Occupational Therapy Handwriting Interventions on a Systems-Level

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Occupational Therapy Handwriting Interventions on a Systems-Level

May 17, 2019

This evidence project, submitted by

Megan Buckingham, Shelby Goodfellow, Catherine Hannan

has been approved and accepted
in partial fulfillment of the requirements for the degree of
Master of Science in Occupational Therapy from the University of Puget Sound.

Project Chairperson: Yvonne Swinth, PhD, OTR/L, FAOTA

OT635/636 Instructors: George Tomlin, PhD, OTR/L, FAOTA; Renee Watling, PhD, OTR/L, FAOTA

Director, Occupational Therapy Program: Yvonne Swinth, PhD, OTR/L, FAOTA

Dean of Graduate Studies: Sunil Kukreja, PhD

Key words: systems-level, schools, occupational therapy, handwriting
Abstract

Julie Anderson, DrOT, OTR/L, is an occupational therapist in the Puyallup School District who works with elementary aged students. For this project, Dr. Anderson worked as the primary collaborator with occupational therapy students to answer the question: What is the evidence that occupational therapy interventions at a systems-level improve student’s academic performance and skill development outcomes, such as handwriting, in elementary age students with and without disabilities? The results of this descriptive study indicate strong evidence that systems-level interventions, involving an occupational therapist, in a school setting improve at least one area of a student’s skill development. Additionally, any consistent handwriting curriculum improved handwriting skills in elementary school children compared to no handwriting curriculum. Finally, when teachers and occupational therapists collaborate, systems-level interventions can be implemented to best fit the needs of individual classrooms. Future research in this area should work to define the terms “systems-level” and “collaboration.” This would allow consistent results when comparing various studies performed at a systems-level and involving collaboration, as currently studies use multiple terms to describe the same approaches.

Knowledge translation for this project included compiling the systematic review, as well as other handwriting research, into a PowerPoint to be presented to administrators at the Puyallup School District. The aim of this presentation was to educate administrators on the benefits of a districtwide handwriting curriculum for kindergarten and first grade classrooms, provide details on specific curricula and provide a possible implementation plan. Pre- and post-survey results, gathered at the presentation, indicate that administrators within the Puyallup School District believe they should have a districtwide handwriting curriculum. All administrators picked TV Teacher as the top choice at the end of the presentation. As a result of the presentation, the administrator for the kindergarten academy in the Puyallup School District will be using TV Teacher as the kindergarten academy’s curriculum. Future recommendations regarding this knowledge translation include recording data on handwriting for either pre- and post-handwriting
curriculum or utilizing a between group design that compares half the Puyallup School District using a handwriting curriculum to half not using a handwriting curriculum.
Executive Summary

Many school-based occupational therapists have several students on their caseload who require intervention for handwriting. A potential reason for this handwriting intervention need is a lack of direct handwriting instruction given to students in kindergarten and first grade. Delivering a consistent handwriting intervention to all students on a systems-level (i.e. a consistent classroom curriculum across a district) could improve handwriting and potentially decrease the number of OT handwriting referrals. The purpose of this study is to address the question: What is the evidence that occupational therapy interventions at a systems-level improve students’ academic performance and skill development outcomes, such as handwriting, in elementary age students with and without disabilities? Additionally, this research aims to translate the data in a way that potentially supports the implementation of a consistent handwriting curriculum within a school district in Washington state. In this study, the use of the terms “systems-level” and “districtwide” are used interchangeably.

This descriptive study used a systematic review and critical appraisal process. Inclusion criteria included articles with a systems-level intervention, interventions performed in an elementary school setting in the United States, occupational therapy involvement in treatment within a classroom, and interventions that either provide service to or on behalf of the student. Exclusion criteria included interventions implemented with individual/small groups of children, studies published before 2000, and interventions not practical for school settings. This study started by evaluating and gathering articles from AJOT, Taylor Francis Online, ERIC, CINAHL, and Google Scholar. Databases were searched using key terms such as schools, elementary, systems-level, RTI, Tier-1, handwriting and academic achievement. Nineteen articles were reviewed and categorized for themes. Information from the critically appraised topic (CAT) table was then translated into a presentation that was delivered to important stakeholders in the district in the effort to establish a districtwide handwriting curriculum. Three administrators attended the meeting and completed pre- and post-presentation surveys that gathered information about attitudes toward handwriting and districtwide handwriting curriculum.
Most studies focusing on handwriting showed statistically significant improvements in at least one area of handwriting. All 11 outcome studies found significant improvement in at least one area of skill development. There is strong evidence that systems-level interventions within schools improve handwriting and fine motor skills with the potential to benefit the greatest number of students and save district resources. There is strong evidence that occupational therapists can support teachers and students in a classroom setting. There is moderate evidence for collaboration between occupational therapists and teachers to support students on a systems-level.

Handwriting interventions at a systems-level increases handwriting legibility, which is beneficial to the completion of academic assignments. Additionally, collaboration between teachers and occupational therapists is crucial for systems-level intervention success. Improvements from systems-level interventions can increase academic skills across the curriculum for all students, which is more beneficial than targeting a single child. Based on the findings of this project, students achieve greater improvements when interventions are used in the classroom compared to pull-out instruction alone. The research implies that a systems-level handwriting approach has the possibility to reduce the number of referrals to school occupational therapists regarding handwriting, which can save valuable school resources and money.

While saving resources, a systems-level approach also enables ‘at risk’ children to obtain the support they require to improve their skills. Based on this research, systems-level interventions, specifically the implementation of a handwriting curriculum at a district level, should be more widely utilized to benefit the greatest number of students.

Knowledge translation involved the creation and presentation of a PowerPoint on the cost, benefits and effectiveness of a districtwide handwriting curriculum to school administrators. A step-by-step implementation plan was created with strategies to document handwriting abilities of students before and after utilizing a districtwide handwriting curriculum. This project is important to occupational therapy practice because of the potential for positive outcomes at a systems-level, when OT interventions are included. All elementary school settings have the potential for improved students’ skill development,
especially in relation to handwriting. While the outcome of the presentation is still ongoing, as no official handwriting decision has been made, all administrators who attended the presentation agreed that a consistent handwriting curriculum would benefit the Puyallup School District. All administrators picked TV Teacher as the top choice at the end of the presentation. As a result of the presentation, the administrator of the Puyallup School District’s kindergarten academy will be using TV Teacher as the academy’s handwriting curriculum.
**CRITICALLY APPRAISED TOPIC (CAT) PAPER**

**Focused Question**

What is the evidence that occupational therapy interventions at a systems-level improve student's academic performance and skill development outcomes, such as handwriting, in elementary age students with and without disabilities?

Operational definitions:
- **Skill development** as defined by OTPF-3 (American Occupational Therapy Association, 2014) client factors and performance skills.
- **Systems-level** as defined by services provided to or on behalf of a student at a district or classroom level including teacher collaboration and training, program development, programmatic consultation and specific interventions.

**Prepared By**

Megan Buckingham, Shelby Goodfellow, Cate Hannan

**Date Review Completed**

January 31st, 2019

**Professional Practice Scenario**

The aim of this research is to examine Dr. Anderson’s question regarding how the impact of an occupational therapy (OT) supported systems-level approach can demonstrate improvements in academic performance and skill development, such as handwriting, on pre-kindergarten to sixth grade students. An example of this approach includes an occupational therapist and general education teacher collaborating to implement an intervention, curriculum or program classroom-wide. Another example would include an occupational therapist incorporating a curriculum districtwide to benefit all students within the district. Response to Intervention (RtI) and Tier-1 level interventions can also be included as examples as they fall within this paper’s definition of systems-level interventions. Answering this question would help inform decision-making addressing the current emphasis of school-based occupational therapy providing services at a systems-level from primarily one-on-one treatment to whole classroom/school intervention. Providing some OT services at a systems-level could potentially cut down on the number of referrals and catch more students in the “at risk” category who are not eligible for Individualized Education Programs (IEP).
Dr. Anderson’s setting includes two schools, Fruitland Elementary and Stewart Elementary, where she manages an average caseload of 40 students spread over a four-day work week. She works with students in pre-kindergarten through sixth grade who are eligible for special education and come from a variety of socio-economic backgrounds. Her students’ diagnoses include, but are not limited to, developmental delay, autism, and Down syndrome. The length of a child’s services is dependent on the child’s individual needs and team decisions. Within the schools, Dr. Anderson treats students both inside and outside the classroom. She works with a variety of professionals across the schools she serves, including occupational therapists, speech therapists, teachers and administrators to create a collaborative and holistic treatment plan for each student and/or classroom. Dr. Anderson also believes in a systems-level approach to intervention and prefers to support general and special education teachers in the classroom when appropriate. Dr. Anderson has a strong collaborative relationship with her supervisors and believes systems-level changes can be made with the support of evidence-based practice.

Search Process

Procedures for the selection and appraisal of articles

Inclusion Criteria

- Interventions on elementary students in pre-k to 6th grade
- Occupational therapists in a school-based setting
- Teachers in any grade-level general education/inclusive classroom
- Schools in the USA
- Systems-level (by provided definition)
- Interventions must be supported by an occupational therapist by either service to the student or services on behalf of student

Exclusion Criteria

- Interventions implemented with individual students or to small groups of students
- Studies published prior to 2000
- Articles focusing on interventions that are not practical for school settings
**Search Strategy**

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<td>Comparison</td>
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<td>Outcomes</td>
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<td>Authors</td>
<td>“Bazyk”, “Dunn”</td>
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**Databases, Sites, and Sources Searched**

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Total: 19/19
Search Outcomes/Quality Control/Review Process

During the initial drafts of the project, the question changed significantly from searching for only systems-level occupational therapy (OT) handwriting curriculums to a general systems-level occupational therapy approach. The displayed strategy and results are from the most recent conceptualization of the research question. In this draft, the question was refined from only including interventions provided at a whole school or district level approach to systems-level interventions also including classrooms. Also, consistent with Individuals with Disabilities Education Act (IDEA) language (Individuals with Disabilities Education Act, n.d.), a definition of systems-level interventions was created to include services to and on behalf of the child with specific examples of those services. Initial search terms regarding systems-level interventions were altered. As researchers discussed the project with faculty, specific influential occupational therapists (OTs) working at a systems-level were mentioned, therefore searches were expanded to include specific authors. Furthermore, studies used different criteria to define collaborating, coteaching, consultation, and coaching. For example, the majority of the studies included in the CAT used the word collaboration to describe the relationships between teachers and OTs. Randall (2018) included joint planning, good communication, modification of tasks as needed and co-teaching in their definition of collaboration, while Bose and Hinojosa (2008) used Friend and Cook’s (2000) theoretical framework to define collaboration as a process of working toward a common goal which entails shared decision making, resources and accountability for outcomes. Therefore, this thesis looked at the relationship between OTs and teacher interaction and did not focus on the effectiveness of the relationship style.

Figure 1 outlines the current search process that was used to find articles. A total of 3,083 articles were found through database searches, citation tracking, reference checking and using “related articles” buttons on the internet. The majority of studies excluded represented Tier-2
interventions, early intervention, and students with specific diagnoses. Based on article titles and publication dates, 224 were screened for initial inclusion criteria. Then 65 full articles were read for further analysis. Articles in this phase were excluded if they did not meet the inclusion or exclusion criteria. This includes studies published before 2000, interventions done on individual children, and children not enrolled in pre-school to elementary school. In addition, studies included in a prior CAT addressing the effectiveness of handwriting delivery models (Arnold, Michlmayr & Throop, 2018), that examined literature from 1997-2017, were considered for inclusion in this CAT. This produced 1 article that is included in the current CAT (Pfeiffer, Murray, Rai, & Brusilovskiy, 2015). 19 articles met criteria for inclusion in this CAT table.

