

Contrasted Features of a Remedial Handwriting Program

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Abstract. This study is an evaluation of an 8 day remedial handwriting program based on research evidence indicating that direct cognitive approaches produce the best outcomes. A single group repeated measures design was employed for 26 children, mean age 9 years 2 months at *The Handwriting Clinic* in Plano, Texas. All the children had received handwriting instruction prior to program entry. Salient features of the program were 1) the use of a midline writing guide one third the height of the writing space, 2) child focused 'fun' writing activities and topics, and 3) training in error recognition without instruction in stroke sequencing for letter formation. Immediate pre and post test results showed positive changes for measures of individual letter legibility, alignment, sizing, and overall legibility. Comparisons pre test to 3 weeks follow up provided insight into the relationships between features of handwriting production and legibility. Improvement was sustained in alignment, sizing, and overall legibility but degraded to baseline for individual letter formation suggesting that address of these factors may produce improved overall legibility independent of changes in individual letter formation. In addition it is possible these improvements can be achieved within a relatively short time period without instruction in stroke sequencing.

1. Introduction

The translation of handwriting research into best practices is of critical importance to professionals in the field of occupational therapy. Occupational therapy is a health care practice that employs the therapeutic use of everyday activities (occupations) to help people across the lifespan participate in the things they want and need to do (AOTA, 2010). One third of occupational therapy practitioners in the United States work in school systems and provide services to assist children with disabilities to accomplish the tasks necessary for full school day participation. Occupational therapists have taken a leadership role in providing handwriting remediation through individual child centered therapeutic intervention, classroom consultation, and authorship of handwriting programs that have been adopted across the nation (Olsen, 2003).

In exploring for efficacy in intervention, translational research and program evaluation become intertwined. Research informs practice and in return practice must inform research (Crist & Kielhofner, 2005). This interchange can be expressed by the term practice-based evidence. This study is a report of an evaluation of an 8 day remedial handwriting program based on research evidence indicating that cognitive approaches produce the best outcomes (Schneck & Amundson, 2010; Zwiker & Hadwin, 2009). Findings confirmed the efficacy of the cognitive approach and provided insight into the relationships between features of handwriting production and legibility.

2. Background

The intervention studied was created by Jan McCleskey, an occupational therapy practitioner who established *The Handwriting Clinic*, a center for handwriting development and remediation (www.thehandwritingclinic.com). A common feature of programs for handwriting development is consistent direction in the sequencing of the strokes used for letter formation (Troia & Graham, 2003). Approaches for children who have been unsuccessful and require handwriting remediation are varied and differ based on the hypothesized deficits that may be impeding good performance (Volman, Schendal & Jongmans, 2006). Sensory motor integration has been proposed as a potential problem and several programs that incorporate sensory strategies, particularly kinesthetic approaches, are favored by occupational therapists for remediation (Olsen, ; Benbow,). As in programs for handwriting development, attention to sequencing of letter formation strokes is a strong feature of these programs.

Although sensorimotor approaches are favored by many occupational therapy practitioners, evidence research indicates that these may be less effective than more direct cognitive teaching methods (Schneck & Amundson, 2010; Zwickler & Hadwin, 2009). Based on her clinical experiences working with older children ages 8-13, Jan McCleskey questioned the efficacy of addressing the sequencing, or motor programs of letter formation for children in this age group who have undergone previous writing instruction and have had several years of practice forming letters using individualized patterns. The resultant *One Hour to Legibility Program* does not directly address stroke sequencing. Instruction is based on three factors, 1) the use of a midline writing guide one third the height of the writing space, 2) 'zany' writing activities and topics, and 3) training in error recognition.

All handwriting instruction in the *One Hour to Legibility Program* occurs using base, mid, and top writing lines with the midline guide set one third of the distance between base and top. To overcome resistance to engagement in writing and increase meaning for the children, zany topics and activities are incorporated into the program. Children may write on hand lined paper using large spaces (1 to 2 inch widths) and novel writing tools such as cotton swabs dipped in paint or writing using glue followed by glitter. These activities are followed by practice using cursive-ruled paper with the one third height midline guide that provides a 1 cm writing band. 'Zany' writing topics may include descriptions of monsters or unsavory recipes. Throughout this context the children receive instruction in identifying handwriting errors. The first error the children are oriented to is sizing. The lined paper is used to emphasize the differences between tall and small letters. Other errors addressed include retracing (when double rather than single lines appear), teepees (openings between the belly of letters and their extensions), lakes (openings at the tops of letters), poor closure and hyperclosure. No instruction is given on stroke sequencing. The purpose of this study was to determine if the *One Hour to Legibility Program* was effective in improving participants' quality of handwriting immediately after and three weeks post completion.

