strategies to
4 strengthen fine motor skills and suggests gross motor activities to promote postural stability
5 (Olsen & Knapton, 2016). HWT further addresses potential difficulties with visual perception
6 by utilising simple, clean practice pages, visual cues such as grey blocks, and clear start
7 points to support correct sizing and alignment.

8 A number of studies have demonstrated the effectiveness of HWT with children
9 without developmental disabilities (Lust and Donica, 2011; Marr and Dimeo, 2006; Roberts
10 *et al.*, 2014). However, little research has explored its efficacy with children with
11 developmental disabilities. Of the studies that have used HWT with this population, several
12 weaknesses are evident, such as non-standardised outcome measures being used to measure
13 progress (Carlson *et al.*, 2009; Coussen *et al.*, 2012) and failure to follow key
14 recommendations from the curriculum, for example, the recommended duration of sessions
15 not being adhered to (McBride *et al.*, 2009; Thompson *et al.*, 2012). Additionally, all studies
16 cited described 1:1 teaching only. This limits the assumptions that can be made about the
17 effectiveness of using HWT for teaching children in small groups.

18 Grindle *et al.* (2018) utilised an adapted version of HWT (a-HWT) with children with
19 developmental disabilities who were taught in small groups. The a-HWT was adapted to suit
20 these children in several ways, for example as a 'catch up' curriculum where only the
21 components deemed as essential were included (e.g., some sensory activities were excluded,
22 while activities directly related to letter formation were prioritised), and prompt strategies and
23 mastery criteria were specified. Participants (three children aged 11-14 years) received 20–
24 30-minute sessions three times per week over a school year (32-weeks). A standardised
25 assessment, the Minnesota Handwriting Assessment (Reisman, 1999), demonstrated

1 improvements in handwriting. Crucially, though, the authors demonstrated the feasibility of
2 implementing a-HWT through group teaching, albeit with highly trained tutors. This is
3 important as 1:1 teaching is rarely used in special education settings in the United Kingdom
4 (UK).

5 The present study aims to extend the evidence from Grindle *et al.* (2018) by providing
6 additional evidence on the feasibility of implementing a-HWT through group teaching
7 methods. Further, this study seeks to build upon existing research by including children from
8 a wider age range, training typical school staff (i.e., paraprofessionals) to implement the
9 intervention, and refining the a-HWT curriculum.

10 Method

11 Participants

12 Six children, two girls and four boys aged between 9-15 participated in the study (see
13 Table 1 for participant information). Participants were diagnosed with a learning disability
14 (this entitled them to attend a special school for children with learning disabilities). For four
15 participants, the primary diagnosis was severe learning disability (two had a secondary
16 diagnosis of hearing impairment, one of whom had an additional diagnosis of visual
17 impairment; one had additional diagnoses of ADHD and epilepsy; and one had a secondary
18 diagnosis of autism), while two participants had a primary diagnosis of autism. Information
19 about participant diagnoses was obtained from school records.

20 Class teachers at the special education setting recommended children for participation
21 in the study if they were considered to require additional handwriting support. Children were
22 eligible to take part if they reliably demonstrated pre-requisite skills: sitting willingly to

1 engage in learning activities for up to 10 minutes; labelling at least 50 objects and pictures;
2 following one- or two-step instructions; and demonstrating some alphabetic knowledge, such
3 as being able to identify at least five letters.

4 Senior school staff recommended two paraprofessionals (Teaching Assistants- TAs)
5 to deliver the intervention. Both paraprofessionals and two class teachers took part in social
6 validity interviews.

7 **Materials and Setting**

8 The study took place in a state-maintained special education school in the Midlands
9 (UK), serving over 400 students aged two to nineteen years with severe learning disabilities.
10 Pre- and post-test assessments were conducted in a self-contained room away from the
11 children's main classrooms. Teaching sessions took place either in a corner of the children's
12 regular classroom or in a separate, self-contained classroom (decided by the class teacher to
13 fit in with their timetable and staffing levels).

14 **Handwriting Without Tears® – adapted version.** The HWT curriculum (Olsen,
15 2018; Olsen and Knapton, 2016) is a handwriting programme designed for children aged 4-11
16 years. The HWT approach differs from typical handwriting instruction in several ways,
17 including recommending a 'developmentally sequenced' letter order beginning with capital
18 letters and incorporating multisensory activities such as forming letters using shapes and play
19 dough. Additionally, visual prompting strategies like 'grey blocks' and double lines to write
20 on are used to support letter placement and sizing.