The main collaborators involved in this process have been the student researchers, faculty members Renee Watling, PhD, OTR/L, FAOTA and Yvonne Swinth, PhD, OTR/L, FAOTA, and a local clinician, Dr. Julie Anderson, DrOT, OTR/L. Through a series of meetings, specific search criteria were set, and words gained operational definitions as the literature appeared inconsistent. The collaborators were valuable as they were able to identify specific researchers and professionals who were involved in this area of OT practice.
Figure 1

PRISMA Flow Diagram

Records identified through database searching (n = 2642)

Additional records identified through other sources (n = 441)

N = 3,083 total articles
Records after 33 duplicates removed (n = 3050)

Records screened (n = 224)

Records excluded (n = 159)

Full-text articles assessed for eligibility (n = 65)

Full-text articles excluded, due to not meeting inclusion/exclusion criteria (i.e.: other country, before year 2000, intervention completed on single children) (n = 46)

Studies included in table (n = 19)
Qualitative (n=3)
Quantitative (n=15)
Mixed Methods (n=1)
Results of Search

**Summary of Study Designs of Articles Selected for the CAT Table**

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<th>Pyramid Side</th>
<th>Study Design/Methodology of Selected Articles</th>
<th>Number of Articles Selected</th>
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<td>Outcome</td>
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<tr>
<td>Qualitative</td>
<td>___Meta-Syntheses of Related Qualitative Studies Group Qualitative Studies w/ more Rigor 1 prolonged engagement with informants triangulation of data (multiple sources) 1 confirmation (peer/member-checking; audit trail) comparisons among individuals, w/ a person 1 Group Qualitative Studies w/ less Rigor 1 Qualitative Study on a Single Person</td>
<td>3</td>
</tr>
<tr>
<td>Descriptive</td>
<td>1 Systematic Reviews of Related Descriptive Studies ___Association, Correlational Studies 2 Multiple Case Series, Normative Studies, Descriptive surveys ___Individual Case Studies</td>
<td>3</td>
</tr>
<tr>
<td>Mixed</td>
<td>1 Q2/O4</td>
<td>1</td>
</tr>
</tbody>
</table>

AOTA Levels
I- 1
II- 5
III- 8
IV- 2
V- 0
NR-3

Comments:

TOTAL number of articles =19
**CAT Table**
What is the evidence that occupational therapy interventions at a systems-level improve student's academic performance and skill development outcomes, such as handwriting, in elementary age students with and without disabilities?

**Quantitative Studies**

<table>
<thead>
<tr>
<th>Author, Year, Jnl, Country</th>
<th>Study Objectives</th>
<th>Study Design/ Level of Evidence</th>
<th>Participants/ Sample Size/ In/Ex</th>
<th>Interventions &amp; Outcome Measures</th>
<th>Summary of Results</th>
<th>Study Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mische-Lawson et al. 2012</td>
<td>To determine if yoga is effective in ↑ GM &amp; FM performance, classroom behavior, &amp; AP of pre-k age children w/ &amp; w/o disabilities in classroom.</td>
<td>Quasi-experimental/ pretest posttest III</td>
<td>N= 33 pre-k students n= 20 boys age= 3-5yrs O3 3/7</td>
<td>Int: 10min video of Yoga Reflex Integration yoga followed w/ motor activity 4 days/ wk for 6 wks. Ctrl: Small group FM activities only O: FM: Coloring, name writing, letter copying, draw- a-person, cutting GM: Analysis of yoga pose Behavior: Entire class score given based on individual classroom scale AP: Grade report- recognition of shapes, colors, numbers, letters &amp; coloring, cutting, &amp; writing abilities</td>
<td>Tx group stat sig improved in letter (p=0.004) &amp; name (p=0.022) writing. Stat sig improved in shape recognition (p=0.0125) for academic report. Ctrl group stat sig ↑ in coloring (p=0.028) No stat sig diff in any other O measure. Behavior data thrown out for ctrl group due to missing data.</td>
<td>Criteria for draw-a-person may not have been sensitive enough. Inconsistent directions given on poses caused two to be thrown out. Yoga approach &amp; length of int was not consistent w/ previous literature. Missing data from ctrl classroom caused ↓ in sample size. No specified amount of time spent on motor activities.</td>
</tr>
<tr>
<td>Bazyk et al.</td>
<td>To examine how full integration of OT services in a K curriculum impacts FM &amp; emergent literacy O for children w/ &amp; w/out disabilities.</td>
<td>One group pretest posttest descriptive study</td>
<td>N=37 K students n=12 w/ disabilities 2 K classrooms In: Parent consent to participate</td>
<td>Int: Direct fully integrated OT services two days/wk &amp; indirect OT services/teacher support. O: PDMS-2 FM: Grasping &amp; VM subtests VMI: VM tests Nine-hole pegboard: In-hand manipulation, translation, rotation, &amp; speed using 5 pegs Observation of pencil grip OSELA: Three emergent literacy subtests Approximations to Text: Ability to reread a story</td>
<td>Children w/o disabilities: FM &amp; emergent literacy stat sig improved in all 8 categories (p&lt;0.05). Children w/ disabilities: Stat sig improvement in PDMS-2, pencil grip. Approximation to Text, &amp; 2 of 3 OSELA subtests. VMI scores not stat sig, but PCI&gt;1 indicating improvement beyond maturation. PCI scores reveal ↑ acceleration in FM skill &gt; compared to children w/o disabilities. Whole class: FM changes were higher during the int.</td>
<td>No ctrl group to determine effect of maturation on student performance, low-SES, FM &amp; emergent literacy delays in pretest scores limit generalizability, one classroom did not allow pull-out therapy, small sample size. Use of int package prevents determining what components had the greatest impact. Dosage of services unclear.</td>
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<tr>
<td>Silverman</td>
<td>To determine the efficacy of an OT co-teaching in self-contained K classrooms.</td>
<td>Single group pretest posttest</td>
<td>Yr 1: N=40 K students n=11 w/ disabilities Yr 2: N=160 K students n=56 w/ disabilities K students from 2 schools in suburban PA school district in self-contained classrooms. In: Not specified</td>
<td>Int: OT co-teaching for 6 mo w/ K teacher FM, sensory motor, &amp; visual perceptive skills. Instruction was focused on universal design &amp; individualized instruction. O: Teacher survey: Spatial skills, FM skills, &amp; sensory modulation</td>
<td>Based on teacher perception, students ↑ their skills in all areas measured. Greatest improvement when adaptations &amp; prompts were used in the classroom. No statistical analysis was performed.</td>
<td>Lack of numerical analysis prevents knowledge of sig. diff. and possibility of maturation of K students. There is no information about the participants demographics. All data was based on teacher perception. No dosage of int. listed in study.</td>
</tr>
</tbody>
</table>
| Bazyk et al. | To determine if CCP affects student perceptions of lunchtime & cafeteria supervisors’ effectiveness, and gain OTs assessment of the program. | Mixed methods | $N=366$ students  
$N=18$ cafeteria staff, 2-3 staff per lunch  
Students K-4th grade  
4 schools  
4 OTs  
Over 2 years  
In: OTs completed Every Moment Counts initiative | **Int:** 6 wk occupation-based program, 1 day/wk at lunch supervisor training/on-going coaching, embedded weekly activities w/ theme. OTs visit cafeteria 1-2x/mo post 6wk int. | **O:**  
**VAS:** 4 items  
**Interview data:** From student focus group  
**Supervisor Survey:** 12 items, scale 1-5  
**OTs written reflections** | **VAS:**  
Students grouped by:  
High enjoyer: $n=65\%$  
Mid-enjoyer: $n=27\%$  
Low enjoyer: $n=8.0\%$  
Stat sig ↑ in pre to posttest scores in low ($p<0.001$) & mid-enjoyer ($p<0.001$) groups.  
**Post interview themes from students:** Importance of positive behavior & social interactions.  
**Supervisors Survey:** Stat sig ↑ at posttest on items related to knowledge, skills, & resources needed to supervise ($p<0.05$), & the ability to encourage healthy eating ($p<0.001$). Themes found in post interview: supervisors applied what they learned, & noticed students benefited from program.  
**OTs themes:** Student & supervisors enjoyed program, supervisors were receptive to new information & demonstrated new skills. | No ctrl group, cultural bias (all schools in suburban areas). Student qualitative data was collected in a short 10-min interview. |
<table>
<thead>
<tr>
<th>Author et al.</th>
<th>Year</th>
<th>Journal</th>
<th>Title</th>
<th>Study Design</th>
<th>Participants</th>
<th>Intervention Details</th>
<th>Outcomes</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ohl et al.</td>
<td>2013</td>
<td>AJOT USA</td>
<td>To determine the efficacy of a Tier-1 RtI (STEPS-K) developed by OT &amp; K teachers on improving FM &amp; VM skills of GenEd K students.</td>
<td>Experimental controlled Pretest posttest</td>
<td>N=75 K students</td>
<td>Tx: N=47 K students n=27 boys, Ctrl: N=28 K students n=15 boys</td>
<td>Int: STEPS-K program 30 min led by OT 1x/wk for 10wks in classroom, FM center w/ new activities introduced throughout 10 lessons, additional consultation between OT &amp; teacher through int period. Ctrl: No STEPS-K program</td>
<td>BOT-2: FM VMI Developmental Scale of Pencil &amp; Crayon Grips: Pencil grip</td>
</tr>
<tr>
<td>Taras et al.</td>
<td>2011</td>
<td>JOTSEI USA</td>
<td>To evaluate effectiveness of Write Direction HW skill development program in a K environment.</td>
<td>Pretest-posttest matched comparison group</td>
<td>N=211 K students</td>
<td>Tx: N=171 K students</td>
<td>Int: Write Direction 30 mins 1x/wk for 14 wks.</td>
<td>Non-standardized HW samples: Legibility, formation, line approximation, line orientation, proportion, directionality &amp; reversals, spacing</td>
</tr>
</tbody>
</table>

Two schools were unable to collect posttest data within allotted timeline of the study, so their data isn’t included. Small sample size from one geographic location limits the generalizability. Only measured perf skills, not functional perf.
**Donica 2015**

To explore effectiveness of consultative approach in K classroom when implementing HWT curriculum.

**Cohort Pilot Study**

II

O3

4/6

*N = 59 K students*

4 groups

Ctrl: *n =19*

HWT yr 1: *n=20*

HWT yr 2: *n=20*

HWT comb: *n=40* (HWT yr 1 & HWT yr 2)

Ex: Lack of parent permission, not enrolled for entire yr, age <6yr during data collection

**Int:**

HWT yr 1/ HWT yr 2:

GM activity coord. w/ HW song 15 min 5x/wk HWT lesson plan (letter formation) implemented by GenEd teacher after OT consultation.

**O:**

THS-R: Assess neurosensory integration skill through print writing (10 subtests).

HWT yr 1 & HWT yr 2 scored stat sig higher than ctrl (*p<0.05*) in 6/10 subtests.

HWT comb scored stat sig higher than ctrl (*p<0.05*) in 7/10 subtests.

