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## A Retrospective Study of Handwriting Skills of Kindergarten Students

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**OBJECTIVE.** The purpose of this study was to guide teachers and occupational therapist in recognizing handwriting needs in order to provide appropriate early intervention support for handwriting.

**METHOD.** 218 kindergarten students in a public school district were screened for handwriting ability using the Handwriting Without Tears and the Public School's copy screeners. Students were assessed three times during the 2014 to 2015 school year on letter memory, line placement, letter orientation, copy legibility, and copy placement skills.

**RESULTS.** The results indicated that winter scores were a better predictor of spring scores. Significant effects in four out of five variables were found when utilizing repeated measures of retrospective data.

**CONCLUSION.** Winter scores were shown to be significant in determining handwriting outcomes measured in the spring. The Handwriting Without Tears' screener and the Public School's screener are appropriate tools for school-based occupational therapists to use to identify intervention needs.

**Key Words:**

- Handwriting Without Tears Screener
- Handwriting difficulties

1 Referrals to school-based occupational therapists (SBOTs) often stem from handwriting  
2 difficulties in students (Case-Smith, Holland, Lane, & White, 2012). In schools, handwriting is  
3 the primary way students display information learned (Donica, 2010). School success is often  
4 determined by the child's ability to master the fundamentals of handwriting (Schneck, Shasby,  
5 Myers, & DePoy Smith, 2012). The ability of the child to write legibly and quickly is essential  
6 to the functional skills of writing their name, filling out an application, drawing a picture, or  
7 taking notes. Even with the advancements in technology (Thompson, McLaughlin, Derby, &  
8 Conley, 2012), handwriting in the form of note taking, message taking, writing examinations,  
9 and completing applications are important life skills. Overall, handwriting is a functional  
10 activity that impacts an individual's satisfaction, creativity, productivity, and academic  
11 achievement (Feder, Majnemer, & Synnes, 2000).

12 Improvements in a child's handwriting can be beneficial to social-emotional, early  
13 educational, and school career. Handwriting performance is often viewed as a reflection of the  
14 individual's capabilities affecting their self-image, attitude, behavior, and overall academic  
15 achievement (Feder et al., 2000). Writing creates the ability to distinguish each letter, which  
16 provides an avenue for learning about letters and sounds. Therefore, letter knowledge, ability to  
17 print, and attention to print is critical to early reading and literacy skills (Diamond, Gerde, &  
18 Powell, 2008). The ability to perform handwriting also affects a child's self-image, academic  
19 achievement, attitude, and behavior, which is often viewed as a reflection of an individual's  
20 capabilities (Feder et al., 2000). Overall, handwriting is a skill that is the building block for a  
21 student's ability to read, write, use language, and think critically (Handwriting Without Tears,  
22 2015).

23           An estimated 20% of children in elementary schools experience difficulty acquiring  
24 necessary handwriting skills. This is problematic because 42% of children's time at school is  
25 spent on fine-motor activities, such as paper-and-pencil tasks (Schneck et al., 2012). Children  
26 struggling with handwriting often deplete their cognitive resources on the motor planning  
27 required for simple tasks, such as forming letters, rather than being able to utilize their skills for  
28 composition and written expression of an idea (Case-Smith, Weaver, & Holland, 2014). Due to  
29 the complexity of handwriting, impairments in the motor, sensory, or perceptual systems could  
30 lead to inefficient letter formation and functionally poor handwriting. However, many teachers  
31 are not trained on handwriting instruction, leading to difficulty addressing handwriting concerns  
32 in the classroom and prompting referrals to SBOT (Schneck et al., 2012).

33           Services provided by the OT may vary depending on the general education curriculum,  
34 the teacher's priorities, and the child's needs (Bazyx et al., 2009). In order for a child to be  
35 successful as a student, the team, including the SBOT and the general education teacher, must  
36 address difficulties in handwriting performance skills and analyze the demands of the activity  
37 (Donica, 2010). SBOT interventions address handwriting limitations for school-aged children  
38 because handwriting is a necessary skill for functioning in the mainstream classroom  
39 environment. When it is recognized that the student has greater needs, SBOTs are requested to  
40 assess the child for further intervention.

41           Within the school setting, SBOTs use assessments to aid in determining when treatment  
42 is necessary and to help guide intervention planning (Feder et al., 2000). Handwriting Without  
43 Tears screener is a standardized tool that uses a script for administration (Handwriting Without  
44 Tears, 2009a). This screener helps identify students who need additional support and track the  
45 development of critical handwriting skills (Handwriting Without Tears, 2009b). This tool

46 screens written capital letters, numbers, lower case letters, and sentence writing. The screener is  
47 used independently or as a part of a Response to Intervention (RtI) model to gather handwriting  
48 performance outcomes (Handwriting Without Tears, 2009a). Reports from classroom screeners  
49 provide percentages of students meeting or not meeting benchmarks; RtI Tier 1 achievement  
50 comparisons; and where to focus instruction and intervention (Handwriting Without Tears,  
51 2009b).

