FOCUSED QUESTION
Does using the Log Handwriting Program improve the legibility, form, alignment, size, space, and speed of handwriting in students between 6 and 8 years old who scored equal to or less than 30 on the Minnesota Handwriting Assessment?


CLINICAL BOTTOM LINE:
This study looked at how the Log Handwriting Program improved handwriting skills. Researchers found that this program is effective in increasing handwriting legibility, form, alignment, size, and space. Despite the limitations of having a small sample size and therefore low power, this intervention can be implemented in the clinic because it was shown to be a useful intervention tool. This is important for practicing clinicians because the Log Handwriting Program can be used with children who have poor handwriting skills. This article will benefit occupational therapists working in a school-based setting or with a younger population that struggles with fine motor skills, specifically handwriting.

RESEARCH OBJECTIVE(S)
List study objectives.

1) Evaluate whether the Log Handwriting Program would be easy or feasible to administer for occupational therapists in a school setting.
2) Evaluate if the Log Handwriting Program is effective in improving the legibility, form, alignment, size, space, and speed of handwriting in students between the ages of 6 and 8.

DESIGN TYPE AND LEVEL OF EVIDENCE:
Level III: Pretest–posttest. An assessment was given, followed by an intervention. Lastly, the assessment was given again to determine any change in functioning. Because this study has no control group, its level of evidence is Level III.

Limitations (appropriateness of study design):
Was the study design type appropriate for the knowledge level about this topic? Circle yes or no, and if no, explain.
SAMPLE SELECTION
How were subjects selected to participate? Please describe.

Six school principals in Sydney, Australia were contacted for recruitment of students. Two of them were unable to participate. Packets with informed consent were sent to the parents of 36 students from the four schools that were able to participate in the study. Of those, 32 were returned and signed, allowing their child to participate in the study. The Minnesota Handwriting Assessment was administered. Children who scored equal to or less than 30 of 34 were included in the study to avoid a ceiling effect at baseline. In total, 16 students were eligible to participate.

Inclusion Criteria
There were two inclusion criteria for this study. First, the children had to be between the ages of 6 and 8 and be in first or second grade. Second, the students had to score less than or equal to 30 on the Minnesota Handwriting Assessment to avoid a ceiling effect at baseline.

Exclusion Criteria
The children could not have any comorbid physical or intellectual disabilities. The children could not be receiving any other handwriting services at the time.

SAMPLE CHARACTERISTICS
N = 16
% Dropouts 0
#/ (%) Male 13 (81.3)  #/ (%) Female 3 (18.7)
Ethnicity NR
Disease/disability diagnosis Students who scored less than or equal to 30 on the MHA screening assessment.

Check appropriate group:

<table>
<thead>
<tr>
<th>Group</th>
<th>Brief Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;20/study group ✓</td>
<td>The first 5–8 minutes of each session was used for warm-ups. The children did various physical activities such as animal-walking, wall push-ups, using play dough, etc. Handwriting training lasted between 25 and 30 minutes. The last 3–5 minutes each week was used to play a fine motor game as a reward. The eight sessions were broken into categories. Sessions one...</td>
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</tbody>
</table>
through three were letter formation. Session four was focused on log writing. Session five was used for letter correction of single words. Sessions six and seven worked on writing full sentences. Session eight summarized the learned skills, and the children wrote multiple lines of sentences.

<table>
<thead>
<tr>
<th>Setting</th>
<th>N/R</th>
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<tbody>
<tr>
<td>Who Delivered?</td>
<td>The intervention was delivered by an occupational therapy student. The author of the LHP provided both training and supervision for the student.</td>
</tr>
<tr>
<td>Frequency?</td>
<td>The therapy student met with each group of students once a week for 8 weeks.</td>
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<tr>
<td>Duration?</td>
<td>Each session lasted for 45 minutes.</td>
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</tbody>
</table>

**Intervention Biases:** *Circle yes or no and explain, if needed.*

**Contamination**

**YES/NO**

There was no control group in this study, so contamination could not occur.

**Co-intervention**

**YES/NO**

Because the students in the study were attending regular school while receiving the intervention, handwriting skills also were being used in the classroom setting. Although this is not a formal intervention, it is still working on the same skill being addressed in the study.

**Timing**

**YES/NO**

There were five students who missed a session and therefore missed time in the intervention. This poses a possible bias because there were other students who received more time participating in the intervention.

**Site**

**YES/NO**

**Use of different therapists to provide intervention**

**YES/NO**

**MEASURES AND OUTCOMES**

Complete for each relevant measure when answering the evidence-based question:

Name of measure, what outcome was measured, whether the measure is reliable and valid (as reported in article – yes/no/NR [not reported]), and how frequently the measure was used.
The assessment used to measure handwriting skills was the Minnesota Handwriting Assessment. This assessment measured six subcategories, including legibility, form, alignment, size, space, and speed of handwriting skills.

This assessment was used as a screening tool for students to determine whether or not they were eligible for the study. The assessment was then used again after the intervention to measure improvement of participants.

The test had interrater reliability of $r = .98$, intrarater reliability of $r = .96$, and a test–retest reliability of .72. Validity was not reported.

Measurement Biases
Were the evaluators blind to treatment status? *Circle yes or no, and if no, explain.*

YES/NO

Recall or memory bias. *Circle yes or no, and if yes, explain.*

YES/NO

Others (list and explain):

RESULTS
List results of outcomes relevant to answering the focused question
Include statistical significance where appropriate ($p < 0.05$)
Include effect size if reported

The changes in mean scores as well as the statistical significance were measured using the Minnesota Handwriting Assessment. There was a positive change in mean between pretest and posttest scores of 4.1 points for legibility, 5.3 points for form, 7.8 points for alignment, 7.9 points for size, and 5.3 points for space. The subcategory of speed had a negative change in mean of 3.9 points. This study set the alpha value using the Bonferroni adjustment. The subcategories that were found to be significant were those in which the $p$ value was less than the set alpha value of 0.008. Therefore, there was statistical significance across all subcategories except speed. These included legibility ($p = .000$), form ($p = .001$), alignment ($p = .002$), size ($p = .002$), and space ($p = .002$). Speed was not shown to have statistical significance, with a $p$ value of .043.

Was this study adequately powered (large enough to show a difference)? *Circle yes or no, and if no, explain.*

YES/NO With an 80% power and an alpha of .05, it was calculated that a sample size should be 22 participants. This study, however, only used 16 participants.

Were appropriate analytic methods used? *Circle yes or no, and if no, explain.*
CONCLUSIONS
State the authors’ conclusions that are applicable to answering the evidence-based question.

Use of Log Handwriting Program in the study shows clinical significance in that legibility of handwriting increased. This study showed that an individual gains skill performance as that skill is practiced and is reinforced with feedback. It also was shown that while legibility increased, handwriting speed decreased. This shows clinically that a balance between legibility and speed is needed, with an understanding that legibility should be emphasized initially. As this skill is achieved, speed can be addressed.

This work is based on the evidence-based literature review completed by Amanda Scull, OTS, and Rondalyn Whitney, PhD, OTR/L, Faculty Advisor, University of the Sciences, Philadelphia.


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