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Effective Beginning Handwriting Instruction: Multi-modal, Consistent Format for 2 Years, and Linked to Spelling and Composing

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Abstract

In Study 1, the treatment group ($N = 33$ first graders, $M = 6$ years 10 months, 16 girls) received Slingerland multi-modal (auditory, visual, tactile, motor through hand, and motor through mouth) manuscript (unjoined) handwriting instruction embedded in systematic spelling, reading, and composing lessons; and the control group ($N = 16$ first graders, $M = 7$ years 1 month, 7 girls) received manuscript handwriting instruction not systematically related to the other literacy activities. ANOVA showed both groups improved on automatic alphabet writing from memory; but ANCOVA with the automatic alphabet writing task as covariate showed that the treatment group improved significantly more than control group from the second to ninth month of first grade on dictated spelling and recognition of word-specific spellings among phonological foils. In Study 2 new groups received either a second year of manuscript ($N = 29$, $M = 7$ years 8 months, 16 girls) or introduction to cursive (joined) instruction in second grade ($N = 24$, $M = 8$ years 0 months, 11 girls) embedded in the Slingerland literacy program. ANCOVA with automatic alphabet writing as covariate showed that those who received a second year of manuscript handwriting instruction improved more on sustained handwriting over 30, 60, and 90 seconds than those who had had only one year of manuscript instruction; both groups improved in spelling and composing from the second to ninth month of second grade. Results are discussed in reference to mastering one handwriting format before introducing another format at a higher grade level and always embedding handwriting instruction in writing and reading instruction aimed at all levels of language.

Keywords

Beginning Handwriting Instruction; Linking Handwriting to Spelling and Composing; Manuscript (Unjoined) Letters; Cursive (Joined) Letters; Multi-Modal Writing

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Conflicts of Interest:

The first author is affiliated with the Slingerland® Institute for Literacy and the third author is author of the PAL—II RW Reading and Writing Diagnostic, used for evaluating treatment effects because it has multiple measures of handwriting, spelling, and composing based on the same national norming sample for grades 1 and 2.

Increasingly around the world in the 21st century, educators are being encouraged to base their practices on research evidence. For example, in Europe the COST Action IS1401 for building the European Literacy Network (ELN) and in the United States the What Works Network at the Institute for Educational Science are disseminating research results on teaching writing and reading. However, given individual differences in learners and environmental diversity (language, cultural, racial, family, and community), translation of educational research based on groups of students in controlled research designs into educational practice is not always straightforward and simple (see Berninger, 2015, for an introduction and overview of the emerging field of translation science for translating reading and writing research into educational practice).

Ultimately translation science requires the participation of educational professionals in school settings to implement what is being learned in research. However, the voice of experience from teaching can also inform research by (a) identifying questions for which answers require research and (b) evaluating with data collected in school settings whether implementation of research findings is effective. At the same time, many teaching practices have evolved over the years simply based on teacher creativity, insight, and experience, which often have not had the benefit of research approaches for evaluating their effectiveness. One example is the widely used practice of multi-sensory teaching. For an historical overview of how this approach has evolved for teaching students with and without dyslexia and other language learning disabilities, see Berninger and Wolf (2009, 2015). Pioneers in the multi-sensory instruction included Gillingham and Stillman (1956 and 1960), Orton (1989), and Slingerland (1971).

Although much of this pioneering work focused on specific learning disabilities (SLDs), Slingerland also pioneered in prevention (Slingerland, 1974) and teaching all students in general education (Slingerland, 2008). However, despite the wide use of the Slingerland methods, controlled research has not yet been used to evaluate its effectiveness, as is one goal of the current research. In the spirit of translation science, a teacher leader with many years of using Slingerland methods and training other educational professionals to do so, partnered with a university research team conducting research on writing and reading. The experienced teacher designed the research, recruited the participants and obtained informed consent, and conducted the research including data collection. The research team provided data analysis support to evaluate the effectiveness of the implementation of the Slingerland methods, which increasingly are being used in countries around the world through initiatives sponsored by the International Dyslexia Association.