3. Method

A one group repeated measures design was employed. Data were gathered during the summer of 2010. Participants were drawn from the children enrolled in the *One Hour to Legibility Program* sessions held that summer. Each program consisted of 8 days of instruction, two hours per day, held over a period of two weeks. Inclusion criteria were 1) attendance of no less than 6 out of the 8 *One Hour to Legibility* sessions, 2) completed data collection at the pre, post, and follow-up. Exclusion criterion was conditions affecting motor execution such as cerebral palsy or hand injury. A total of 44 children were recruited for the study. Twenty six completed follow-up data collection and were included in the analysis. Average age was 9 years, 2 months with a range of 7 years, 6 months to one older child 14 years, 6 months. Grades completed that summer ranged from first to sixth grade. There were six girls and twenty boys. Diagnoses per parent report included none reported (15), attention deficit hyperactivity disorder (3), dysgraphia (3), sensory/vision difficulties (1), non verbal learning disability (1), sensory processing disorder (1), occupational therapy intervention(1), and lazy eye corrective surgery at two years old (1 participant who was almost 9 years old at time of study).

Handwriting samples were collected on standard notebook paper (5/8 inch width, no midline guide) from each child pre, post, and three weeks following their participation in the *One Hour to Legibility Program*. In manuscript each child wrote the lower case English alphabet and copied from a paragraph for one timed minute. Pre and post samples were collected at *The Handwriting Clinic* as part of the program. Follow-up samples were obtained via each child's parent through the mail with telephoned instruction. The samples were evaluated for individual letter legibility, alignment, size, spacing, rate, and overall legibility.

- Individual letter legibility was scored from the written alphabet sample. Letter legibility criteria from the *Minnesota Handwriting Assessment* (Reisman, 1999) were modified for the 5/8 inch width notebook paper. Each letter of the alphabet sample was scored independent of the other letters. Letters needed to be recognizable out of context. Inter-rater reliability for the three raters was .88.
- Alignment was scored from the written alphabet sample. Alignment referred to placement of the letters on the baseline. Letters more than 1mm from baseline were scored as unaligned. Inter-rater reliability for the three raters was .90.
- Sizing was scored for the alphabet and the first five words of the paragraph copy sample. The size of all letters was measured in millimeters. The ratio of the average size of tall or long letters to the average size of the small letters was used in the analysis. Inter-rater reliability for the three raters was .97 for the alphabet and .95 for the paragraph.
- Spacing was scored for the first five words in the paragraph sample. The closest distance in millimeters was measured between letters. The ratio of the average size of the space between words to the average size of the space between letters was used in the analysis. Inter-rater reliability for the three raters was .87.

- Rate was scored by counting the number of words copied in the paragraph in one minute. Inter-rater reliability for the three raters was 100%.
- Overall legibility was evaluated using the median ranking of five teachers. Teacher judges had teaching experience from 4 to 13 years. All had instructed in elementary education. The 5 participating teachers were blinded to the data and asked to subjectively rate each of the 78 samples based on their personal judgment. Teachers were asked to look at each paragraph sample for five seconds or less and rank the sample on a scale of 1-6 with one indicating very poor, unreadable legibility and six indicating very legible.

4. Results

Repeated measures univariate tests revealed significant differences in scores for Legibility, Alignment, and Sizing for alphabet and paragraph samples, displayed in Table 1.