**Randall 2018**

To examine the effectiveness of HWT curriculum on a group of K students when utilizing a collaborative approach between OTs & teachers.

**Single group, non-randomized pretest/ posttest**

III

O4

3/6

*N=2 K teachers*

N=27 K students in GenEd classroom

*n=10 students on IEPs or 504 plans*

In: informed consent from parents

**Int:**

Implement HWT 4x/wk over six weeks: Lower case letters, letter placement, pencil grasp.

**O:**

HWT Print Tool (Modified with permission): Memory, orientation, placement, start, & sequence of letters

**Weekly communications & teacher feedback**

Stat sig ↑ in lower case letters printed from memory (*p<0.0001*).

Stat sig improvement in alignment (*p=0.01*).

**Teacher Feedback Results:** Both teachers reported a positive experience, & found having OTs in room 2-3x/wk was helpful in accountability, modeling of lesson plans & helping struggling learners.

**Could not do pretest/posttest in research, confounding variables present (number of times THS-R completed varies), intrarater reliability not formally established, some blinding but not consistent, multiple people implementing tx. Number of weeks int provided not stated.**
<table>
<thead>
<tr>
<th>Howe et al.</th>
<th>To determine if students HW legibility improves in intensive practice or a visual-perceptual-motor int. &amp; if there is a diff in effectiveness.</th>
<th>Nonequivalent, One group Pretest/posttest</th>
<th>$N=72$ 2nd grade students</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td></td>
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<td>Tx1: $n=38$ Visual-perceptual-motor</td>
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<tr>
<td>AJOT</td>
<td></td>
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<td>Tx2: $n=34$, intensive practice</td>
</tr>
<tr>
<td>USA</td>
<td></td>
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<td>In: 1st &amp; 2nd grade from one NYC elementary school</td>
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<td>Ex: Students with high legibility scores</td>
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<td><strong>Int:</strong> 2x/wk, 40-45min, for 6 wks, OT lead.</td>
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<td><strong>Tx1:</strong> 20min on My Book of Letters &amp; My Book of Shapes.</td>
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<td><strong>Tx2:</strong> 20min on grade-level HW curriculum &amp; tasks, &amp; diff levels of HW activities.</td>
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<td><strong>Both:</strong> HWT book, games like Hangman, Scattergories, Mad Libs.</td>
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<td><strong>O:</strong> MHA: Manuscript-version, HW speed &amp; legibility.</td>
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<td><strong>VMI</strong></td>
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<td></td>
<td><strong>Btwn Groups:</strong></td>
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<td><strong>Pretest:</strong> Tx2 sig higher legibility ($p=0.01$).</td>
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<td><strong>Posttest:</strong> Tx2 stat sig $&gt;$ Tx1 in legibility ($p=0.018$). No stat sig diff for visual-perceptual-motor or HW speed. All $M \uparrow$ for Tx1 &amp; Tx2 pre to posttest in O except $M$ VMI score in Tx1 $\downarrow$.</td>
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</table>

Scores in HW were stat sig diff in pretest, no randomization when assigning groups, potential bias for 1st researcher scoring O.
To examine if all students & students grouped by baseline eligibility improve stat sig. in HW legibility, speed, writing fluency, & written expression immediately & at 6mo following the Write Start program.

**Prospective One group Pretest/posttest III O4 5/6**

**N=36 1st grade students**
- Male: n=19
- n=5 w/ IEP
- 2 classrooms
- In: 1st grade classes w/ some students who have IEP’s
- Ex: Cognitive level on academic testing <70%, severe visual or hearing loss

**Int: OT, classroom teacher, & int. specialist co-taught Write Start program in classroom 45min 2x/wk for 12 wks. Adaptations for individual students as needed.**

**O: ETCH-M WJIII: Subtests for fluency & writing samples**

Students evaluated at baseline, 1 wk & 6mo after int.

**ETCH-M Pre-test:**
- 3 Groups: Low: n=11, Average: n=15, High: n=10

**All Students Follow-up:**
- **Legibility:** Lowercase alphabet improved 27% ($p<0.001$) & uppercase alphabet improved 11.2% ($p=0.002$).
- **Speed:** Lowercase speed improved by 122s ($p<0.001$) & uppercase speed improved 97.1s ($p<0.001$).
- **Fluency:** Improved 6.7 point ($p<0.001$).
- **Written Expression:** Writing sample score improved stat sig. ($p<0.001$).

**Btwn Groups:**
- Groups differed in lowercase legibility ($p<0.001$). Low ($p<0.001$) & average group ($p=0.002$) ↑ > high group in legibility. No stat sig diff for uppercase legibility ($p=0.304$). Group time interactions not stat sig for lower or uppercase speed, uppercase legibility, fluency (after Bonferroni correction) & writing samples.

Small sample size, protocol followed w/ 93.5% consistency in classroom 1 & 94% in classroom 2, only representative of suburban SES students, no ctrl group used, blinding only used w/ scoring but not test administration, potential maturation effect.
<table>
<thead>
<tr>
<th>Case-Smith et al.</th>
<th>To examine impacts of Write Start HW program on first-grade children when co-taught by GenEd teachers &amp; OTs over 2 yr.</th>
<th>Pretest/ posttest group comparison</th>
<th>Int group: N=80 1st grade students</th>
<th>Ctrl group: N=58 1st grade students</th>
<th>Ctrl: Teachers provided HW instruction 3-4 days/wk for 15-20 min to review 1-2 letters a day through short writing assignments.</th>
<th>ETCH-M: Both groups made stat sig improvements in HW legibility (p&lt;0.001) &amp; speed (p&lt;0.001). Int group improved stat sig more in lowercase legibility (p&lt;0.001) &amp; improved more in speed (p=0.025). At 6 mo follow up, int group had stat sig higher scores in speed (p=0.016) &amp; legibility (p=0.001).</th>
<th>Possible ceiling effect in the WJIII, which may have caused lack of stat sig results btw groups. Groups were not randomly assigned, &amp; blinding was limited which ↓ validity of the study. Diversity was limited in this sample &amp; only included middle-class suburban communities.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>AJOT</td>
<td>USA</td>
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<tr>
<td>Case-Smith et al.</td>
<td>To examine the effectiveness of Write Start in a co-taught first-grade.</td>
<td>Single-group pretest-posttest</td>
<td>N=19 1st grade students in Midwest suburban school</td>
<td>n=8 females</td>
<td>O: ETCH-M: Lowercase alphabet writing, near-point copying, far-point copying, &amp; dictation subtests. MHA WJIII: Writing Fluency &amp; Writing Samples subtests.</td>
<td>ETCH-M: Stat sig ↑ in all subtests from pretest 62% to posttest 87% of writing by student that is legible. 87% was maintained after 6 mo. MHA: Stat sig ↑ in speed (p&lt;0.001) &amp; legibility (p=0.024). WJIII: Fluency stat sig ↑ (p=0.003). Writing samples stat sig ↑ from pre to posttest (p&lt;0.001), &amp; posttest to 6 mo follow up (p=0.029).</td>
<td>No ctrl group which limits conclusions that can be drawn from this study. Maturation not taken into effect. Small sample size in only one classroom &amp; had limited diversity which ↓ generalizability. ETCH-M &amp; MHA may have limited gains due to ceiling effect of assessments.</td>
</tr>
<tr>
<td>2011</td>
<td>AJOT</td>
<td>USA</td>
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<tr>
<td>Pfeiffer et al.</td>
<td>To examine changes in HW legibility in K, 1st &amp; 2nd grade students in response to SMHP.</td>
<td>Two group pretest/posttest</td>
<td>N = 207 students</td>
<td>Int: Tx: SMHP 20 mins, 5x/wk for 8 wks of teacher implemented lesson w/ OT instruction consult. Ctrl: Standard HW instruction. O: THS-R MHA</td>
<td>K THS-R: Tx group ↑ in all subtests (p &lt; .05). K THS-R between groups: Greater ↑ in tx group (p &lt; .0388). Time 1: MHA: Tx group ↑ on all measures except spacing &amp; legibility (p &lt; .05) THS-R: Tx group ↑ on all measures (p &lt; .05) MHA btwn groups: Greater ↑ on alignment (p = .0007) &amp; size (p = .000) THS-R: Greater ↑ on 2 subtests (p &lt; .0203) Time 2: MHA: Tx group ↑ on all measures except spacing, legibility, &amp; rate (p &lt; .05) THS-R: Tx group ↑ 6 subtests (p &lt; .05) MHA btwn groups: Greater ↑ in alignment &amp; size (p &lt; .0003) THS-R btwn groups: Greater ↑ on all subtests (p &lt; .0061)</td>
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<tr>
<td>2015</td>
<td>OTJR USA</td>
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<td>No In/Ex criteria described, non-randomization of ctrl/tx groups, not compared to another int group.</td>
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</tbody>
</table>
### Descriptive Studies

<table>
<thead>
<tr>
<th>Author, Year, Jrl, Country</th>
<th>Study Objectives</th>
<th>Study Design/Level of Evidence</th>
<th>Participants: Sample size, description In/Ex Criteria</th>
<th>Response Rate, Instruments &amp; Procedures</th>
<th>Results</th>
<th>Study Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benson et al. 2016 USA JOTSEI</td>
<td>To examine teacher’s perceptions of the roles of OTs in a school setting via online survey.</td>
<td>Descriptive survey IV D3 2/3</td>
<td>N = 306 surveys sent out to school administrators GenEd &amp; SpEd teachers who have worked w/ OTs in PA schools N = 47 surveys returned n=37 SpEd teachers n=10 GenEd teachers In: GenEd &amp; SpEd teachers in PA schools</td>
<td>31-question anonymous online survey sent to 306 school administrators in PA asking to be forwarded to teachers. No response rate can be calculated because no way to determine how many teachers received the survey. Survey measured background &amp; employment information of participants &amp; their opinion on school-based OT.</td>
<td>77% stated OTs are a valuable member of the team. 53% want to work with OTs more, 37% reported a good relationship w/ OTs. 22% found OT as “not important”. 80% regularly work w/ OTs as either collaborators or consultants. 20% rarely see or speak to OTs, sometimes only in IEP meetings.</td>
<td>Surveys were sent out to school administrators &amp; not to teachers. Unable to get response rate because unsure how many teachers were initially sent survey from administrators.</td>
</tr>
<tr>
<td>Cahill 2010 USA JOTSEI</td>
<td>To document the contributions of OTs implementing RtI, specifically looking at whole school/classroom ints.</td>
<td>Descriptive survey IV D3 1/3</td>
<td>N =12 OTs N=24 surveys completed Convenience sample of OTs from a large urban school district working in pre-k &amp; Head Start programs OTs could attend prob solving meetings voluntarily In: Worked in district, participate in RtI initiative</td>
<td>The OTs were emailed monthly for 6 mo to take survey if they had attended prob solving meeting. RR = 33% OTs RR range= 16% to 58% (Over 6 months)</td>
<td>42% of OTs provide support in self-regulation, attending, FM, GM, HW, self-management, transitioning, self-help, &amp; sensory processing. 75% of OT suggestions implemented by school-based problem-solving teams.</td>
<td>Small sample size, absence of OTs demographic information, low response rate, not a lot of work done to ↑ rigor.</td>
</tr>
</tbody>
</table>
### Qualitative Studies