A second goal is to call attention to the multi-modal methods employed in Slingerland methods. Although Orton-Gillingham and Slingerland methods are typically portrayed as multi-sensory, they are in fact multi-modal (Wolf, 2005) drawing on multiple sensory and motor methods all linked with language (see Berninger & Wolf, 2009, 2015). As will be explained further in the methods, children are encouraged to (a) attend to visual cues by looking at letters, auditory cues by listening to letter names or their sounds pronounced by the teacher, and kinesthetic cues (tactile sensations for movement on skin) by touching and tracing letter forms with their index finger; and (b) engaging their motor output systems by hand in holding the writing tool with appropriate pencil grip and by mouth in naming letters

they write and saying the sounds that go with the letters. That is, not only multiple sensory input but also multiple motor output systems are involved. Research with young children has shown how letter production can enhance letter perception and transfer to word reading (e.g., James & Atwood, 2008).

Moreover, Slingerland (1972, 1974) recommended embedding handwriting instruction in a systematic instructional program that teaches handwriting for transfer to word reading, word spelling, sentence construction and text composing and comprehension. Such an approach is consistent with research in which handwriting was taught using numbered arrow visual cues, naming letters, holding them in memory, and then writing them by hand engaging both kinesthetic somatosensory systems and grapho-motor output systems (finger and hand) to compose words, syntax, and text (for review see Berninger, 2009). That is, handwriting was taught for transfer across multiple levels of language—word, multi-word in sentences, and multiple sentences in text (Abbott, Berninger, & Fayol, 2010). This example shows that sometimes experienced teachers and researchers independently create and adopt comparable approaches.

Although other research has focused on children at-risk for handwriting in first or second grade comparable to the grade levels in the current study (e.g., Berninger et al., 1997; Graham, Harris, & Fink, 2000; Jones & Christensen, 1999) or students with early diagnosed handwriting disabilities (e.g., Berninger et al., 2006), the current study focused on typically developing writers in general education classrooms. As such the findings should advance knowledge of beginning writing development and effective approaches for teaching beginning writing to supplement the growing body of knowledge of writing development and effective writing instruction during middle childhood and adolescence with focus on the relationship of transcription (handwriting and spelling) to composing (e.g., Alves & Limpo, 2015).

Study 1, thus, evaluated whether, first graders (at least six years of age) taught handwriting systematically using Slingerland methods for transfer of handwriting skills to spelling and composing, would improve more in multiple writing skills at different levels of language from the beginning to end of first grade than would those taught using Slingerland methods. Both groups were taught manuscript (unjoined) letter writing because that is what is taught in first grade in the region where the research was conducted. The first hypothesis tested was that those in the treatment group who received Slingerland instruction would show more improvement across levels of language from pretest to posttest than would those in the contact control group who received handwriting instruction but now with the Slingerland method.

Study 2, in contrast, evaluated whether second graders (generally at least seven years old), who received the same Slingerland training as the treatment group in first grade but were not in Study 1, would improve more than those taught a new format of handwriting—cursive (joined letters). Otherwise they both received the same Slingerland instruction aimed at the word, sentence, and text levels of written language. Thus, the second tested hypothesis was that a second year of systematic handwriting instruction using the same format—manuscript (unjoined letters) would result in more improvement in writing skills across levels of written

language than would introduction of a new format of handwriting (cursive) before the first format was fully consolidated.

STUDY 1—GRADE 1

Method

Participants—Three schools were recruited by the first author who also obtained parental informed consent for students at each school to participate. Altogether 33 first graders (16 girls; 17 boys) from one school participated in the Treatment Group which included 29 right-handers and 4 left-handers. Altogether 16 first graders (7 girls; 9 boys) from two other schools participated in the Control Group, which included 12 right-handers and 4 left-handers. On average, the treatment group was 6 years 10 months old, and the control group was 7 years and 1 month at the beginning of the study. None of the participating students were on free and reduced lunch; and all attended schools that reflected the ethnic diversity of the region where the research was conducted. Most were European Americans, but two were African American, one was Native American, one was East Indian, one was Filipino, and five were of mixed ethnicity.

Treatment and Control Groups—For both the treatment group and control group pretesting occurred in the second month of the school year and posttesting occurred in the ninth month of the school year. The instructional program intervening between pretesting and posttesting is described next.