Table 1

Pre, Post and Follow-up Handwriting Sample Scores

Measure	Pre-test		Post-test		Follow-up		<i>p</i> value
	Mean	SD	Mean	SD	Mean	SD	
Letter Legibility	21.84	2.88	24.69	1.01	23.04	2.99	.001
Alignment	14.19	5.06	21.03	4.22	18.79	4.23	.001
Sizing Alphabet	1.50	0.21	2.31	0.32	1.97	0.37	.001
Sizing Paragraph	1.50	0.24	2.09	0.30	1.95	0.40	.001
Spacing	4.20	3.25	6.76	8.83	7.85	13.84	.10
Rate	11.92	2.29	10.46	2.58	11.34	3.21	.08

Paired t-tests revealed significant differences pre to post testing. Performance improved for legibility ($p < .001$), alignment ($p < .001$), and sizing for the alphabet ($p < .001$) and paragraph samples ($p < .001$). Between post test and follow up significant changes indicating degraded performance were detected for legibility ($p = .016$), alignment ($p = .011$), and sizing for the alphabet ($p < .001$). Performance did not change between post and follow-up for sizing for the paragraph ($p = .079$). Pre test to follow up scores were significantly different and showed retained improvement for alignment ($p < .001$) and sizing for the alphabet ($p < .001$) and paragraph samples ($p < .001$). Pre test scores were not significantly different from follow up scores for individual letter legibility ($p = .114$) indicating a return to baseline performance.

Interclass correlation coefficient for all the subjective ranked scores from the five teacher judges of the paragraph samples was .378. Median rankings from the judges for the pre, post, and follow up samples were compared using paired samples tests. Significant differences illustrating a perceived increase in legibility were detected from pre test to post test and follow up as displayed in Table 2.

Table 2

Paired t test Comparisons of Median Teacher Ranking Scores

Pre-test		Post-test		Pre-test to Post-test <i>p</i>	Follow-up		Post-test to Follow-up <i>p</i>	Pre-test to Follow-up <i>p</i>
Mean	SD	Mean	SD		Mean	SD		
3.07	1.09	3.94	1.15	.001	3.80	0.93	.609	.003

5. Discussion

The *One Hour to Legibility Program* is a short term handwriting remediation intervention for children who are experiencing difficulty in legibility. A key feature of this program is the focus on error recognition without address of the stroke sequencing used in letter formation. The findings provide strong support for the immediate effects of the program. The children demonstrated immediate improvement in the legibility of the individual letters of the lower case alphabet. Alphabet letters were better aligned to the baseline guide. The sizing ratios of tall to small letters increased, tall letters moving from approximately one and half times the size of small letters to twice the size. In addition, subjective teacher ratings of the readability of the children's paragraphs improved by approximately one rank on the six rank scale. These improvements occurred without a change in the rate of production in that the children were able to create better forms without reducing their speed.

This study was conducted during the summer months when the children were not formally engaged in handwriting activities. The findings at follow up provide an interesting look at the learning effects of the program without formalized intervening practice. The children retained improved performance for alignment and sizing indicating that they had learned how better to write on the line and discriminate between tall and small letters. Although the mean scores remained higher than at pre test, when measured letter by letter legibility was not significantly different from initial performance. Individual letter legibility may have been impacted by the lack of instruction in stroke sequencing. Children were allowed to form the letters using their preferred motor patterns. However, the results from the subjective teacher ratings of overall legibility of the paragraph samples introduces an interesting contrast. Although when rated individually out of context from a written message letters were scored as less legible, overall teacher judgments found sustained improvement in readability for the paragraph sample. This contrast provides some insight into the relative impact of individual letter formation vs. more global features of a handwriting sample to legibility. The retained legibility from the perspective of the teachers seemed to be related more to the spatial organization of the samples in terms of alignment and relative sizing than individual letter formation.

As a work conducted in the field within a single organization this study has limitations. The participants were drawn from the population of clients to *The Handwriting Clinic* over a single summer. Children are enrolled in the program by their parents and may or may not have been identified by educators or other professionals as having difficulty in this area. The return rate for the follow up samples was low. Summer vacations were a confounding factor and asking the parents to collect the follow up samples requires the assumption they followed the requested protocol. The study is also challenged by the wide variability in most assessments of handwriting quality. Agreement amongst the teachers on sample rankings was low as is typical of subjective rating of handwriting and the results must be interpreted with that variability in mind.

In conclusion, this program evaluation study provides practice based evidence for the use of direct cognitive teaching methods in handwriting remediation for children who have already received basic handwriting instruction. The findings suggest that attention to alignment and sizing are important features of overall legibility. Address of these factors may produce improved overall legibility independent of changes in individual letter formation. In addition it is possible these improvements may be obtained without address of specific stroke sequencing and can be achieved within a relatively short time period.

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