<table>
<thead>
<tr>
<th>Author, Year, Jrn, Country</th>
<th>Study Objectives</th>
<th>Study Design/Level of Evidence</th>
<th>Participants: Sample Size, Description In/Ex Criteria</th>
<th>Methods for enhancing rigor</th>
<th>Themes &amp; Results</th>
<th>Study Limitations</th>
</tr>
</thead>
</table>
| Bose & Hinojosa 2008 AJOT USA | To describe the perspective of school-based OTs working in inclusive classrooms collaborating w/ teachers. | Grounded theory | N=6 OTs  
n=5 female  
n=1 male | Triangulation of data, prolonged engagement, auditable trail, comparisons btwn individuals, member checking | **Benefits of Collaboration:** Work to meet goals of the child, a lot of the focus on the study was the process of collaboration in order to meet said goals. | Small sample size, no opportunities for team meetings to directly facilitate collaboration, all from the same area. |
|                           |                  | NR                            | Approximately 1 hour in-depth interviews over 20 wk period |                             | **Other themes** include:  
- Challenges of Interactions  
- Attachment to Expert Status  
- Communication failure |                  |
|                           |                  | Q2                            | Purposeful sampling via fliers in NY city metropolitan area |                             | Overall participants expressed high importance of being a team member (vs consultant) in order to work toward supporting kids. |                  |
|                           |                  | N/A                           | In: Licensed to practice, 2 yr clinical experience, 20+ hr/wk in school setting, 4+ hr/wk in inclusive prek-2nd grade classroom, sign consent form |                             |                 |                  |

**In/Ex Criteria:**
- **In:** Licensed to practice, 2 yr clinical experience, 20+ hr/wk in school setting, 4+ hr/wk in inclusive prek-2nd grade classroom, sign consent form
- **Ex:**
<p>| Koelbl et al. | To describe experiences of OTs who implemented STEPS-K &amp; what collaboration w/ teachers in the construct of an RtI program involved. | Phenomenological | ( N=6 ) OTs | Member checking, auditable trail, comparisons btwn individuals, peer checking | <strong>Theme:</strong> Knowledge exchange - Interchange of dialogue skills, &amp; professional opinions btwn OTs &amp; teachers enhancing rapport &amp; program carryover. |
| 2016 | | NR | Selective sampling of therapists who participated in STEPS-K pilot study, &amp; a therapist in the Northwest. Semi-structured phone interviews ranging from 20-60 minutes. In: Currently working in school-based setting, implemented STEPS-K within last year | <strong>Subthemes:</strong> Conversation - Observe teachers using OTs input in classroom to improve student performance, teachers use OT language &amp; cueing. OTs gained classroom management skills, familiarity with children &amp; knowledge on K material. Camaraderie - Collaboration strengthened working relationships btwn teacher &amp; OT. OTs felt they could ask teachers for feedback &amp; explain what OT is. Creating Best Fit - Easier to make programmatic changes to fit each teachers style, teachers requested to use the OT collaborative program in subsequent years. | No clear sampling procedure, responses were specific to the STEPS-K classroom wide intervention &amp; therefore not generalizable, therapists volunteered for the study &amp; may have had more positive reviews of working with teachers, sample size of teachers was small &amp; does not represent the breadth of school-based OTs. | USA |</p>
<table>
<thead>
<tr>
<th>Blackwell &amp; Dunn</th>
<th>To describe key characteristics necessary to create an embedded int within an early education setting.</th>
<th>Grounded theory (deductive analysis)</th>
<th>$N=3$ early childhood teachers, 2 at end of study</th>
<th>Peer checking</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td></td>
<td>$N=5$ of 8 planned meetings transcribed</td>
<td>Purposeful sampling</td>
<td></td>
</tr>
<tr>
<td>JOTSEI USA</td>
<td></td>
<td>In: Teachers who participated in the connected feasibility study.</td>
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<td>Therapist relates to teacher – Relationship with respect &amp; collaboration between OTs &amp; teachers needed for teacher investment &amp; insight related to int.</td>
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<td>Therapist translates therapeutic int – To improve teacher insight &amp; investment in int, OTs adapts activities to be used in classrooms to meet needs of students &amp; teachers. Explanation of relevant activities to teacher also helpful.</td>
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<td>Teacher invests &amp; demonstrates insight related to therapeutic int – Improved Os from teachers investing in int &amp; accepts ownership of it. Teacher insight through use of int also improves Os &amp; development of routines.</td>
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<td>Missed opportunities – Low quality feedback, lost chance for collaboration, &amp; directive interaction style weaken impact of first three themes in creating positive O’s.</td>
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<td></td>
<td></td>
<td></td>
<td>Small sample size, no clear sampling procedure, only 2/3 teachers finished study, only 5/8 of planned meetings were examined for themes.</td>
<td></td>
</tr>
<tr>
<td>Author, Year, Jrn, Country</td>
<td>Study Objectives</td>
<td>Study Design/ Level of Evidence</td>
<td>Number of Papers included, In/Ex Criteria</td>
<td>Intervention &amp; Outcome Measures</td>
</tr>
<tr>
<td>-----------------------------</td>
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<tr>
<td>Engel et al. 2018 AJOT USA</td>
<td>To examine the efficacy of curriculum-based HW int in pre-k to 2nd grade classrooms.</td>
<td>Systematic Review I D1 N/A</td>
<td>N=13 articles II: $n=11$ III: $n=2$ In: Published Jan 2006-Dec 2015, kids w/ &amp; w/o disabilities, curriculum-based HW program, occurred in GenEd classroom, int longer than 1 session, int w/ clear beginning &amp; end Ex: Kids older than 5th grade, int occurred outside classroom, lacked clear int</td>
<td><strong>Int</strong>: Write Start, HWT, HWT-Get Set for School, Peterson Directed HW Curriculum, FM &amp; Early Writing Pre-K curriculum, Size Matters HW Program, Write Direction, HW clubs, &amp; explicit HW programs. <strong>O</strong>: HW Legibility HW Speed HW Fluency Specific Curricula Age at Instruction Instruction Length</td>
</tr>
</tbody>
</table>
Abbreviations Key

- ↑ = increase
- ↓ = decrease
- < = less than
- > = greater than
- & = and
- 1º = primary
- AP = academic performance
- btwn= between
- CCP = Comfortable Cafeteria Program
- comb. = combined
- ctrl = control
- diff = difference
- ES = Effect size
- ETCH-M = Evaluation tool of children’s handwriting-manuscript
- Ex = exclusion
- FM = Fine motor
- GenEd = general education
- GM = gross motor
- HW = handwriting
- HWT = Handwriting W/out Tears
- IEP=individual education program
- In = inclusion
- Int = intervention
- ISB = in seat behavior
- K= kindergarten
- M = mean
- MHA = Minnesota Handwriting Assessment
- min = minutes
- mo = month
- N/A = not applicable
- NR=not rated
- O = Outcome
- OSELA = Observation Survey of Early Literacy Achievement
- OT=occupational therapy
- OTs= occupational therapists
- PA = Pennsylvania
- PALS=preschool and language simulation (integrated classroom)
- PCI = Proportional Change Index
- PDMS-2 = Peabody Developmental Motor Scales-2
- perf = Performance
- Pre-k = preschool
- RR = response rate
- RtI = response to intervention
- s = seconds
- sig = significant
- SpEd = special education
- SMHP= Size Matters Handwriting Program
- stat sig= statistically significant
- STEPS-K = Specialized Teaching and Enhancement of Performance Skills for Kindergarteners
- THS-R = Test of Handwriting Skills, Revised
- tx = treatment
- VAS = visual analogue scale
- VM = Visual-motor
- VMI = Visual-Motor Integration test
- w/ = with
- w/o = without
- WJIII = Woodcock-Johnson Tests of Achievement
- wk=week
- yr= year
Summary of Key Findings

Systems-level Interventions in Classrooms and Schools

Ohl et al. (2013) found that while occupational therapy (OT) intervention statistically significantly improved VMI and BOT-2 outcomes, there is limited experimental evidence that supports a systems-level OT intervention. Engel, Lillie, Zurwawski, & Travers (2018) found that no single handwriting curriculum is most effective and that a minimum of 6 weeks, or approximately 15 hours, of classroom-wide instruction is sufficient to improve various aspects of handwriting such as legibility, speed and fluency. All outcome studies were completed in a school setting, ten were completed in a school classroom, and one was done in a school cafeteria. Seven studies were completed in one to three classrooms within one school. Four studies were completed over multiple schools in the same district, between two and twelve schools. Most studies were done in young elementary age students. There is strong evidence that OT systems-level interventions improve skill development as all 11 outcome studies showed improvement in at least one skill development area (i.e.: social participation, fine motor, etc.) as measured by tests such as ETCH-M (Case-Smith et al., 2011, 2012, & 2014), WJIII (Case-Smith et al., 2011, 2012, & 2014), or MHA (Case-Smith et al., 2011; Howe et al., 2013). The majority of the outcome studies focused on handwriting and showed statistically significant improvements in at least one area of this occupational skill and found strong evidence that a systems-level OT approach is an effective form of intervention. There is mixed evidence that OT systems-level interventions improve visual spatial skills as tested by VMI, as noted from Bazyk et al. (2009) and Howe et al. (2013).

Collaboration in the Classroom

Many of the outcome and experimental studies utilized co-teaching (Case-Smith et al., 2011; Case-Smith et al., 2012; Case-Smith et al., 2014; Silverman, 2011), consultation (Donica, 2015; Ohl et al., 2013; Pfeiffer et al., 2015), collaboration (Randall, 2018), or coaching (Bazyk et al., 2018) between
occupational therapists and teachers during their systems-level intervention. Of these studies, only Randall (2018) explored the teachers or occupational therapists’ perspectives around working together. Five qualitative and descriptive studies reviewed focused on collaboration between teachers and occupational therapists (Benson, Szucs, & Mejasic, 2016; Bose & Hinojosa, 2008; Cahill, 2010; Koelbl, Myman., Wuestefeld, Elenko, & Ohl et al., 2016; Blackwell & Dunn, 2016); two focused on occupational therapist perspectives (Bose & Hinojosa, 2008; Koelbl et al., 2016), and three focused on teacher perspectives (Benson et al., 2016; Blackwell & Dunn, 2016; Randall, 2018) around collaboration. Multiple studies found there were challenges within collaborating, specifically in communication between therapists and teachers and a lack of understanding in the purpose of the intervention (Blackwell & Dunn, 2016; Bose & Hinojosa, 2008; Cahill, 2010). However, all studies found benefits to systems-level interventions in supporting the needs of students through training and/or supporting teachers in implementing systems-level intervention. Many studies found it is important to consider the individual needs of the teacher and classroom during collaboration (Blackwell & Dunn, 2016; Bose & Hinojosa, 2008; Koelbl et al., 2016). The similarities in the findings of qualitative and descriptive studies, including both the occupational therapist and teacher perspective, provide moderate evidence for collaboration between occupational therapists and teachers to support students on a systems-level. Evidence from the outcome and experimental studies provides strong evidence that an occupational therapist can implement an effective handwriting intervention in the classroom in collaboration with teachers on a systems-level.