21 Grindle *et al.* (2018) developed an adapted version of the curriculum (a-HWT) for
22 children with developmental disabilities. Teaching plans were drawn from the Readiness &

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4 1 Writing Pre-K Teacher's Guide (Olsen and Knapton, 2016) and Letters and Numbers for Me
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6 2 Kindergarten Teacher's Guide (Olsen, 2013) as these were considered to be most appropriate
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8 3 for children in UK school years Foundation and Year 1, respectively. The a-HWT teaching
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10 4 plans outlined more detailed guidance for each target, including instructions on how to
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12 5 implement the lesson using a multi-step teaching approach and mastery criteria. Guidance
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14 6 also included suggestions for additional support to be provided during teaching (e.g., verbal
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16 7 prompts to support vocalising of instructions for writing each letter). As children with
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18 8 developmental disabilities often do not readily generalise skills, suggestions were provided in
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20 9 a-HWT for specific generalisation activities (e.g., practising the skill with different
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22 10 instructors). Additionally, a-HWT recommended fewer sensory activities than HWT. Many
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24 11 of the sensory activities recommended in HWT require abstract and conceptual thinking. For
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26 12 example, rolling little and big snakes out of dough requires the child to make the conceptual
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28 13 leap that the dough snakes represent little and big lines used in writing. For this reason, 'Roll-
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30 14 A-Dough' activities (Olsen, 2018) were excluded to prioritise more concrete exercises
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32 15 addressing letter formation with a pen or pencil.

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38 16 Several key elements from HWT were retained in a-HWT. Consistent, repetitive
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40 17 instructions were used for the formation of each letter (e.g., "big line down, jump to the top,
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42 18 big curve"), and teacher modelling of skills was emphasised (e.g., showing the child how to
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44 19 write the letter for them to copy). It was felt that including these features would help the child
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46 20 learn to self-instruct when writing, making them less reliant on prompts from the teacher (this
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48 21 supposition was actually borne out in Grindle *et al.*, 2018). Materials and resources were also
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50 22 consistent; for building letters, a 'Mat for Wood Pieces' and 'Wood Pieces Set for Capital
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52 23 Letters' (Sensational Kids, n.d.) were used as recommended by HWT manuals. For letter
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54 24 tracing, worksheets were used from the HWT workbooks (Olsen, 2013).

55 56 57 58 59 25 **Measures**

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1 **Minnesota Handwriting Assessment.** The primary handwriting measure was the
2 manuscript version of the Minnesota Handwriting Assessment (MHA) (Reisman, 1999), a
3 standardised measure involving a copying task presented on a landscape piece of A4 paper.
4 During the assessment, children were instructed to copy a series of printed lowercase words
5 (the, brown, jumped, lazy, fox, quick, dogs, over) on a set of guidelines directly underneath.
6 Once they completed the task, their handwriting sample was scored for legibility, form,
7 alignment, size, and spacing. The assessment provides an overall score and five sub-test
8 scores for each area.

9 **Screener of Handwriting Proficiency.** The secondary handwriting measure was the
10 Screener of Handwriting Proficiency (SHP; Olsen, 2017). The child was verbally instructed
11 to write, and their ability to form capital letters, numbers, lowercase letters, and a short
12 sentence from memory was assessed. The kindergarten-level assessment was used, as this
13 corresponded to the level of instruction during the intervention. While scoring guidance was
14 provided, it was not quantifiable; the authors developed a numerical rating measure for the
15 assessment to allow for pre- and post-test and inter-observer agreement (IOA). Here, a
16 dichotomous scoring system was devised, awarding marks for memory, orientation, and
17 placement of letters (i.e., a zero score if the skill was not demonstrated and a score of one for
18 demonstration of the skill).

19 **Goodenough Draw-A-Person Test.** The Goodenough 'Draw-A-Person' test
20 (Goodenough, 1926) involved asking the child to 'make a picture of a person' using
21 standardised instructions. The drawing was scored according to the presence or absence of a
22 range of features and details (e.g., head, shoulders, neck, hair), using binary scoring of 1 or 0.
23 The total possible score is 51, and each score corresponds to an age equivalent between 3
24 years 3 months and 15 years 9 months.

