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A Comparison of Print and Cursive Handwriting in Fifth and Sixth Grade Students: A Pilot Study

Abstract

Background: Handwriting is an important skill to master because handwriting demands take up a significant portion of the school day. Pediatric occupational therapists evaluate and treat children who are experiencing challenges with handwriting; therefore, it is important for practitioners to understand the performance of children using both of these writing styles.

Method: A convenience sample of 36 fifth and sixth grade students participated in the study. Print and cursive handwriting samples were collected on two separate occasions, and a Wilcoxon-Mann-Whitney test was used to examine speed and legibility differences in these writing styles.

Results: Speed in print writing did not differ significantly for gender between the fifth and sixth graders. Cursive writing speed improved significantly for the sixth grade female students compared to the fifth grade female students. Female print legibility scores decreased from the fifth to the sixth grade. Regardless of grade level, the female students were faster with cursive than the male students.

Conclusion: The female students consistently used cursive, and their writing speed increased from one year to the next, as compared to the male students, who did not use a consistent writing style. It is important for occupational therapists to educate teachers and parents on the importance of consistent handwriting instruction and practice.

Keywords

Handwriting, Print, Cursive, Speed, Legibility

Credentials Display and Country

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Because of its speed and efficiency, technology has become a mainstream way of communicating in academia, in the business world, and in social exchanges. The increasing popularity of technology use has triggered concern that handwriting proficiency is not being addressed in schools (Carpenter, 2007). Even with the growing popularity of technology, handwriting remains an important skill for a young person to master, because handwriting demands take up a significant portion of the school day. According to a recent survey of kindergarten through fifth grade teachers, grade school students spend 24% to 58% of classroom time writing (“Handwriting Without Tears,” 2013).

In a study by Graham et al. (2008), 12% of teachers reported that they do not feel prepared to teach handwriting, yet handwriting experts stress the importance of teaching both print and cursive in order to build the foundational skills that students use to communicate fluently and swiftly (“Handwriting Without Tears,” 2013). Writing by hand is important because research suggests the act of writing impacts reading acquisition, recall, motor skills, composition skills, and academic performance in children (Dinehart & Manfra, 2013; Gimenez et al., 2014; Graham, Harris, & Fink, 2000; James & Engelhardt, 2012; Longcamp, Boucard, Gilhodes, & Velay, 2006; Longcamp, Zerbato-Poudou, & Velay, 2005; Mather & Roberts, 1995; Sülzenbrück, Hegele, Rinkenaur, & Heuer, 2011). For example, Mueller and Oppenheimer (2014) conducted three experiments that compared written note taking with laptop note taking. The investigators found that the individuals who took

written notes had better recall of conceptual information than the laptop users.

Educators frequently debate whether or not cursive handwriting instruction should be a requirement in schools. A 2013 study revealed that 41% of 612 elementary schools surveyed in the United States did not include cursive writing in their curricula, indicating that instruction in cursive handwriting is on the decline (“National Poll Reveals,” 2013). This issue has gained media attention because the National Common Core standards do not require cursive handwriting instruction (National Governors Association Center for Best Practices and the Council of Chief State School Officers, 2010). However, support for cursive is rallying. In recent years, 10 states have passed legislation requiring cursive handwriting instruction (“Can You Imagine,” 2012). For example, in Tennessee, the bill HB 16974/SB 1881 was recently passed, mandating that cursive handwriting be taught in elementary schools across the state.

Some handwriting experts suggest that writing in cursive promotes faster, automatic writing and reduces the tendency to reverse letters (Amundson & Wiel, 1996), but research does not consistently indicate that writing in cursive is faster or more legible than writing in manuscript. In fact, the results of a study by Ziviani and Watson-Will (1998) suggested that students write faster when printing as compared to writing in cursive, and Graham, Berninger, Weintraub, and Schafer (1998) found that a mix of manuscript and cursive or manuscript alone is produced more quickly by children in grades 4-9 in the US than in cases when

children wrote only in cursive.