Problems with Terminology and Definitions
As stated on page 13 in Search Outcomes/Quality Control, inconsistencies and a lack of definitions of the concepts of collaboration, co-teaching, consulting and coaching were noted. While there is
likely some overlap between these concepts, the inconsistencies in terminology create a challenge in pinpointing what each method entailed, as well as which style of occupational therapist/teacher interaction may be most effective. Bose and Hinojosa (2008) found that collaboration worked better than consultation, however, many outcome studies utilizing a “consultation” technique had positive results for students (Donica, 2015; Ohl et al., 2013; Pfeiffer et al., 2015). While there is moderate evidence that a collaborative approach is effective, there are mixed results about which specific type of teacher-therapist interaction is the most effective. There were similar difficulties in the definition of systems-level interventions. No research was found that defined “systems-level”, so a definition was created for this CAT table. The researchers defined the term “systems-level”, to encompass a broad spectrum at a district, school and classroom level. Examples of systems-level interventions can be found on page seven.

### Implications for Consumers

These results have a range of implications across consumers and within each consumer group of systems-level occupational therapy. The consumers for this CAT can include teachers, school administrators, children and families. Implications that span all consumers include:

- Improvements in the areas of handwriting, visual motor, fine motor and social skills could occur across entire classrooms/schools.

- Handwriting interventions, when provided at a systems-level, have positive outcomes which could be beneficial to the completion of academic assignments due to increased handwriting legibility which could subsequently support academic performance.

- Collaboration between teachers and occupational therapists takes time and support from all consumers in order to be successful.
These results also have implications that are specific to certain types of consumers. Specific implications include:

**Teachers:** When teachers collaborate with occupational therapists, programs involving occupational therapy can be altered to fit the teacher’s style which could support program carryover to improve student performance (Koelbl et al., 2016). Students can achieve greater improvements when adaptations and cueing are used in the classroom compared to pull-out instruction (Silverman, 2011). The results from this study imply that teachers should prioritize time for collaboration with occupational therapists, specifically around handwriting. Teachers should follow the requirements of the program. However, they should be able to incorporate these requirements in a way to best fit their classroom’s individual needs in order to support follow through of systems-level OT intervention.

**Administrators:** Systems-level occupational therapy interventions can reach more teachers and students in a school setting than one-on-one interventions. This holistic intervention type can lead to greater outcomes and save resources for children who may need more involved services. This could also save valuable resources in time and/or money for the district. Administrators should work with occupational therapists to develop the most cost-effective and beneficial systems-level programs for the district to improve children’s academic performance and overall skill development.

**Students and Families:** A systems-level delivery method allows the students requiring services to remain longer in the least restrictive environment and avoid missing class time from a pull-out OT session. This systems-level approach also allows “at risk” children who are not eligible for special education to receive additional assistance. While these results do not discuss families/caregivers
specifically, they should support OT programs in the classroom and across home practice to improve handwriting, visual motor, fine motor and social skills in students.

**Implications for Practitioners**

Important implications for practitioners to consider when implementing a systems-level intervention include:

- Practitioners might have a decrease in the number of referrals they receive, as “at risk” students improved more than “average” students after an occupational therapist co-taught a handwriting curriculum (Case-Smith, 2012).
- While collaboration is initially time consuming, time commitment could eventually be low (i.e., consultation vs collaboration) for skill development programs, such as handwriting, once they have been established.
- Systems-level approach allows treatment of many students in a small amount of time, increasing the efficiency of services.
- Practitioners should communicate with teachers as communication is highly linked to successful program implementation and student improvement on a systems-level.
- Practitioners should consider the individual needs of teacher and classroom for successful communication and relationship building between occupational therapist and teacher when working on a systems-level.
- Practitioners should advocate for the ability to treat children at district and classroom levels with treatment time to collaborate with teachers in order to provide services on behalf of several children at once.
- Practitioners should develop programs that incorporate skill development in areas beyond handwriting such as visual motor, fine motor and social skill development.
Implications for Researchers

The following are implications, and gaps in literature for researchers to consider:

- Any research relating to systems-level interventions should be read carefully due to lack of concrete definitions and consistency in this area, specifically related to “systems-level” and “Tier-1”.
- Researchers should establish a definition of systems-level and Tier-1 approaches to draw a clear distinction between the two service models.
- Researchers should conduct studies that specifically involve social skills and family involvement models.
- Additional research should be completed with OT as a school wide intervention expanding beyond the classroom setting, as well as intervention dosage required to make skill development improvements in students.
- Supplementary research should be completed to compare collaboration, consultation, co-teaching, and coaching across classrooms, schools, and districts to find an optimal intervention within schools.
- Research should be conducted at a higher level of evidence as current studies are mostly at the O3 and O4 level, as defined by Tomlin & Borgetto’s (2011) research pyramid, to create clearer implications for occupational therapists.
Bottom Line for Occupational Therapy Practice/ Recommendations for Best Practice

When systems-level curricula and programs are implemented, there is moderate to strong evidence that occupational therapists can support both students and teachers in a classroom setting. There is strong evidence that a systems-level OT approach is effective in improving skill development, especially in at least one area of handwriting development. Based on this research, systems-level interventions should be a more widely used and acceptable form of OT intervention in school as it has the potential to benefit a greater number of students and save district resources. Also, current research must be read carefully to distinguish how the article defines systems-level, RtI, or Tier-1 interventions. Finally, occupational therapists should communicate with teachers to create the best intervention designs to fit their classroom needs.
References


Involvement Plan

Introduction

The collaborator for this project is Dr. Julie Anderson, DrOT, OTR/L. Dr. Anderson works in a school setting and identified a need for a districtwide handwriting curriculum in kindergarten and first grade classrooms due to the number of children being referred for occupational therapy (OT) services for handwriting. After discussing the CAT table findings and implications, Dr. Anderson identified a course of action that was most beneficial for her. Consistent with the OTPF-3 (American Occupational Therapy Association, 2014), “client” included students, the staff working with students and the educational system. This project included implementing several aspects of knowledge translation (Palinkas & Soydan, 2012). The first step of the knowledge translation project was compiling information for the educational staff working in the Puyallup School District. Emphasis was on the staff at the school who will then make a decision affecting student outcomes specific to handwriting. A cost benefit analysis of three handwriting curricula was created and presented to the administration, teachers, and school board. Dr. Anderson felt this aspect of the project is key because those on the school board usually make decisions based on cost.

The second knowledge translation activity completed was a PowerPoint presentation with content including but not limited to the need for a curriculum, what curricula can be implemented in both kindergarten and first grade as well as the amount of training teachers receive about handwriting to complement the cost-benefit analysis. The purpose of this presentation was to show the administrators the importance of adopting one handwriting curriculum that is consistently applied across grade levels within the district. It included information from the completed CAT table such as implications for consumers, occupational therapists, and administrators. It also included the cost benefit analysis and the curriculum’s implementation plan (described below). Information incorporated from the CAT table
included evidence supporting a systems approach to handwriting, occupational therapy’s potential role in supporting teachers and the importance of collaboration. Additionally, more research was gathered regarding the importance of handwriting, video modeling and information specific to the Puyallup school district to include in the presentation. Dr. Anderson presented the slides that student researchers prepared. Additionally, the students designed a pre-and post-presentation survey to gather information about the audience’s views towards handwriting before and after the presentation that Dr. Anderson administered. The project chair, Dr. Swinth, assisted in creating the PowerPoint that was delivered to administrators.

The third and final piece of this knowledge translation project was creating an implementation plan. This plan could be modified for any handwriting curriculum, so when a curriculum is chosen, the school staff will have a set plan to follow. This included a logistical plan of how the handwriting curriculum would be implemented with staff and students. Pragmatics considered included: Time spent training teachers, how much time an occupational therapist needs to spend in and out of the classroom, time the handwriting curriculum is taught in the classroom, how many OT hours will be needed after the 1st, 2nd, and 3rd year of implementation. Dr. Anderson felt that the combination of these three knowledge translation steps, allowed her to make the most convincing argument possible to the district administrators and board.

Context

Dr. Anderson splits her time between two schools and works in a “caseload” based system meaning that the amount of work she does is based on the number of clients she sees not the number of hours she treats. Her current caseload is around 40 students and she works with a variety of professionals including other occupational therapists, speech therapists, teachers and administrators to create a collaborative and holistic treatment plan for each student and/or classroom. Based on the three
previously identified aspects of knowledge translation, the following are contextual factors in Dr. Anderson’s district that may affect this process.

The adaptability of implementing handwriting programs should have assisted in the translation process. A handwriting program can be incorporated into each teachers’ classroom as they see fit, as long as they are meeting the minimal standards of the program. Funding may be a contextual factor that can negatively impact the knowledge translation process. If the start-up cost for a handwriting program is high, or if there is a high annual cost, the administration will be much less likely to implement the program. Depending on how the current Board and administrators value handwriting skills and perceive the importance of a handwriting problem, fit may have been another barrier to implementation. If a handwriting program isn’t compatible with the Puyallup School District’s values, norms, and goals, they won’t agree on the benefit of implementing a handwriting curriculum districtwide. This could become a challenge as the current elementary standards, the Common Core, does not include handwriting as one of the benchmarks that needs to be met. While handwriting is an important aspect of writing, which is an aspect of the Common Core, this could potentially create a mismatch of fit and directives within the curriculum. The school district’s network of occupational therapists and teachers could help with the mismatch in fit, as Dr. Anderson has been working to ensure teachers are open to a consistent handwriting curriculum, and collaboration between OT and teaching staff. Finally, occupational therapists in Dr. Anderson’s district have Response to Intervention (RtI) time built into their contract schedule, which could be utilized to collaborate with teachers. This fit may be a support to implementing a handwriting curriculum across an entire district, as time spent on entire classrooms would not cut into one-on-one time with individual students.
## Tasks/Products and Target Dates

<table>
<thead>
<tr>
<th>Task/Product</th>
<th>Deadline Date</th>
<th>Steps w/ dates to achieve the final outcome.</th>
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</thead>
</table>
| Cost-Benefit analysis of programs that the Puyallup school district will use. The end product will be a comparison table of the desired programs. This will also compare costs of treating individual students vs the number of program hours required to run it (per school). | April 8th     | March 4th - gather information about pros/cons and cost for each handwriting program: Write Start, TV Teacher, HWT, Size Matters, Zaner-Bloser  
March 7th- gather information about average OT salary and calculate price per handwriting hour  
March 11th- check-in meeting, present project costs, know price per hour for OTs to log into project proposal  
April 1st- integrate the cost benefit analysis into the project proposal and PowerPoint presentation |
| PowerPoint presentation to present to the members of the district (Inservice) | April 8 – final draft of PowerPoint to Dr. Anderson for final edits  
April 30th - turn in final forms of CAT and project | March 11 – an outline of PowerPoint with titles, layout, and flow  
March 29th- draft of PowerPoint sent to chair and collaborator  
April 5th- second draft of PowerPoint sent to chair and collaborator  
Week of April 15th - Dr. Anderson presents and distributes/collects surveys (returned by April 19th)  
Week of April 22nd- compile survey data and add it to final thesis |
Opportunities

- OT teacher collaborations
- Hours required
- Initial program startup vs after first year

April 8th - final draft of proposals to Dr. Anderson

March 7th - have initial program startup vs after first year for Write Start, TV Teacher, HWT, Size Matters, Zaner-Bloser

March 11th - Decide what should be included in proposal.