1 **Check Readiness.** The HWT Readiness & Writing Pre-K Teacher's Guide (Olsen and
2 Knapton, 2016) includes an informal assessment tool, the Check Readiness, designed to
3 evaluate children's pre-writing skills (e.g., tracing and copying shapes, recognising colours,
4 colouring, identifying capital letters). Guidance suggests this tool should be analysed
5 informally and assessments repeated throughout the year for comparison. The first and
6 second authors developed a scoring system to facilitate data collection and the calculation of
7 IOA.

8 **Procedure**

9 This study received ethical approval from Bangor University's School of Educational
10 Sciences ethics committee. Informed consent was given by members of staff involved in the
11 study and parents of children involved.

12 **Training.** The TAs received training from the first author who was experienced in
13 HWT delivery. Initial training comprised a 1-hour session on the background of HWT, a
14 'walk-through' of the a-HWT manual, teaching materials, prompting strategies, and data
15 recording. Prompting suggestions varied for different targets, for example, verbal prompts
16 (related to reciting the instructions for each letter), gestural prompts (pointing to the start
17 point for each letter), and visual prompts (adding additional dots to a shape or letter to
18 support formation). Additionally, the a-HWT recommended that some children would benefit
19 from additional motivation, such as token boards or tangible rewards. The TAs were also
20 provided with minimal ongoing supervision throughout the intervention.

21 **Assessments.** Pre-test assessments were carried out by the first and third authors the
22 week before the intervention in a self-contained room away from the children's main
23 classroom, and assessment scores were used to select initial targets for each child. Post-test
24 assessments were carried out the week after the intervention finished under the same

1 conditions. Follow-up assessments were completed 12 weeks after the intervention to assess
2 for maintenance of learnt skills.

3 **Inter-observer agreement.** IOA was calculated for roughly 33% of assessments,
4 whereby two assessors scored each assessment. The average IOA agreement across pre- and
5 post-test assessments was 94% (range 86.3%–100%).

6 **Intervention.** Sessions took place 3–4 times per week and lasted between 15–40
7 minutes (the length of sessions was decided by school staff according to the children’s
8 timetable and their concentration), with children in pairs or small groups. During each
9 session, TAs were responsible for preparing materials in accordance with lesson plans
10 provided ahead of time by the authors. Teaching assistants ensured they had the child’s
11 attention before presenting materials or placing an instruction. They also ensured they
12 engaged the child and incorporated their interests into the lesson. During each session, TAs
13 used appropriate instructions (as outlined in the a-HWT manual), followed the lesson plan,
14 praised the child when correct, prompted effectively by providing only as much support as
15 needed for the child to be successful, faded prompts as soon as possible, provided
16 opportunities for the child to generalise their skills and encouraged the child to self-evaluate
17 their work, referring to the verbal instructions provided in the lesson.

18 During the sessions, the children and their TA sat around a table away from their
19 peers. A typical session included a ‘warm-up’ activity, such as drawing ‘Mat Man’ or
20 reviewing a target the child had already mastered, followed by two or three teaching targets
21 (either a shape, letter, or number). The TA began by modelling the target while saying the
22 associated instructions (e.g., demonstrating capital ‘F’ while reciting ‘big line down, jump to
23 the top, little line across, little line across’). Next, the child was asked to trace and copy the
24 letter on their worksheet (occasionally on a small whiteboard). Once the child had completed

1 the activity, the TA encouraged self-evaluation of their work, if appropriate (e.g., by asking,
2 “Is that a big line down?”).

3 As the sessions took place in small groups, children were given instructions one at a
4 time and encouraged to take turns. This promoted observational learning through peer
5 modelling. Additionally, children were often asked to evaluate another child’s work.

6 **Data and fidelity of HWT delivery.**

7 The first and second authors developed a data sheet for the TAs to complete. The data
8 sheet was adapted from Grindle *et al.* (2018) and simplified to be accessible to school staff.
9 Teaching assistants recorded which target (or ‘activity’) was completed by which child,
10 scored their engagement in the lesson (no engagement, some engagement, full engagement),
11 their level of independence by the end of the lesson (i.e. could the child write or draw the
12 target letter or shape with correct formation independently or did they require support to do
13 so), and if they were asked to self-evaluate.