52 Although there is literature to support that handwriting is the number one reason for  
53 referrals to SBOT's, researchers have found a lack of information that can guide SBOTs to  
54 determine when it is necessary to intervene early versus knowing that developmentally  
55 kindergarten students will gain these skills throughout the school year. Since there is a lack of  
56 consensus among handwriting data, the difficulty in skills related to handwriting has caused an  
57 abundance of children to be referred for occupational therapy (Hape Flood, McArthur, Sidara,  
58 Stephens, & Welsh, 2014). Through a retrospective analysis of the 2014-2015 school year,  
59 handwriting performance was assessed. Prompted by a clinical question, researchers were able  
60 to gather baseline data that will allow for SBOTs to know, based on the Handwriting Without  
61 Tears and copy screener data, when intervening is necessary.

## 62 **Research Question**

63 The purpose of this study was to guide teachers and SBOTs in recognizing handwriting  
64 needs and provide appropriate early intervention support for handwriting. The following  
65 research question guided the investigation: Are there correlations between the three measured  
66 aspects of Handwriting Without Tears screen categories of letter memory, line placement, and  
67 letter orientation, or additional copy legibility and copy placement skills that are predictive of  
68 handwriting ability in kindergarten students?

## 69 **Method**

70           *Research design.* This was a retrospective quantitative study designed to determine if  
71 errors in letter memory, line placement, letter orientation, copy legibility, and copy placement  
72 skills contribute to handwriting difficulties. Researchers analyzed variables measured during the  
73 fall, winter, and spring of the 2014-2015 school year. Handwriting screeners were administered  
74 to all kindergarten students in the Public School District. Baseline skills identified determined  
75 difficulty in handwriting skills versus the need for further instruction at the kindergarten level.  
76 Ethical approval was obtained from the Human Research Review Committee at Grand Valley  
77 State University.

78           *Participants and setting.* The population targeted by this study included general and  
79 special education kindergarten students who attended the Public School in the participating  
80 school district. Each kindergarten classroom had 20-28 students and the classroom teacher was  
81 present during the screening. All students on the class roster were given the Handwriting  
82 screeners. Students were excluded if they were absent on the day of the screen or if they had  
83 moved out of the district. Approximately 200 kindergarten students between the ages of 5.5-7  
84 were given the handwriting screening. No participant recruitment was involved, a convenience  
85 sample of all students on the class roster in each kindergarten room were given the screener. The  
86 screener was administered as part of the natural school environment to collect data per State of  
87 Michigan curriculum guidelines.

88           *Instruments.* The Handwriting Without Tears screener helps identify students who need  
89 additional support and track the development of critical handwriting skills (Handwriting Without  
90 Tears, 2009b). The screener is a standardized tool that uses a script for administration  
91 (Handwriting Without Tears, 2009a). Face validity has been established because it was created

92 by a licensed occupational therapist. This tool screens written capital letters, numbers, lower  
93 case letters, and sentence writing. The screener is used independently or as a part of a RTI model  
94 to get handwriting performance outcomes (Handwriting Without Tears, 2009a). The Public  
95 School's copy screener was developed by the certified occupational therapists at the Public  
96 School. This screener was used to evaluate student legibility and line placement when copying  
97 from a near point sample. The screener was scored according to the student's ability to place  
98 words within 1/8 inch of the line and whether or not the letters were recognizable.

99 *Data collection.* Two occupational therapists and the certified occupational therapy  
100 assistant administered the Handwriting Without Tears Screener and a copy screener developed  
101 by the occupational therapists at the Public School. The Handwriting Without Tears Screener  
102 and the copy screener was put on an overhead projector and the administrator would read per the  
103 standard instructions for each section of the screen. The screener took an average of 15 minutes.  
104 No help was given to the students besides reminders about procedure and reorientation to which  
105 line they needed to be on via the overhead projector. After administration, the screeners were  
106 scored, converted to percentages, and de-identified before researchers received the data.

107 *Data analysis:* Data was analyzed using SAS Version 9.4 for Windows (SAS Institute  
108 Inc., Cary, NC). A proc-mixed procedure was completed to control for variability between  
109 classes. Researchers chose to use the statistical analysis of repeated measures because the  
110 students were measured more than one time throughout the school year. This analysis compared  
111 the difference between winter and spring percentages of all 218 students. The level of  
112 significance for testing was set at .05. The Handwriting Without Tears screener yields  
113 percentages to help identify specific skill areas where students are struggling.

114 **Results**



115 A sample of 218 kindergarten students participated in this study. The  $p$  values for four of  
 116 the five winter variables were significant when compared to alpha level of .05. The  $p$  values for  
 117 winter are less than .05 indicating a significant difference between students' scores when  
 118 measured in the winter versus students' scores when measured in the spring. All line placement  
 119 variables were unable to be predicted due to the fact that the estimate of zero implies that none of  
 120 the variability for the spring score comes from the different classes when previous scores are  
 121 used to explain variability.