Though the cursive versus print debate continues, educators agree that for cursive and print, handwriting instruction is important for improving legibility and fluency (Graham, Weintraub, & Berninger, 1998). The formation, spacing, alignment, and size of letters impact legibility (Graham & Miller, 1980; Ziviani & Elkins, 1986). One study examined the impact of the length of a handwriting task on legibility and found increased legibility in participants who participated in a short writing task compared to a longer writing task (Dennis & Swinth, 2001). Another study suggested that when a child is asked to change handwriting speed, legibility is negatively impacted (Weintraub & Graham, 1998). A number of studies have found that girls write faster than boys (Berninger & Fuller, 1992; Wallen, Bonney, & Lennox, 1996; Ziviani, 1984; Ziviani & Watson-Will, 1998), and several studies suggest that handwriting legibility influences grades (Chase, 1986; Klein & Taub, 2005; Sweedler-Brown, 1992). One consistent finding related to handwriting speed is that it increases with age (Feder & Majnemer, 2007).

Because occupational therapists who work in pediatric and school system settings often evaluate and treat children who are experiencing challenges with handwriting (Cermak, 1991; Oliver, 1990; Reisman, 1991), it is important for educators and practitioners to understand the performance of children using both of these writing styles. This pilot study will examine the print and cursive writing performance of a group of fifth and sixth grade students who have received formal instruction

in both styles of handwriting.

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Method

To compare the differences in cursive and print handwriting, print and cursive writing samples were collected on two separate occasions on a single convenience sample.

Participants

Thirty-six students in the fifth and sixth grades at a parochial school in Memphis, TN, participated in the study. A sample of fifth and sixth grade students was used because research suggests that handwriting has become automatic by these grades (Blote & Hamstra-Bletz, 1991; Karlsdottir & Stefansson, 2002). The sample included a total of 15 girls and 21 boys, and all of the participants were Caucasian and from middle to upper-middle socioeconomic backgrounds. The students ranged in age from 10 years 7 months to 12 years 9 months ($M = 11.86$, $SD = .62$), and none of the students had developmental concerns or received special services. In this parochial school, the male and female students receive instruction in separate classrooms. The school administrators reported that all of the students who attend the school receive consistent manuscript instruction in kindergarten and the first grade and cursive handwriting instruction in the third grade. The students are instructed in the Zaner-Bloser manuscript and cursive styles of handwriting. The administration initially reported that the students are required to write in cursive after the third grade. After the assessments had been administered, the teachers for the sixth grade boys shared that the cursive requirement is not strictly enforced because the male students typically prefer not to write in cursive.

Handwriting Measure

The tool of measurement used for the current study was the Test of Handwriting Skills-Revised (THS-R). This tool is a standardized assessment that allows professionals to evaluate neurosensory integration issues that impact students' print and cursive handwriting (Milone, 2007). The test is appropriate for students between six and 18 years of age and requires 10 to 15 min to administer and approximately 15 min to score. The THS-R has a total test-retest reliability of .82 (Milone, 2007).

Procedures

Prior to the administration of the handwriting assessment, the investigators received Institutional Review Board approval and obtained written parental consent and assent for student participation. The principal investigator and four occupational therapy students administered the THS-R at the school. The supervising occupational therapist has over 22 years experience administering and scoring the THS-R, and the four students were trained in the administration and scoring of the test by viewing the THS-R instructional videos and practicing the administration of the test on each other and on the principal investigator until the students were comfortable with administration. Two samples of handwriting were obtained from each student: the first was manuscript and the second cursive. The investigators collected manuscript writing samples on a Friday morning and cursive writing samples on the following Monday morning. Because only speed and legibility scores were needed for the study, the

scores for 3 out of 10 subtests of the THS-R were used in the analysis of the data.

The tests were administered to a group of four to six students at a time. Two to three investigators were present in the room during the testing. The student investigators administered the exam, and the principal investigator was available if questions arose. If a student stopped writing or became fatigued, an administrator encouraged him or her to continue writing. Throughout the testing sessions, the students were attentive, cooperative, and appeared to enjoy participating in the handwriting test.

Data Analysis

A Wilcoxon-Mann-Whitney test, which is a non-parametric counterpart of two-sample t-test, was used to examine the speed of cursive and manuscript handwriting in the male and female fifth and sixth grade students. The P-value in this report was not adjusted for multiple testing.

Results

Speed in print writing did not differ significantly by gender when the fifth and sixth graders were compared, although there was an increase in speed for the sixth graders overall. This increase, 75 versus 95 LPM (letters per min), was significant when all of the students, regardless of gender, were considered. Cursive writing speed was significantly improved for the sixth grade female students as compared to the fifth grade female students; however, the same comparison did not result in a notable difference in speed for the male students (see Table 1).

