

Research Data Table for the Write Way Infographic

Author/year	Study Purpose	Level of evidence Study design	Participants Study setting	Outcomes	Key results	Limitations	Reason for selection Main takeaway
Sinclair & Szabo (2015).	<p>Examine the impact of pencil size on preschool and kindergarten students' handwriting.</p> <p>Pencils examined: Golf pencil (3/4 cm diameter, 3 ½ in long) Short jumbo pencil (1 cm diameter, 4 in long) Standard pencil (3/4 cm diameter, 7 ¼ in long) Jumbo pencil (1 cm diameter, 7 ½ in long)</p>	<p><i>Level 3B</i> Action Research Cohort study</p> <p>A different pencil type was used on each day of the week, on Friday, students chose a preferred pencil.</p>	33 preschoolers & 16 kindergarteners attending the same urban school	Handwriting rubric developed for study includes: pencil grip, pressure, letter formation, and relationship to line, handedness, and height of grip	<p>No significant difference in legibility was found.</p> <p>Majority of student used tripod or quadrupod grip</p> <p><i>Most popular pencil:</i> Preschoolers most often chose a golf pencil. Kindergartners most often chose a jumbo pencil.</p> <p>Children maintained the same grip height on each pencil regardless of pencil type.</p> <p>Children who held the pencil at a higher level had "shaky light script" and children who held a lower grip had "firm darker writing."</p>	<p>Small sample size</p> <p>Handwriting rubric was not tested for validity or reliability.</p> <p>Outcomes may be impacted by a learning curve as children practiced throughout the week.</p>	<p>Compared four different pencil types/sizes and allowed for student choice.</p> <p>Although pencil type did not significantly impact handwriting legibility, students showed a preference for certain pencils. Instructors can encourage student choice in pencil selection without being overly concerned that it will impact legibility.</p>
Oehler et al. (2000).	<p>Examine the impact of pencil size and shape on the pre-writing of kindergarteners.</p> <p>Pencils examined: Standard round pencil (no dimensions given) Round jumbo pencil (7/8 cm diameter)</p>	<p><i>Level 3B</i> Cohort study Students were assessed three times on the same day, using a different pencil type each time.</p>	126 kindergarteners in central Indiana	Graphomotor Task Instrument	Pencil type did not significantly impact performance.	Grasp patterns were noted but only grouped as Dynamic Tripod, Lateral Tripod, Other, or Inconsistent. Although student most often fell into the category of Other, more details were not provided.	<p>Compared three pencil types.</p> <p>Because pencil type did not significantly impact handwriting performance, instructors can comfortably offer students a choice of pencil type.</p>

	Wide triangular pencil (7/8 cm diameter)						
Reidlinger et al. (2012).	<p>Examine the handwriting production of first graders using differently lined paper.</p> <p>Paper types examined:</p> <p>Foundations four-lined paper (each line is labeled with a name and a picture: apex line, has a picture of a cloud; midline has a picture of a plane; base line has a picture of grass; sub-base line has a picture of a worm. The space between each line is 5/16 in Handwriting Without Tears two-lined paper – bottom line represents the base of the letter, and the top line indicates the midpoint of a capital letter or the top of most lowercase letters (<i>a, c, e, ect.</i>)</p>	<p><i>Level 3B</i> Two-group design Students were randomly assigned the four-lined or double-line condition. Students were given a sample sentence to copy using either the four-line or double-lined paper. Samples were scored by one person.</p>	65 first grade students in Suffolk County, New York	Minnesota Handwriting Assessment	<p>No statistical difference between writing performance using four-lined paper or double-lined paper on legibility, form, alignment, and spacing. However, statistical difference in the category of size. Students using double-lined paper scored lower on the size category compared with students who used four-lined paper.</p> <p>More than half of the students in the double-lined group used the upper double line as an indicator for the top of tall letters (b, d, f, h, ect.) rather than a midline.</p>	<p>Did not consider three-lined paper or paper without lines</p> <p>Did not assess novice handwriters learning to write.</p> <p>Participants in this study had been taught handwriting with Zaner-Bloser method and unfamiliar with four-line or double-line paper.</p>	<p>Comparison of two differently lined paper.</p> <p>All participants were able to copy all lower case letters at the time of assessment. For children who are proficient with handwriting, paper selection may have a greater impact on letter sizing than legibility, form, alignment or spacing.</p> <p>Using differently lined paper than what students have practiced with, may cause confusion.</p>
Asher (2006).	Review of handwriting instruction by	<p><i>Level 4</i> Open-ended questionnaire</p>	23 - 5 th & 6 th grade teachers	N/A	Teachers reported using several different kinds of paper:	No comparison of handwriting quality on	Author's review of motor learning theory and recommendation