14 Fidelity checks were undertaken by the first author and another university student for
15 at least 10% of sessions to ensure TAs delivered the sessions according to the lesson plans. A
16 scoring sheet was developed which evaluated nine key aspects of session delivery: pre-
17 preparing of resources; getting the child’s attention; engaging the child and incorporating
18 their interests into the lesson; using the correct instructions; following the lesson plan;
19 delivering praise when the child was correct; providing effective prompts and fading prompts
20 when the child made errors; providing opportunities for the child to generalise their skills;
21 and encouraging the child to self-evaluate their work. Each skill area was scored on a Likert
22 scale from 1–3 according to the percentage of opportunities during which the skill was
23 demonstrated. A score of 3 represented that the skill was demonstrated on 90–100% of
24 opportunities; a score of 2 represented 50–90% of opportunities; and a score of 1 represented
25 0–50% of opportunities. A total percentage fidelity score was calculated for each observation.

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4 1 All participants' Check Readiness scores increased from pre- to post-test, apart from
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7 2 James' scores, which remained the same. James' Check Readiness post-test scores improved
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10 3 on the subsections for tracing and writing, but he lost points on the subsections for naming of
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12 4 objects, colours, and shapes.

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15 5 Follow-up scores were also collated on all measures after 12 weeks with no
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18 6 intervention. MHA, SHP and Check Readiness scores decreased for all children from post-
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21 7 test to follow-up, and three children achieved a lower score than at baseline on the MHA. On
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24 8 the Goodenough Draw a Person Test two children maintained their skills at follow up, two
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26 9 children performed worse than post-test, and two scored lower than pre-test.

10 **Social Validity**

11 All staff members interviewed reported a positive attitude towards a-HWT and its
12 impact on the standards children achieved. Staff feedback identified some aspects of a-HWT
13 that worked particularly well, including breaking down skills into smaller steps and repeating
14 the instructions for each letter. When asked to describe areas of improvement, staff members
15 noted that James' letter sizing improved, that David could use his right hand to steady the
16 paper, and that Bertie could draw shapes more accurately. Additionally, staff reported the
17 children looked forward to handwriting sessions and requested to do them. When asked about
18 the progress made by the children in areas other than handwriting, staff responded that they
19 had observed the children being more focused and reported improvements in their social
20 skills. As the sessions were run in small groups, children were happy to sit together (which
21 reportedly they were not so willing to do before) and 'support' each other (e.g., children
22 would volunteer to demonstrate a skill for another child who was having difficulty).

23 **Discussion**

1 The present study aimed to extend the evidence from Grindle *et al.* (2018) regarding
2 the feasibility of implementing a-HWT using group teaching methods, and to build upon
3 existing research by including children from a wider age range, training typical school staff
4 (i.e., paraprofessionals) to implement the intervention, and further refine the a-HWT
5 curriculum.

6 Assessment results confirm an overall improvement in the children's handwriting
7 after just eight weeks of intervention. Additionally, this study demonstrated advances in
8 related areas such as drawing, with one child increasing their drawing age equivalent by more
9 than two years in just eight weeks. The lack of maintenance of gains at follow-up highlights
10 the need for long-term commitment and consistent implementation of a-HWT to ensure
11 lasting handwriting improvements for children with developmental disabilities.

12 After receiving a brief initial training session and minimal ongoing supervision,
13 typical teaching staff in a special school were able to implement the handwriting intervention
14 with small groups, achieving 85% fidelity. Findings from the social validity interviews
15 suggested the intervention was acceptable to school staff. Interviews also provided anecdotal
16 evidence for improvements in areas other than handwriting. These findings support the
17 feasibility of implementing a handwriting programme based on the a-HWT in a special
18 school setting and having it delivered by typical teaching staff.

19 This study was consistent with prior research by Grindle *et al.* (2018) and has
20 extended findings in several ways: children were younger; the intervention was delivered by
21 existing school staff and not expertly trained tutors; a-HWT manual was further refined to
22 improve accessibility for non-specialist interventionists; training and fidelity measures were
23 developed; and additional measures were utilised, including assessments of related skills such
24 as drawing. Further, findings suggest that teaching handwriting in small groups can be

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4 1 beneficial, and teaching staff can be trained to deliver a-HWT with minimal training and
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6 2 supervision.