Table 1
Speed in Print and Cursive

			N	M	P-value*
Print	Female	Fifth	6	83	0.17
		Sixth	9	105	
		All Students	15	84	
	Male	Fifth	11	74	0.11
		Sixth	10	95	
		All Students	21	78	
	All Students	Fifth	17	75	0.02*
		Sixth	19	95	
		All Students	36	82	
Cursive	Female	Fifth	6	59	0.03*
		Sixth	9	65	
		All Students	15	63	
	Male	Fifth	11	48	0.32
		Sixth	10	48	
		All Students	21	48	
	All Students	Fifth	17	51	0.03*
		Sixth	19	62	
		All Students	36	51	

Note. *P-value for Wilcoxon-Mann-Whitney test was provided based on normal approximation.

When the legibility scores of the females in the fifth and sixth grades were compared, the mean scores for print writing went down from 13 to 10, respectively. For the male students, there was no significant change between the results of the two grade levels. No other significant change was observed between the fifth and sixth graders (see Table 2). We also compared the speed and legibility (for both styles) between the females and males regardless of grade, and the female students were much faster (68 vs. 53 LPM) in cursive writing than the male students, regardless of grade level (see Table 3). Overall, the mean handwriting speed scores for manuscript were 82 LPM and 51 LPM in cursive.

Table 2
Legibility in Print and Cursive

			Score						
			N	Min	Q1	Median	Q3	Max	P-value*
Print	Female	Fifth	6	10	12	13	13	14	0.008*
		Sixth	9	6	8	10	10	12	
		All Students	15	6	9	10	13	14	
	Male	Fifth	11	5	7	10	12	13	0.80
		Sixth	10	5	7	9	12	19	
		All Students	21	5	7	10	12	19	
	All Students	Fifth	17	5	8	11	13	14	0.12
		Sixth	19	5	7	10	12	19	
		All Students	36	5	8	10	12	19	
Cursive	Female	Fifth	6	7	9	9	11	13	0.23
		Sixth	9	5	7	8	10	10	
		All Students	15	5	7	9	10	13	
	Male	Fifth	11	7	8	10	11	17	0.77
		Sixth	10	7	8	9	11	17	
		All Students	21	7	8	9	11	17	
	All Students	Fifth	17	7	9	9	11	17	0.19
		Sixth	19	5	7	9	10	17	
		All Students	36	5	8	9	11	17	

Note. *P-value for Wilcoxon-Mann-Whitney test was provided based on normal approximation.

Table 3
Speed and Legibility in Print and Cursive

			Score						P-value	
			N	Min	Q1	Median	Q3	Max		
Speed	Print	Female	15	75	84	105	123	138	0.27	
		Male	21	51	78	98	114	137		
		All Students	36	51	82	99	115	138		
	Cursive	Female	15	57	63	68	93	101		0.0004
		Male	21	29	48	53	62	93		
		All Students	36	29	51	62	71	101		
Legibility	Print	Female	15	6	9	10	13	14	0.17	
		Male	21	5	7	10	12	19		
		All Students	36	5	8	10	12	19		
	Cursive	Female	15	5	7	9	10	13		0.14
		Male	21	7	8	9	11	17		
		All Students	36	5	8	9	11	17		

Discussion

The purpose of the present study was to examine the print and cursive writing performance of a group of fifth and sixth grade students who received formal instruction in both styles of handwriting. Occupational therapists frequently evaluate and treat students with handwriting difficulties, so it is important to examine the handwriting performance of typical students who have received handwriting instruction.

In the current study, the participants exhibited a mean handwriting speed score of 82 LPM in manuscript and 51 LPM in cursive. Since amount of practice has been found to contribute to handwriting speed (Howe, Roston, Sheu, & Hinojosa, 2013), and because the students in our

study began printing in kindergarten and have more years of experience printing versus writing in cursive, this finding is expected.

Our results also reveal that the girls' cursive handwriting speed was significantly faster in the sixth grade as compared to the fifth grade. Because the cursive requirement for girls was enforced in both grades, the female students likely spent more time writing in cursive, which would explain the speed increase from the fifth to the sixth grade. The girls' manuscript speed score did not increase from one grade level to the next, likely because the female students were completing their assignments in cursive and not in print and were gaining less experience with printing. The females' legibility scores for print declined from the fifth to the sixth

grade, likely because the female students were not spending time printing due to the cursive requirement. The finding that the female students wrote faster in cursive than the male students, regardless of grade level, is consistent with the research suggesting that girls write faster than boys (Graham et al., 1998; Schwellnus et al., 2012; Ziviani, 1984).