March 26th - draft of implementation plan sent to chair

March 29th - second draft of implementation plan sent to chair and collaborator

April 1st - integrate the project proposal into the PowerPoint presentation

Expected Outcomes

The researchers planned to monitor and evaluate progress on the program elements by holding at least one regularly scheduled meeting for the student researchers in person once per week to discuss progress. At each weekly meeting, tasks were delegated and progress and barriers to the project were discussed. If barriers arose, immediate contact was made to the chair and/or collaborator if guidance was needed. Also, there was daily virtual communication through Google documents and other forms of media. The researchers had a check-in session with the collaborator and chair on March 11th to discuss the outcomes of the rough draft of the cost-benefits analysis, and PowerPoint outline. After deliberation, three handwriting curricula were selected to create proposals for. At the March 11th meeting, researchers also discussed the pre- and post-presentation survey which served as the data collection tool for this project.

The final outcome of the project implementation was evaluated based on the administrators and district official’s responses to the program proposal and PowerPoint presentation as documented by the
pre- and post-presentation survey given at Dr. Anderson’s presentation. If the district decides not to implement the proposal, the end product will be evaluated by Dr. Anderson as to whether she feels the knowledge translation project was completed to the fullest extent despite the rejection from the school board. If the district adopts a handwriting curriculum, then the implementation will be monitored by Dr. Anderson and the staff using the program proposal created by the student researchers.

**Knowledge Translation Summary**

Once the research was collected, several steps were completed to ensure the research was properly translated into a usable product for the school district. The first step included compiling information on several handwriting curricula to create a cost-benefit analysis for the district administrators (Appendix A). These curricula needed to have a structure that allowed for implementation in kindergarten and first grade classrooms. This process began with the collaborator, Dr. Anderson, choosing which curricula she felt would be most beneficial to her district. Once three curricula were chosen, Zaner-Bloser, Handwriting Without Tears, and TV Teacher, the researchers created price lists for the initial year of implementation and the subsequent years. The initial year included the base cost for the curriculum itself, first year of workbooks, and training costs for those administering the curriculum. The subsequent years included the cost of workbooks and any additional training needed to implement the curriculum.

In order to accurately estimate training costs, the collaborator provided a salary schedule for occupational therapists and teachers in the district. Since there was no data available for the number of students receiving occupational therapy services for handwriting, the collaborator had to estimate this number based on responses she received from colleagues in the district. Another estimate had to be made for the number of training and implementation hours it would take to roll out the curriculum. The number of training and implementation hours as well as number of students receiving 30 minutes of occupational therapy once per week and salary schedule were used to estimate the current cost of
occupational therapists teaching handwriting to individual students. In the end, a bar graph was created to compare the estimated cost of the three curricula to the estimated cost the district currently spends on individual handwriting instruction provided by occupational therapists. This graph was then imported into the presentation created for Dr. Anderson.

The second step was to create a practice guideline in the form of a district handwriting implementation plan to give the district administrators a step by step guide to disperse the curriculum across the district once one had been selected (Appendix B). To start this section of the project, Dr. Anderson provided an outline of her ideal implementation process. With this information, the researchers inputted the specific steps that would need to be completed to implement the curriculum for the first year and subsequent years. Some of these steps included purchasing booklets and specific timelines for data collection to track students’ progress with the curriculum. The only difficulty with this process was ensuring the guide was broad enough to fit whatever curriculum the district chose while still allowing specific details to provide a step by step guide for implementation. In the final meeting with the collaborator, the guide was edited to include an option for a half-district or select school implementation in the first few years instead of implementing the curriculum districtwide. This would allow the district to track data between students who have and have not received the district handwriting curriculum. After receiving edits from the chair and collaborator, the implementation plan was complete and embedded into the PowerPoint presentation. Due to the nature of this piece of the knowledge translation process, the outcome of the implementation plan will be monitored by Dr. Anderson and her colleagues as they continue the process of implementing a handwriting curriculum districtwide.

The final step of knowledge translation included the creation of a PowerPoint presentation Dr. Anderson presented to district administrators (Appendix C). This process began with the researchers creating a skeleton presentation from the CAT paper’s data and the cost-benefit analysis. Then a meeting
was held between the researchers, their committee chair, Dr. Yvonne Swinth, and the collaborator to decide how Dr. Anderson wanted to present the information to the district. At this meeting, it was decided that in order to convey teachers support of a districtwide handwriting curriculum, information would be obtained from the teachers in Dr. Anderson’s district about their opinions on implementing a handwriting curriculum. To do this, an informal survey, created by Dr. Anderson, was sent to teachers to gain their opinions on and experience with current handwriting curricula. This data was then added to the PowerPoint to include the teacher’s perspectives regarding the implementation of a single districtwide handwriting curriculum.

The researchers then compiled information from the CAT paper, new research about the specific handwriting curricula and different aspects of learning such as video modeling into the presentation. Once this was completed, a final meeting took place to finalize the slide order and information to be presented by Dr. Anderson. At this final meeting, it was decided that the district handwriting implementation plan would be added to the presentation instead of providing a paper copy at the meeting. After a series of edits by the chair and collaborator, the presentation was complete.

Dr. Anderson presented this information to members of the administration. Pre- and post-presentation surveys were provided during the presentation to track the impact of the presentation and the administrator’s views. The surveys revealed that all the administrators in attendance agreed a consistent handwriting curriculum should be implemented and they all chose TV Teacher as the curriculum that would be most beneficial to the district. Additional presentations will be completed by the collaborator to veteran teachers at new teacher trainings to continue educating school staff of the importance of a consistent handwriting curriculum.
**Interim Dates of Completion**

<table>
<thead>
<tr>
<th>Dates</th>
<th>Process completed</th>
</tr>
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<tbody>
<tr>
<td>March 4th-11th</td>
<td>Collect information on handwriting curricula and OT salaries and add them to google document. Also create a cost benefit analysis for curricula and have a skeleton of a PowerPoint outline.</td>
</tr>
<tr>
<td>March 11th</td>
<td>Phone meeting with collaborator and chair to go over district implementation plan ideas, the PowerPoint, and survey.</td>
</tr>
<tr>
<td>March 11th-March 25th</td>
<td>Finish district implementation plan, work on PowerPoint, start pre-post survey for board/administration.</td>
</tr>
<tr>
<td>March 21st</td>
<td>Collaborator sends out survey to kindergarten and first grade teachers.</td>
</tr>
<tr>
<td>March 26th</td>
<td>Send district implementation plan draft to chair.</td>
</tr>
<tr>
<td>March 27th</td>
<td>Receive feedback of district implementation plan from chair.</td>
</tr>
<tr>
<td>March 27th-29th</td>
<td>Implement feedback on district implementation plan, finish PowerPoint, finish survey, send draft emails to collaborator and chair for revision.</td>
</tr>
<tr>
<td>March 30th</td>
<td>Begin final paper layout, etc.</td>
</tr>
<tr>
<td>April 3rd</td>
<td>Receive survey results from kindergarten and first grade teachers.</td>
</tr>
<tr>
<td>April 4th</td>
<td>Incorporate survey results from teachers into PowerPoint presentation.</td>
</tr>
<tr>
<td>April 5th</td>
<td>Feedback received from chair.</td>
</tr>
<tr>
<td>April 6th</td>
<td>Feedback received from collaborator.</td>
</tr>
<tr>
<td>April 8th</td>
<td>All drafts edited and returned to chair and collaborator for final editing.</td>
</tr>
<tr>
<td>April 9th</td>
<td>Meeting with collaborator to discuss PowerPoint and upcoming presentation.</td>
</tr>
<tr>
<td>April 15th</td>
<td>Feedback received from chair.</td>
</tr>
<tr>
<td>April 15th</td>
<td>Final drafts sent to collaborator for presentation. Start embedding final drafts into thesis paper.</td>
</tr>
<tr>
<td>April 16th</td>
<td>Collaborator presents to administrators and other district members at 3:15pm.</td>
</tr>
<tr>
<td>April 17th</td>
<td>Researchers meet to work on paper and divide writing sections</td>
</tr>
<tr>
<td>April 22nd</td>
<td>Collaborator gives completed surveys to researchers and a report from the presentation.</td>
</tr>
<tr>
<td>April 22nd</td>
<td>Researchers meet with chair to discuss final paper and poster presentation.</td>
</tr>
<tr>
<td>April 24th</td>
<td>Editing meeting between researchers.</td>
</tr>
<tr>
<td>April 29th</td>
<td>Editing meeting between researchers.</td>
</tr>
<tr>
<td>April 30th</td>
<td>Thesis submitted to chair.</td>
</tr>
</tbody>
</table>
How Activities Were Monitored

In order to carry out the involvement plan, the research group had to be very diligent about adhering to the outlined due dates. This was done through use of a calendar and frequent check-ins between the student researchers. Meetings between the chair and community practitioner were also scheduled throughout the process to check progress and answer questions. The researchers shared multiple drafts of the project with the chair and collaborator to allow enough time to incorporate feedback.

An Evaluation of Outcomes

Outcomes were measured through pre-presentation survey (Appendix D) and post-presentation survey (Appendix E) on the day Dr. Anderson presented the PowerPoint to administrators in the Puyallup School District. The pre-presentation survey included five questions and the post-presentation survey included six questions. Response options used a Likert scale with several places to explain why the participant selected their answer. Four of the questions on the pre-presentation survey were repeated in the post-presentation survey to measure change. The survey questions included, but were not limited to, the participant’s role in the district, the importance of teaching handwriting through a consistent curriculum, the importance of handwriting to a student’s academic success, and which curriculum would the participant choose at this time. The purpose of this survey was to determine whether the administrators’ experienced a change in knowledge and perception about the use of a consistent handwriting curriculum, their desire to implement a handwriting curriculum, and which curriculum they would choose to implement.

Three administrators attended Dr. Anderson’s presentation and completed the pre- and post-presentation surveys. The only change within repeated questions was one individual moved from feeling “knowledgeable” about handwriting curricula in the pre-presentation survey to feeling “extremely
knowledgeable” after the presentation. This change implies that the presentation was effective in providing education about various handwriting curricula. In the pre-presentation survey, all three administrators felt that it is either “extremely important” or “important” to teach children handwriting through a consistent curriculum. This remained unchanged after the presentation, which shows that administrators within the Puyallup School District understand the importance adding a curriculum and have now been provided with a possible implementation plan to put their beliefs into action. Post-presentation, all three administrators felt the Puyallup School District should implement a districtwide handwriting curriculum. One comment written by an administrator on the pre-presentation survey stated “How much time will it take during the day, what’s the cost to the district? There are so many questions,” indicating the participant required more information before deciding. Other comments written on the post-presentation survey included wanting tip sheets for the best practices in handwriting. The additional information requested will be provided by the collaborator at a later time. The three administrators present had experience with TV Teacher, Handwriting Without Tears, and Zaner-Bloser, which, according to the collaborator, enabled a thorough conversation on the pros and cons of these curricula during and after the presentation. In the post-presentation survey, all participants selected TV Teacher as the handwriting curriculum they would use within the district at this time.

As a result of the presentation, the administrator of the kindergarten academy in the Puyallup School District will be using TV Teacher as the academy’s curriculum. This indicates the curricula chosen for the presentation were appropriate and informative in supporting the need for the district to use a consistent handwriting curriculum. While the other administrators were not ready to make a decision immediately post-presentation, they agreed on the need for a consistent curriculum. The collaborator plans on completing presentations with veteran teachers at new teacher trainings. Dr. Anderson would like to create writing instructional support teams to establish best practices and
strategies to continue spreading information on the importance of a consistent handwriting instruction at a district level. While the audience of the presentation was smaller than anticipated, the collaborator felt it was a highly efficient way to start the process of beginning a districtwide handwriting curriculum due to the depth of conversation about possible implementation plans.