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8 3 Overall, there is a strong argument and increasing evidence base for using targeted
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10 4 handwriting interventions with children with developmental disabilities. Additional research
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12 5 is warranted to establish further the acceptability and efficacy of handwriting programmes
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14 6 based on a-HWT on a larger scale. Although this study is limited by its small sample size and
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16 7 lack of experimental design, it has further demonstrated and extended previous findings
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18 8 supporting a-HWT and paved the way for more robust research to evaluate the intervention.
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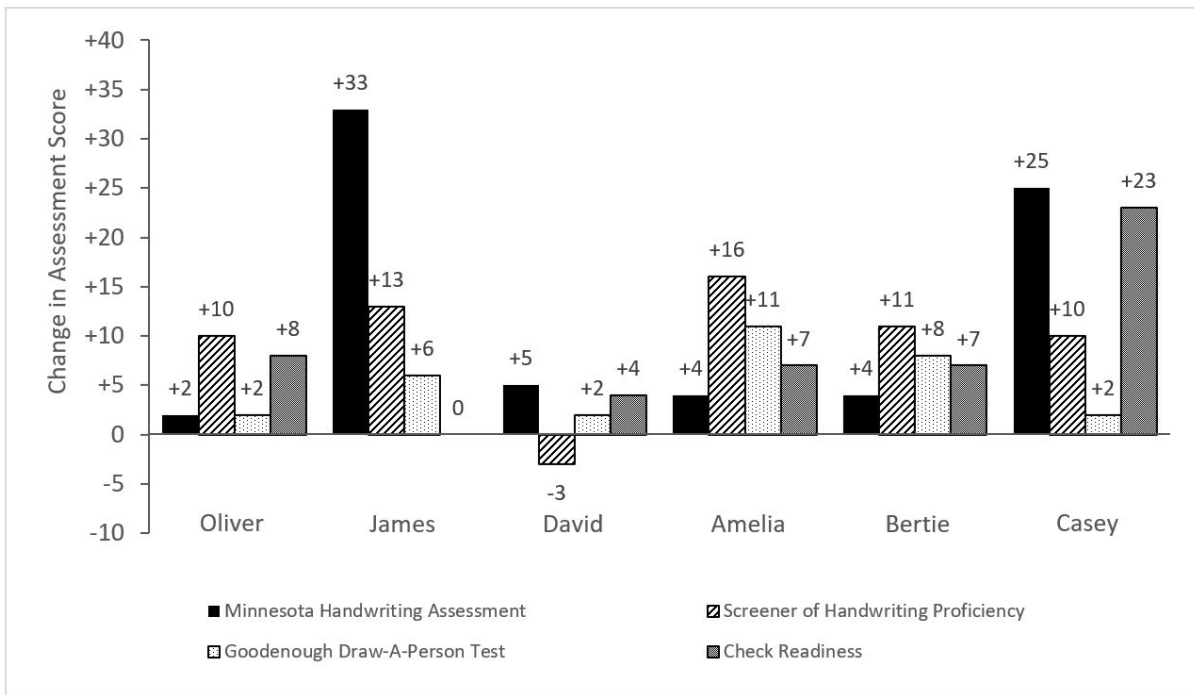
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Tizard Learning Disability Review



Tizard Learning Disability Review

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Table 1

Child Characteristics, Sessions Attended and Skills Mastered

Participant	Age	Diagnosis	Sessions attended	Skills Mastered		
				Shapes	Capital letters	Numbers
Oliver	9y 8m	SLD, HI, VI	26	0	3	1
James	10y 11m	SLD, ADHD, Epilepsy	29	2	6	1
David	11y 8m	SLD, HI	29	1	2	1
Amelia	15y 8m	Autism	27	0	2	0
Bertie	14y 6m	SLD, Autism	28	0	3	0
Casey	12y 10m	Autism	27	0	3	0

Notes. All names are pseudonyms. ADHD = Attention Deficit Hyperactivity Disorder; HI = Hearing Impairment; SLD = Severe Learning Disability; VI = Visual Impairment.