The lack of significant change in speed between the two grade levels for the males is consistent with a study by Howe et al. (2013) indicating that practice contributes to handwriting speed. Because the cursive requirement was enforced for the fifth grade boys but not for the sixth grade boys, the boys likely wrote in cursive in the fifth grade and then printed in the sixth grade. Thus, the males did not have consistent practice from one year to the next with one particular style of handwriting. In contrast, the female students consistently used cursive, and their writing speed increased from one year to the next. These results confirm the importance of handwriting practice and experience for developing speed. The finding that print legibility decreased for females from the fifth to the sixth grade supports the saying, “if you don’t use it, you lose it.”

Limitations and Direction for Future Research

The findings of our study should be taken cautiously since the study sample was a small convenience sample taken from a parochial school and is not a diverse representation of the student population in the area. Additionally, we did not consider individual teaching styles that might have influenced the students’ performance.

For future research, it would be beneficial to use a larger, more diverse sample of students. Similar studies should also use a sample of older students who have had more experience using both handwriting styles. High school and college students are typically allowed to choose which handwriting style they prefer; therefore, using one of these age groups would allow researchers to get a more mature sample of speed and efficiency of both handwriting styles. Another interesting area for future research would be to test the fatigue factor for each handwriting style, since fatigue may impact speed and legibility. For example, because cursive requires a more continuous movement and the pencil is not picked up from the page as often as with printed work, it is possible that the use of cursive over print may decrease fatigue in a writer.

Conclusion

Handwriting instruction is typically implemented in schools beginning in kindergarten or earlier, and it is important to consider the maturity and skills of the students before instructing them in handwriting. This is crucial because children need to be taught correctly from the early years in order to develop proper handwriting habits (Daly, Kelley, & Krauss, 2003). Occupational therapists have the training and skills to play a role in educating teachers on handwriting development and instruction so the teachers can gain knowledge and feel confident with handwriting instruction (American Occupational Therapy Association, 2002).

Research suggests that teachers use a variety of handwriting instructional methods. As a result of this inconsistency, students often do not develop

handwriting fluency (Asher, 2006). Occupational therapists can play an important role in school settings by developing and providing handwriting in-services to the teachers, as well as providing instruction on the importance of implementing consistent handwriting instruction. Based on the results of this study, occupational therapists should also stress the importance of handwriting practice so that students can achieve fluency.

Even with the increasing popularity of technology, handwriting is an important skill that is needed throughout one's lifetime. Because there is a relationship between handwriting and academic achievement, educators and therapists should acknowledge the importance of handwriting instruction and competency. "Early handwriting instruction improves students' writing. Not just legibility, but its *quantity* and *quality*" (Graham, 2010, p. 20), and as long as students are required to write in school, it is critical that educators and pediatric occupational therapy practitioners continue to investigate and better understand this important topic.