A limitation of this outcome measure is the small number of participants and the lack of variety in their roles in the district. Including a larger and varied audience (occupational therapists, teachers, and paraeducators) would have given more reliable results on the effectiveness of the presentation in impacting thoughts and beliefs.

Once a handwriting curriculum is implemented by Puyallup School District, outcomes should be measured by comparing pre- and post-curriculum handwriting samples. If half the district, or only several classrooms, begin using a consistent curriculum, improvement in writing samples from throughout the school year can be compared between curriculum-using and non-curriculum-using classrooms to determine the effectiveness of the handwriting curriculum. These results can be utilized both in research studies to further explain the importance of a consistent handwriting curriculum in kindergarten and first grade and to reassure the district of the benefits of the curriculum.

**An Analysis of the Overall Project Process**

Throughout the critical analysis and knowledge translation process, the research team encountered many challenges and facilitators to this project. These factors provided several learning opportunities and helped shape this research. At the beginning of this process, it was challenging to create a research question that was narrow enough to address the needs of the community practitioner, Dr. Anderson, while broad enough to capture an adequate number of articles for analysis. Communication with the chair and community practitioner was extremely helpful during the development of this research question, as well as inclusion and exclusion criteria.
The search process was also challenging at times, as the researchers screened hundreds of articles, combed through reference lists, and tracked references through a feature on Google Scholar. The research team developed a system for tracking searches as consistent documentation was imperative to prevent re-checking references and having an accurate search table. This experience was helpful as the researchers gained skills to efficiently screen and find relevant articles, which is an important skill for an occupational therapy practitioner.

The research team was grateful for the support from the chair, mentor and collaborator in synthesizing and appraising the selected topic. Organizing the large amount of data was challenging at times, but input was received from the chair and collaborator around organization and formatting of information throughout this process. This analysis process will be helpful as future practitioners, as it reinforces professional reasoning and critical thinking.

Developing a knowledge translation project was a smooth process thanks to input from the collaborator and her clear vision for the project. Some information was difficult to compile, however, through collaboration the researchers were able to collect extra information and translate the information from the CAT table to a PowerPoint presentation. Of the six administrators invited to the presentation, three were able to attend. The student researchers created a pre- and post-presentation survey based on relevant factors. While it was challenging to be confident in results with a sample size of three, the research team worked to examine outcomes with the information available.

Overall, the student researchers found this project to be useful, in that it provided practice to critically reason and examine research, as well as implement the research in a practice setting. Gathering the information and recrafting it to be understood by a broad audience was challenging and required a deep understanding of the material. Having the opportunity to potentially support change through translation of the research into an implementation plan for the district was a unique and beneficial
opportunity. The creation of all of the aspects in this thesis required frequent communication between all members of the team to keep a consistent vision and timeline.

**Recommendations for Future Projects**

This thesis provided several avenues in which future occupational therapy graduate students can continue building upon systems-level research and handwriting implementation plans. The research above shows that as long as a consistent handwriting curriculum is taught to students, it does not matter which one is chosen. This means that there are numerous opportunities for implementation plans to be created and customized for districts around the country. Future projects could focus on creating these plans as well as annual data tracking systems to track handwriting statistics once the handwriting curriculum has been implemented into kindergarten and first grade classroom.

Due to the strict inclusion/exclusion criteria placed by the researchers, only nineteen studies qualified for use in this review. It might be interesting to widen the research net to all countries who use the English alphabet to compare the efficacy of systems-level handwriting curricula between countries. This may reveal other curricula that could be available to United States districts that may have been studied longitudinally or have proven to be more efficacious. Furthermore, as handwriting grows in controversy due to emerging technology and computer use, a future research team could study the effects of handwriting on literacy and the longitudinal impacts of handwriting on academics. This would be an important step in handwriting research as literacy is a key school standard that is frequently tested. Typically, school administrators look for the best programs to enhance student test performance and overall success in schools.

Finally, the aim of this thesis was to study all systems-level evidence of occupational therapy interventions in school districts. However, this team of researchers discovered that most published systems-level evidence focused on handwriting. It may be interesting for a future research team to study
this same question again in three-five years to examine if there has been an increase in evidence for various systems-level occupational therapy interventions in school districts.
References not in CAT


Appendix A

Cost Benefit Analysis:
(Also embedded in the PowerPoint presentation)

How much do they cost?

<table>
<thead>
<tr>
<th>Handwriting Program</th>
<th>First year cost per classroom*</th>
<th>Second year cost per classroom*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zaner-Bloser</td>
<td>$203.83</td>
<td>$203.83</td>
</tr>
<tr>
<td>TV Teacher</td>
<td>K-$245.50; 1st-$175.50</td>
<td>$110.50</td>
</tr>
<tr>
<td>Handwriting Without Tears</td>
<td>K-$499; 1st-$399</td>
<td>$200</td>
</tr>
</tbody>
</table>

*Does not include cost of training
All costs are estimates and subject to change

1st and 2nd Year Costs per District

Costs of Handwriting Programs

All costs are estimated and subject to change. Does not include training costs.
Appendix B

Handwriting Implementation Plan for Puyallup School District:

I. Form a handwriting committee of occupational therapists, paraeducators and teachers for support in implementation of districtwide handwriting program. This could potentially be a subcommittee of the reading/writing committee.

II. Decide on the best handwriting program to implement districtwide or in half of the district to generate comparative data of those students who received the curriculum and those who did not.

III. Purchase curriculum and supplies.

IV. The purpose of the handwriting committee is to:
   A. Develop training meeting structure
      1. Should the training be districtwide training?
      2. How often should the training occur?
   B. Plan data storage and tracking method. (aka- where will the data go?, who will be in charge of the data?) *Find out how Dibels data is entered/stored
      1. Kindergarten Method:
         a) Testing beginning of the year baseline copying data (same time as DIBELS testing)
         b) Testing midyear uppercase and lowercase from memory (same time as DIBELS testing)
         c) If concerns at midyear, make plan for additional intervention
         d) Testing end of year uppercase and lowercase from memory (same time as DIBELS testing)
      2. First Grade Method:
         a) Testing beginning of the year, baseline for retention of upper- and lowercase letters
         b) Testing midyear for struggling students (same time as DIBELS testing)

V. Implement the following roll-out plan:
   Year One:
      A. Handwriting committee schedule training of new handwriting program/protocol
1. Training to include: paraeducators, teachers (K-1, sped, Title 1/ LAP), occupational therapists involved with kindergarten and first grade classrooms

B. Train K and 1st grade teachers, resource, paraeducators (ELL, Title, sped, building), OT, LAP/Title teacher before the start of school
   1. Briefly give background research/importance of handwriting
   2. Introduce new handwriting program and materials
   3. Discuss letter order, wording, and progression (this will likely be dictated by the curriculum selected)
   4. Training should include importance of teacher/OT collaboration and time to come up with a collaboration plan
   5. Each teacher makes a plan/schedule for 10-15 minutes per day supported by admin

C. Complete beginning of the year testing for both kindergarten and 1st grade classrooms

D. Occupational therapists in each school building can support teachers as needed
   1. Occupational therapists are in classroom observing, supporting, and/or teaching at least once per week to ensure consistency for handwriting implementation.
   2. Occupational therapists will document all interactions with teachers and observations in the classrooms.

E. Provide daily handwriting instruction for 10-15 minutes daily
   1. Each teacher to follow same letter formation sequence using the same vocabulary and teaching methods, consistent with curriculum selected.
   2. Review letter formation using curriculum (possibilities: 1 per day or just classroom tricky letters)
   3. Have 10-15 minutes writing time focus on letter formation, spacing, alignment, neatness.

F. Collect the rest of the handwriting samples as required for data tracking.
   1. Kindergarten- Beginning of the year (done at this point), middle of year, end of the year
   2. First grade- beginning of year for all students (done at this point) and mid-year for struggling students

G. Handwriting committee to ensure all data is compiled from all 3 data tracking points
H. Handwriting committee to meet with administrators and district members to review 1st year data and adjust implementation plan and program as needed.

Year 2 and beyond:

A. Purchase any yearly materials (workbooks).
B. Handwriting committee to schedule a training for any new Kindergarten teachers, 1st grade teachers, and/or occupational therapists on handwriting program.
C. Handwriting committee to schedule an annual meeting (as part of RtI time) for occupational therapists, teachers and paraeducators to collaborate about handwriting implementation.
D. Collect data using same format as above.
E. Occupational therapists in classroom for handwriting instruction as needed with at least one classroom observation per classroom each semester. Occupational therapists in classroom at least once per week to ensure instruction consistency for new teachers only.
F. Handwriting committee to ensure data is collected at all three data points.
Appendix C

PowerPoint Presentation:

Why is handwriting important?
- Handwriting letters activates more of the brain than typing.
- Handwriting letters improves letter perception and letter processing.
- Handwriting supports the essential skills of reading, language production, and motor planning.
- Fluency (or handwriting and spelling) of writing supports written expression and idea development when writing.

Handwriting Research
- Formal or direct handwriting instruction is more effective than receiving no direct handwriting instruction or teacher-designed instruction.
- Handwriting instruction twice per week for 45 minutes is the most common intervention approach.
- Multiple studies show improvements with instruction once per week for 30 minutes.
- Evidence suggests that improvements in handwriting are ethereal when handwriting is addressed directly and consistently.

What does the evidence have to say about handwriting programs?
- Strong evidence suggests a systems-level approach with OT involvement is an effective form of intervention to improve at least one area of handwriting skill development (Gordon, Sowell, & Price, 2010).
- Engel, Lille, Zernike, & Taneva's (2012) found
  - No single handwriting curriculum is most effective.
  - Minimum of 6 weeks, or approximately 15 hours, of classroom wide instruction is sufficient to improve various aspects of handwriting.

Why would occupational therapy (OT) be involved in handwriting?
- Systems-level handwriting programs involving an occupational therapist have positive outcomes. For example:
  - Several areas of a child's skill development can be improved including handwriting.
  - Handwriting programs may help children who qualify for additional services (in what way?)
  - Handwriting programs may help many children "at risk" who are struggling to keep up, but are not eligible for an IEP.
  - It is essential to the successful completion of academic assignments which can positively support academic performance.

Statistics of handwriting and OT intervention in PSD?
- With an estimate of 80 children receiving 60 minutes of OT services per week for handwriting district wide, the current annual cost for individualized handwriting instruction is $65,155.
- This is based on an average salary for an OT with a masters degree and 5 years of experience. Please keep this figure in mind as we move forward.

*All numbers approximated.

What the Puyallup School District is currently doing
- There is currently no consistent program taught in the district.
- Current methods include: TV Teacher, Handwriting Without Tears, Zaner-Bloser, teacher created instruction, referral to occupational therapy for instruction, or no instruction.

Let's see what teachers in our district have to say!

Puyallup School District Kindergarten and 1st grade teachers survey results

Puyallup Teacher Statistics
- There are approximately 181 Kindergarten and 1st grade teachers in PSD with 53 responding.
- 23 1st grade teachers average of 3.6 years experience teaching.
- 20 Kindergarten teachers average of 3.4 years experience teaching.