	classroom teachers.		7 - 3 rd and 4 th grade teachers 17 - K- 2 nd grade teachers From suburban school district		No lines Double-line Three-lines with dashed middle line. Different widths between lines Some teachers used different paper concurrently (one type for spelling, another for daily journals)	differently lined paper. Participant size	to keep task demands consistent during initial phase of handwriting instruction by minimizing the variations of paper.
Schwellnus et al. (2012)	Examine the impact of pencil grasp patterns on handwriting legibility and speed.	<i>Level 3B</i> Cohort study Video tapes of students performing assessment using a digitizing tablet, were analyzed to identify grasp pattern. A standardized assessment was used to measure handwriting speed and legibility.	120 4 th graders in Toronto	Children's Handwriting Evaluation Scale (CHES) Evaluation completed on digitizing tablet with an instrumented pen (11 mm in diameter) high friction tip to simulate pencil and paper. Handwriting Proficiency Screening Questionnaire (completed by teacher)	Grasp patterns observed and frequency: Dynamic tripod (DT) grasp occurred most frequently (22.5%) Dynamic quadrupod (DQ) (15%) Lateral tripod (LT) (18.3%) Lateral quadrupod (LQ) (21.7%) Immature grasp (2.5%) 20% switched grasp patterns Authors did not find a relationship between grasp and handwriting speed or legibility.	Participants volunteered and may not be representative of the general population. Use of digitizing tablet can only simulate pencil and paper and may have been unfamiliar to participants.	Catalogues common grasp patterns and impact on handwriting performance. Handwriting speed and legibility were not impacted by the four most common grasp patterns (dynamic tripod, dynamic quadrupod, lateral tripod, and lateral quadrupod). Switching grasp patterns did not impact handwriting legibility or speed. Students with immature grasp (developmentally immature for age) had dysgraphic handwriting (reduced legibility and speed).
Schwellnus et al. (2013)	Examine the differences in handwriting kinetics, speed, and legibility with different pencil	<i>Level 3B</i> Cohort study Participants completed a handwriting assessment prior	74 4 th graders from Toronto	Evaluation completed on digitizing tablet with an instrumented pen (11 mm in	Grasp pattern frequency: DT <i>n</i> = 22 (30%) DQ <i>n</i> = 12 (16%) LT <i>n</i> = 19 (26%) LQ <i>n</i> = 21 (28%)	Participants volunteered and may not be representative of the general population.	Kinetic factors related to pencil grasp were measured.

	grasp patterns after a ten-minute writing task.	to and after completing a copy task. Grip and axial forces were measured using an instrumented stylus and force-sensitive tablet.		diameter) high friction tip to simulate pencil and paper. Children's Handwriting Evaluation Scale (CHES)	Grip and axial forces did not differ significantly between the four grasp patterns.	Use of digitizing tablet can only simulate pencil and paper and may have been unfamiliar to participants.	Research supports the equivalence of four mature pencil grasps for functional writing.
Ferriell et al. (2000).	Examine the impact of various shaped pencil grips on motor unit recruitment. Supplemental pencil grips examined: Standard #2 pencil sans grip Standard pencil with a triangular grip Standard pencil with a pear-shaped grip	<i>Level 3B</i> Cohort study Participants demonstrated understanding of finger positioning with each pencil grip using a dynamic tripod grasp. Electrodes were used to record motor recruitment while participants copied symbols representing cursive letter strokes.	18 participants 18-35 years old randomly selected from a group of volunteers from a small liberal arts university consisting of students and teachers.	Noraxon Myosystem 1200 four channel surface electromyography unit – used to collect data on motor unit recruitment.	Data showed no statistically significant difference among pencil grips for each muscle tested (first dorsal interosseous, abductor pollicis brevis, extensor digitorum, flexors of the fingers).	Small sample size of adults with proficient handwriting. Study did not compare pencil grasp pattern with a pencil grip versus without a supplemental pencil grip.	Research analyzes motor unit recruitment during writing tasks using supplemental pencil grips. The study did not find a significant difference in motor unit recruitment with different pencil grips. Instructors may wish to trial pencil grips to encourage finger placement on pencil.
Brevoort (2017) Dissertation	Determine the impact of combining handwriting practice with use of a slant board to improve letter formation.	<i>Level 2B</i> RCT Both groups practiced handwriting for 8-10 minutes (post 5 min instructions) for 15 sessions. The intervention group use a slant	18 2 nd and 3 rd graders participating in a summer enrichment program (for students identified as struggling academically)	Test of Handwriting Skills, Revised (THS-R) Dynamometer	Frequency of grasp patterns: DT <i>n</i> = 8 (38.1%) DQ <i>n</i> = 2 (9.5%) LT <i>n</i> = 1 (4.8%) LQ <i>n</i> = 8 (38.1%) Atypical <i>n</i> = 2 (9.5) No significant difference found in letter formation	Small sample size Convenience sample Methodological flaws. Pretest for both groups completed on a horizontal surface. Posttest for intervention	Research examining the use of a slant board during handwriting practice to improve letter formation. Dissertation does not provide strong evidence for use of slant board. Instructors may wish to trial slant board in an attempt to

		board angled at approximately 20 degrees for handwriting practice while the control group used a horizontal surface.				group was completed on a slant board.	alter wrist position during writing, however, there is a paucity of research supporting this method.
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