References

- American Occupational Therapy Association. (2002). *Handwriting*. Retrieved from <http://www.aota.org/about-occupational-therapy/patients-clients/childrenand youth/schools/handwriting.aspx>
- Amundson, S. J., & Weil, M. (1996). Prewriting and handwriting skills. In J. Case-Smith, A. S. Allen, & P. N. Pratt (Eds.), *Occupational therapy for children* (pp. 524–541). St. Louis, MO: Mosby.
- Asher, A. V. (2006). Handwriting instruction in elementary schools. *American Journal of Occupational Therapy*, 60, 461–471. <http://dx.doi.org/10.5014/ajot.60.4.461>
- Berninger, V. W., & Fuller, F. (1992). Gender differences in orthographic, verbal, and compositional fluency: Implications for assessing writing disabilities in primary grade children. *Journal of School Psychology*, 30(4), 363–382. [http://dx.doi.org/10.1016/0022-4405\(92\)90004-O](http://dx.doi.org/10.1016/0022-4405(92)90004-O)
- Blote, A. W., & Hamstra-Bletz, L. (1991). A longitudinal study on the structure of handwriting. *Perceptual and Motor Skills*, 72(3), 983–994. <http://dx.doi.org/10.2466/pms.1991.72.3.983>
- Can you imagine a world without handwriting? (2012, January). Retrieved from <https://www.hw21summit.com/>
- Carpenter, C. (2007). Is this the end of cursive writing? *The Christian Science Monitor*. Retrieved from <http://www.csmonitor.com/2007/1114/p13s01-legn.html>
- Cermak, S. (1991). Somatosensory dyspraxia. In A. G. Fisher, E. A. Murray, & A. C. Bundy (Eds.), *Sensory integration: Theory and practice* (pp. 138–170). Philadelphia, PA: F. A. Davis.
- Chase, C. (1986). Essay test scoring: Interaction of relevant variables. *Journal of Educational Measurement*, 23(1), 33–41. <http://dx.doi.org/10.1111/j.1745-3984.1986.tb00232.x>
- Daly, C. J., Kelley, G. T., & Krauss, A. (2003). Relationship between visual-motor integration and handwriting skills of children in kindergarten: A modified replication study. *American Journal of Occupational Therapy*, 57(4), 459–462. <http://dx.doi.org/10.5014/ajot.57.4.459>
- Dennis, J. L., & Swinth, Y. (2001). Pencil grasp and children's handwriting legibility during different-length writing tasks. *American Journal of Occupational Therapy*, 55, 175–183. <http://dx.doi.org/10.5014/ajot.55.2.175>
- Dinehart, L. H. B., & Manfra, L. (2013). Associations between low-income children's fine motor skills in preschool and academic performance in second grade. *Early Education and Development*, 24(2), 138–161. <http://dx.doi.org/10.1080/10409289.2011.636729>
- Feder, K. P., & Majnemer, A. (2007). Handwriting development, competency, and intervention. *Developmental Medicine and Child Neurology*, 49(4), 312–317. <http://dx.doi.org/10.1111/j.1469-8749.2007.00312.x>
- Gimenez, P., Bugescu, N., Black, J. M., Hancock, R., Pugh, K., Nagamine, M., . . . Hoeft, F. (2014). Neuroimaging correlates of handwriting quality as children learn to read and write. *Frontiers in Human Neuroscience*, 8, 155. <http://dx.doi.org/10.3389/fnhum.2014.00155>
- Graham, S. (2009–2010). Want to improve children's writing? Don't neglect their handwriting. *American Educator*,