4 received training after their education, 10 received training during education, 33 received no formal handwriting training.
Of the 20, with training, 13 reported 0 hours of formal training.
Survey results continued

Statistics on what’s being taught:
- 13 teach TV Teacher, 3 teach Zener-Bloser, 3 teach HWT, 1 teaches ReadWrite, 3 teach ‘other,’ make their own curriculum, and 22 don’t teach a special way.
- 28 of 53 teachers teach handwriting less than 20 mins per day, 22 teachers teach handwriting between 20-40 mins per day, and 3 teach over 40 mins per day.

With an average of 18.5 kids in a classroom, there is an average of 4.9 students with poor handwriting skills, which is 16.5%.

63 of 92 (69%) teachers agree that their students would benefit from having taught a single standardized handwriting curriculum in kindergarten and 1st grade.

Teacher Quotes

"Having taught both K and 1st for quite a few years each, K is so foundational. They NEED to learn these things in K, in my opinion. In first, we are teaching full paragraphs in these areas but again, it takes a year to build a habit. (Poor letter formation, no spacing, starting letters at the bottom, capitals in the middle of sentences, etc.) is a problem."

"TV teacher has been amazing and I have seen big improvements."

"I wish we had online access to the curriculum since most of us don't have internet drives for kids and we only have a few external drives to share."

"I use TV teacher because it was at my school and my team uses it. I have said handwriting without tears in another district and really liked that too."

"Zener-Bloser used song with formation so it meets more modalities."

Current handwriting training for teachers

- There is typically no course specific to handwriting.
- Teachers may receive education on handwriting within one of their general education courses.
- Handwriting training is not required in Washington state to become an elementary teacher.

What handwriting programs are available?

There are several handwriting curriculums out there. Listed below are a few examples:
- TV Teacher
- Zener-Bloser
- Handwriting Without Tears (HWT)
- Write Start
- Letter Direction
- Penmanship

What are other districts doing?

- Lake Washington - Zener-Bloser
- Edmonds - Zener-Bloser
- Renton - HWT
- Franklin Pierce - HWT in Kindergarten only*
- Orchis Sunshine Writing System

*used for intervention purposes after Kindergarten

Top Three Curriculums for Puyallup

<table>
<thead>
<tr>
<th>Zener-Bloser</th>
<th>TV Teacher</th>
<th>Handwriting Without Tears</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price</td>
<td>Consistent cost</td>
<td>Lower cost</td>
</tr>
<tr>
<td>Overview</td>
<td>Available online in English and Spanish</td>
<td>available in Spanish</td>
</tr>
<tr>
<td>Features</td>
<td>New technology that provides video based instruction activities</td>
<td>streaming video modeling</td>
</tr>
<tr>
<td>Cost</td>
<td>Purchase each kit each year until the kit is purchased and print shop reproductions</td>
<td>Video format may take flexibility</td>
</tr>
</tbody>
</table>

How much do they cost?

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<tr>
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</tr>
</tbody>
</table>

* Does not include cost of training for kids. All costs are estimates and subject to change.
OCCUPATIONAL THERAPY ON A SYSTEMS-LEVEL

1st and 2nd Year Costs per District

Zaner-Bloser
Website: https://www.zaner-bloser.com/teachers/handwriting/zaner-bloser-handwriting/index.php
QR code extensions: https://qr.qualads.com/zaner-bloser.png

TV Teacher
Website: https://tvteacher.com/
Download option: https://tvteacher.com/tvteacher.com/bundle/appx.js

Handwriting Without Tears
Website: https://handwritingwithouttears.com/teacher
Screener that anyone can use: https://handwritingwithouttears.com/teacher/screening/teacher-screening
The Handwriting Interactive Teaching Tool: https://handwritingwithouttears.com/teacher/screening/teacher-screening

Implications for Administrators
- Systems-level interventions can reach more teachers and students in a school setting than one-on-one interventions.
- Systems-level intervention leads to:
  - Greater outcomes
  - Safer response for children who may need more involved services and time and adept money for the district.
- Collaborate to develop the most cost-effective and beneficial systems-level programs for the district to improve children's academic performance and overall skill development.

What does the evidence say about the need for collaboration in the classroom?
- Several studies have utilized co-teaching (e.g., Smith et al., 2012; Smith et al., 2013; Smith et al., 2014; de Vries et al., 2015; Smith et al., 2016; Smith et al., 2017; Smith et al., 2018). Collaboration can extend beyond occupational therapists and teachers to support all students.
- Benefits of students through training and supporting teachers in implementing intervention.
- It is important to consider the individual needs of the teacher and classroom during collaboration (Smith, 2016; Smith et al., 2018). Meaning such-teacher needs to develop their own routine and process of teaching the curriculum.

Importance of Collaboration
- Strong evidence to support OT/teacher collaboration in the classroom to support students.
- Lack of communication can result in challenges in collaboration/implementation.
- Successful collaboration requires:
  - Strong communication
  - Individualization between OT/teacher team
  - Understanding of program by both teacher and OT
  - Time for team meetings, and opportunities to discuss progress.

Implications for Teachers and Paraeducators
- Students can achieve greater improvements when adaptations and cueing are used in the classroom compared to pull-out instruction (Smith, 2013).
- During collaboration, programs can be allowed to fit the teacher's style to support program carryover and improve student performance. For (Biddle et al., 2016).
- Teachers/Paraeducators could:
  - Follow the requirements of the program in a way to best fit their classroom's individual needs (Smith, 2013).
  - Prioritize time for collaboration with occupational therapists, specifically around handwriting (Smith, 2013).
Implications for Occupational Therapists

- There could be a decrease in the number of handwriting referrals as “at risk” children are treated.
- The time commitment could eventually be lower once the handwriting program has been established.
- A systems-level program allows for intervention for many students in a small amount of time, increasing the efficiency of services.
- Occupational Therapists and teachers should collaborate and consider their individual needs to create a successful program implementation for student improvement.

Potential Implementation Plan

1. Add handwriting focus to the writing curriculum committee.
2. Decide on best handwriting program to implement district wide.
3. Purchase curriculum and supplies.
4. Carry out rollout plan.
5. Collect data throughout to track progress.

See full “Handwriting Implementation Plan for Puyallup School District” for details.

Handwriting Implementation Plan for Puyallup School District

1. Form a handwriting committee of occupational therapists, interventionists, and teachers for support in implementation of district-wide handwriting program. This could potentially be a subcommittee of the reading/learning committee.
2. Decide on best handwriting program to implement district-wide or half of the district to compare data of those who received the curriculum and those who have not.
3. Purchase curriculum and supplies.

First Grade Method:

- Testing beginning of the year, baseline for retention of upper and lower-case letters.
- Testing midway for struggling students (same time as DIBELS testing)

Handwriting Implementation Plan for Puyallup School District (continued)

Year One (continued):

4. Occupational Therapists or district school social workers can support teachers as needed.
   1. Occupational Therapists are in classroom observing, supporting, and/or teaching at least once per week to ensure consistency for handwriting implementation.
   2. Occupational Therapists will document all interactions with teachers and observations in the classrooms.
   3. Provide daily handwriting instruction for 50-120 minutes daily.
      1. Each student in the same letter formation sequence using the same vocabulary and teaching methods, consistent with curriculum selected.
      2. Practice letter formation using curriculum (possibilities: 1 per day or last classroom teacher’s letter)
      3. Have 30-60 minutes each day for letter formation, spacing, alignment, neatness.
   1. Collect the rest of the handwriting samples as required for data tracking.
      1. Kindergarten: Beginning of the year (start at this point), middle of the year, end of the year.
   2. First grade: Beginning of the year for all students (start at this point), and end year for struggling students.

Handwriting Implementation Plan for Puyallup School District (continued)

Year One (continued):

5. Implement the following school plan.
   a. Meet committees to schedule time for handwriting program/protocol
      1. Training to include: paraeducators, teachers (K-1 quiz, Title I, LAP), occupational therapists, and kindergarten and first-grade classroom teachers.
   b. Task K and 1st-grade teachers, resource, paraeducators (K-1, Title I, LAP) (1st-grade teacher before the start of the year)
      1. Meet with teachers, paraeducators, and occupational therapists.
      2. Introduce new handwriting program and materials.
   c. Discuss letter formation, handwriting, and progress (this will likely be dictated by the curriculum selected).
   d. Training should include: importance of teacher/classroom collaboration and time to come up with a collaborative plan.
   e. Each teacher makes a plan/schedule for 10-15 minutes per day supported by admin.

Handwriting Implementation Plan for Puyallup School District (continued)

Year One (continued):

6. Handwriting committees to ensure all data is compiled from all 3 data tracking points.
   a. Handwriting committees to meet with administrators and district members to review 1st-year data and adjust implementation plan and program as needed.
Handwriting Implementation Plan for Puyallup School District (continued)

The Bottom Line

It does not matter what program is used. The research states that direct handwriting instruction is more effective than nothing at all.

High numbers of students transferring within the district to another classroom leads to confusion.

Long-term

System-level handwriting programs taught with collaboration between teachers and OTs can give all children the opportunity to learn and develop skills that support a child's success in school, may reduce handwriting referral which would save the district money and resources.

References (continued)


References (continued)


References (continued)


OCCUPATIONAL THERAPY ON A SYSTEMS-LEVEL
Pre-Presentation Survey

Disclaimer: All responses from this survey will remain anonymous. Data from this survey will be used by UPS students and faculty to support current and future decision-making and dissemination of information about this process for educational purposes. By filling out this survey you consent to allowing anonymous publication of your responses.

1) What is your role in the district?
   a) Teacher
   b) Administrator
   c) Occupational Therapist
   d) Other: ____________________________

2) How important is it for children to be taught handwriting through a consistent curriculum?
   a) Extremely Important
   b) Important
   c) Neutral
   d) Unimportant
   e) Extremely unimportant

3) How important is handwriting to a child’s academic success in school?
   a) Extremely Important
   b) Important
   c) Neutral
   d) Unimportant
   e) Extremely unimportant

4) How knowledgeable do you feel about handwriting curricula?
   a) Extremely knowledgeable
   b) Knowledgeable
   c) Not knowledgeable

5) Do you think Puyallup School District should implement a districtwide handwriting curriculum?
   a) Yes
   b) No
   c) I do not have enough information to make a decision

Please explain your choice:
Appendix E

Post Presentation Survey

1) Have your opinions changed about the need for a handwriting curriculum?
   a) Yes   b) No

   If yes, how have they changed:

2) How important is it for children to be taught handwriting through a consistent curriculum?
   a) Extremely Important   b) Important   c) Neutral   d) Unimportant   e) Extremely unimportant

3) How important is handwriting to a child’s academic success in school?
   a) Extremely Important   b) Important   c) Neutral   d) Unimportant   e) Extremely unimportant

4) Do you think Puyallup School District should implement a districtwide handwriting curriculum?
   a) Yes   b) No   c) I do not have enough information to make a decision

   Please explain your choice:

5) How knowledgeable do you feel about handwriting curricula?
   a) Extremely knowledgeable   b) Knowledgeable   c) Not knowledgeable

6) If PSD were to implement a handwriting curriculum districtwide, which handwriting curriculum would you chose at this time?
   a) Zaner-Bloser
   b) TV-Teacher
   c) Handwriting Without Tears

7) What other information would you like to know
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Name: Megan Buckingham  Date: 5/17/19

Signature of MSOT Student

Name: Shelly Goodfellow  Date: 5/17/19

Signature of MSOT Student

Name: Cate Hannan  Date: 5/17/2019

Signature of MSOT Student

Name:  Date:  

Signature of MSOT Student