122 Figure 1 shows the inconsistencies among the changes in score from fall to winter  
 123 according to  $p$  values. Only two of the five  $p$  values calculated between fall and winter showed a  
 124 significant effect. Figure 2 presents the significant outcomes of scores from winter to spring  
 125 according to  $p$  values. The lower and upper confidence intervals illustrated in Figure 2 pinpoint  
 126 parameters for the amount that students' spring scores may improve. From this information,  
 127 there is a 95% confidence that for every increase of one percentage in the winter scores, the  
 128 spring scores will go up between the upper and lower parameters identified.

129 Figure 1. Fall Statistics

Solution for Fixed Effects								
Effect	Estimate	Standard Error	DF	t Value	Pr >  t	Alpha	Lower	Upper
Fall Copy Legibility	0.02639	0.02833	141	0.93	0.3532	0.05	-0.02962	0.08239
Fall Letter Memory	0.05793	0.03119	145	1.86	0.0653	0.05	-0.00372	0.1196
Fall Line Placement	0.08403	0.02889	138	2.91	0.0042	0.05	0.02691	0.1412
Fall Copy Placement	0.08146	0.06597	142	1.23	0.2190	0.05	-0.04895	0.2119
Fall Letter Orientation	0.005120	0.01960	139	0.26	0.7943	0.05	-0.03363	0.04387

130 \*  $p < .05$ .

131 Figure 2. Winter Statistics

Solution for Fixed Effects								
Effect	Estimate	Standard Error	DF	t Value	Pr >  t	Alpha	Lower	Upper
Winter Copy Legibility	0.1742	0.06475	157	2.69	0.0079	0.05	0.04633	0.3021
Winter Letter Memory	0.5874	0.05900	161	9.96	<.0001	0.05	0.4709	0.7039
Winter Line Placement	0.5537	0.05976	155	9.27	<.0001	0.05	0.4357	0.6718
Winter Copy Placement	0.3303	0.06658	157	4.96	<.0001	0.05	0.1988	0.4619
Winter Letter Orientation	0.8116	0.05951	156	13.64	<.0001	0.05	0.6941	0.9292

132 \*  $p < .05$ .

### 133 Discussion

134 This study compared fall, winter, and spring writing samples from kindergarten students  
 135 measured by the Handwriting Without Tears' screener and the Public School's copy task. When  
 136 comparing these three samples, researchers looked at copy legibility, letter memory, copy  
 137 placement, line placement, and letter orientation. Results indicate that winter scores are more  
 138 predictive of spring scores than those obtained during the fall. The majority of fall scores were  
 139 not consistently predictive of winter and spring scores. The results of this study can help  
 140 SBOTs, as well as educators, in identifying when it may be necessary to provide intervention for  
 141 handwriting needs. The outcomes indicate that SBOTs should intervene after results are  
 142 obtained from the winter screens. Researchers found that the Handwriting Without Tears screens  
 143 and the Public School copy task can identify significant changes in handwriting performance.

### 144 Limitations and Directions for Further Research

145           The major limitations of this study was that on average there were 30 children absent on  
146 screening days or moving out of the school district. Additionally, the use of only one geographic  
147 region limits the ability to generalize the results of this research. Next, a convenience sample  
148 from only one school district was used; the participants did not effectively represent a  
149 heterogeneous population of kindergarten students, as a random sample would have. Also, there  
150 was a lack of blinding to students samples until data was de-identified by the Public School  
151 occupational therapist. Finally, this research was limited based on validity and reliability, which  
152 are not statistically established for the Handwriting Without Tears screener or the Public  
153 School's screener.

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

155  
156           Intervening during early childhood is critical in children's handwriting development; it is  
157 related to early literacy skills such as letter knowledge (Gerde, Foster, & Skibbe, 2014), which is  
158 supported by the current study. SBOT's should consider the following implications of this  
159 study:

- 160       • During a kindergarten school year, screening tools can be used to identify intervention  
161       needs.
- 162       • Information cannot be gained from fall scores to indicate a student's need for handwriting  
163       intervention.
- 164       • Intervention needs are better recognized following winter screens because there was  
165       minimal change between fall and winter screening scores.

#### 166 **Conclusion**

167           A comparison of retrospective data determined that there were significant changes among  
168 handwriting data. Winter scores were shown to be significant in determining handwriting

169 outcomes measured in the spring. This study recognizes that SBOTs can best determine  
170 intervention needs after the winter screen. The Handwriting Without Tears screener along with  
171 the screener created by the Public School occupational therapist are appropriate tools for SBOTs  
172 to use to identify when intervention is needed.

### 173 **Acknowledgements**

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175 data for this project. We thank the Grand Valley State University Statistical Center, for  
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177

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