- 33(4), 20-40. Retrieved from
<http://www.aft.org/sites/default/files/periodicals/graham.pdf>
- Graham, S., Berninger, V., Weintraub, N., & Schafer, W. (1998). Development of handwriting speed and legibility in grades 1-9. *The Journal of Educational Research*, 92(1), 42-52.
<http://dx.doi.org/10.1080/00220679809597574>
- Graham, S., Harris, K. R., & Fink, B. (2000). Is handwriting causally related to learning to write? Treatment of handwriting problems in beginning writers. *Journal of Educational Psychology*, 92(4), 620-633.
<http://dx.doi.org/10.1037/0022-0663.92.4.620>
- Graham, S., Harris, K. R., Mason, L., Fink-Chorzempa, B., Moran, S., & Saddler, B. (2008). How do primary grade teachers teach handwriting? A national survey. *Reading and Writing: An Interdisciplinary Journal*, 21(1), 49-69. <http://dx.doi.org/10.1007/s11145-007-9064-z>
- Graham, S., & Miller, L. (1980). Handwriting research and practice: A unified approach. *Focus on Exceptional Children*, 13, 1-16.
- Graham, S., Weintraub, N., & Berninger, V. W. (1998). The relationship between handwriting style and speed and legibility. *The Journal of Educational Research*, 91(5), 290-297.
<http://dx.doi.org/10.1080/00220679809597556>
- Handwriting without tears. (2013). *Research Review*. Retrieved from
<http://www.hwtears.com/files/HWT%20Research%20Review.pdf>
- Howe, T-H., Roston, K. L., Sheu, C-F., & Hinojosa, J. (2013). Assessing handwriting intervention effectiveness in elementary school students: A two group controlled study. *American Journal of Occupational Therapy*, 67, 19-26.
<http://dx.doi.org/10.5014/ajot.2013.005470>
- James, K. H., & Engelhardt, L. (2012). The effects of handwriting experience on functional brain development in pre-literate children. *Trends in Neuroscience and Education*, 1(1), 32-42.
<http://dx.doi.org/10.1016/j.tine.2012.08.001>
- Karlsdottir, R., & Stefansson, T. (2002). Problems in developing functional handwriting. *Perceptual Motor Skills*, 94, 623-662.
<http://dx.doi.org/10.2466/pms.2002.94.2.623>
- Klein, J., & Taub, D. (2005). The effect of variations in handwriting and print on evaluation of student essays. *Assessing Writing*, 10(2), 134-148.
<http://dx.doi.org/10.1016/j.asw.2005.05.002>
- Longcamp, M., Boucard, C., Gilhodes, J-C., & Velay, J-L. (2006). Remembering the orientation of newly learned characters depends on the associated writing knowledge: A comparison between handwriting and typing. *Human Movement Science*, 25(4-5), 646-656.
<http://dx.doi.org/10.1016/j.humov.2006.07.007>
- Longcamp, M., Zerbato-Poudou, M-T., & Velay, J-L. (2005). The influence of writing practice on letter recognition in preschool children: A comparison between handwriting and typing. *Acta Psychologica*, 119(1), 67-79.
<http://dx.doi.org/10.1016/j.actpsy.2004.10.019>
- Mather, N., & Roberts, R. (1995). *Informal assessment and instruction in written language: A practitioner's guide for students with learning disabilities*. New York, NY: John Wiley & Sons.
- Milone, M. (2007). *Test of handwriting skills revised*. Novato, CA: Academic Therapy Publications.
- Mueller, P. A., & Oppenheimer, P. A. (2014). The pen is mightier than the keyboard: Advantages of longhand over laptop note taking. *Psychological Science*, 25(6), 1159-1168.
<http://dx.doi.org/10.1177/0956797614524581>
- National poll reveals that cursive writing education is in danger. (2013). *PR Web*. Retrieved from
<http://www.prweb.com/releases/2013/4/prweb10667809.htm>
- National Governors Association Center for Best Practices and the Council of Chief State School Officers. (2010). *Common Core State Standards*. Washington, DC: Authors. Retrieved from
<http://www.corestandards.org>
- Oliver, C. E. (1990). A sensorimotor program for improving writing readiness skills in elementary-age children. *American Journal of Occupational Therapy*, 44(2), 111-116.
<http://dx.doi.org/10.5014/ajot.44.2.111>
- Reisman, J. E. (1991). Poor handwriting: Who is referred? *American Journal of Occupational Therapy*, 45(9), 849-852. <http://dx.doi.org/10.5014/ajot.45.9.849>
- Schweltnus, H., Carnahan, H., Kushki, A., Polatajko, H., Missiuna, C., & Chau, T. (2012). Effect of pencil grasp on the speed and legibility of handwriting in children. *American Journal of Occupational Therapy*, 66, 718-726.
<http://dx.doi.org/10.5014/ajot.2012.004515>
- Sülzenbrück, S., Hegele, M., Rinkenauer, G., & Heuer, H. (2011). The death of handwriting: Secondary effects of frequent computer use on basic motor skills. *Journal of Motor Behavior*, 43(3), 247-251.
<http://dx.doi.org/10.1080/00222895.2011.571727>
- Sweedler-Brown, C. O. (1992). The effect of training on the appearance bias of holistic essay graders. *Journal of Research and Development in Education*, 26(1), 24-29.
- Wallen, M., Bonney, M-A., & Lennox, L. (1996). *The Handwriting Speed Test*. Adelaide, South Australia: Helios.

- Weintraub, N., & Graham, S. (1998). Writing legibly and quickly: A study of children's ability to adjust their handwriting to meet common classroom demands. *Learning Disabilities Research and Practice, 13*(3), 146-152.
- Ziviani, J. (1984). Some elaborations on handwriting speed in 7- to 14-year olds. *Perceptual and Motor Skills, 58*, 535-539.
<http://dx.doi.org/10.2466/pms.1984.58.2.535>
- Ziviani, J., & Elkins, J. (1986). Effects of pencil grip on handwriting speed and legibility. *Educational Review, 38*(3), 247-257.
<http://dx.doi.org/10.1080/0013191860380305>
- Ziviani, J., & Watson-Will, A. (1998). Writing speed and legibility of 7-14-year-old school students using modern cursive script. *Australian Occupational Therapy Journal, 45*(2), 59-64.
<http://dx.doi.org/10.1111/j.1440-1630.1998.tb00783.x>