The **treatment group** received Slingerland instruction (with manuscript handwriting embedded in structured language activities) taught by teachers who had received two or more years of training from the first author who has more than 30 years of experience in training teachers in the Slingerland Adaptation of the Orton Gillingham Approach (Slingerland, 2008). The training uses demonstration, lecture, and practicum and meets the standards of The International Multisensory Structured Language Education Council (IMSLEC). As part of the training, the first author observed in their classrooms over a period of two or more years prior to the study. During the course of the study, she regularly visited their classrooms to monitor their instruction, advise if necessary, and ensure fidelity to the basic principles of the Slingerland approach.

The Slingerland® Adaptation of the Orton Gillingham Approach (Slingerland, 2008) is a complete Language Arts and Reading Program that integrates teaching handwriting with oral and written language instruction through daily modeling and practice of skills across levels and modes of language. As shown in the Appendix, each lesson at the first grade level begins with *Learning to Write* – teaching, practicing, and reviewing letters. This writing practice focuses on the letters needed for successful completion of the multi-modal learning activities that follow, beginning with auditory activities.

In the *Auditory* activities the students listen to the teacher's oral instruction and pronunciation of letter names, letter sounds, and spoken words; thus, students process *heard* language. Instruction begins with a brief review of phonic elements that will be used in the lesson (integrating letters and sounds); then students encode (spell) words (integrating

sounds with letters), add affixes (morphology), and write phrases, sentences, and paragraphs (syntax and text). This daily practice with phonology, orthography, and morphology provides the tools for students' self-regulation of their own learning of written English, which is a morphophonemic orthography (Henry, 1989, 1990). In the last half of first grade, students learn spelling through the structure of paragraphs with topic sentences, supporting information, and concluding sentences. At appropriate times, outlining, composing letters to mail, and report writing are introduced using this same multiple levels-of -language approach.

In the *Visual* activities, students practice decoding written words. Within reading groups the teacher works with written words or phrases from the text material to be read in preparation for successful book reading. There is also emphasis on teaching the ways that words are "put together" in phrases and sentences to convey thoughts. The teacher guides students through successive steps that help them develop phrase concept, "chunking", comprehension skills, and fluency for written letters, words, sentences, and text.

In sum, after initially receiving 30 minutes of daily manuscript handwriting instruction, the treatment group received 45 to 60 minutes of daily phonics, spelling, and written language instruction in addition to instruction in reading groups. From the beginning all spelling activities used only letters already taught; and by the third month of the school year all letters had been introduced. During the second half of the school year paragraph composing was introduced which incorporated transcription skills (handwriting and spelling) already taught.

The **contact control group** in two other schools received non-Slingerland handwriting instruction taught by experienced teachers. The teachers in the control group in Study 1 were not supervised or trained by the first author who did not guide teachers in this group in their planning or presentation of the lessons. However, she confirmed by periodic observation that handwriting practice did occur in the control group in which experienced teachers relied on their teacher judgment based on classroom observation of students to guide the order of presentation and the amount of practice given a particular letter, but did not follow a systematic program of handwriting instruction. In general, the students in the control group worked more independently and formal instruction was provided as teacher judgment thought it was needed.

The first author's observations showed that teachers in the control group introduced letters in two ways. Some letter forms were presented as teachers taught their sounds for decoding and spelling. Others were introduced as teachers saw a need for improving the quality of student writing of those letters through practice or review. Students spent from one to two fifteen- minute periods each week tracing and practicing a particular letter, but the amount of time devoted to other literacy activities was variable within and across weeks. Although students received some oral instruction about the letter and its form and additional oral instruction for review, they mostly practiced tracing and writing the letter on duplicated sheets as independent activities. The sheets were made up of the letter to be traced multiple times, the lines on which the child wrote the letter multiple times, and the words to be copied containing the target letter. The words to be copied were not necessarily related to the

class spelling lessons. The teachers reminded students to use good letter form when students were given writing or copying assignments. In the control group the spelling instruction and reading instruction were not integrated with writing—handwriting or composing. Reading instruction was sometimes provided in small groups and sometimes with the whole class. Some students required supervision by both a teacher and an aide to keep them on task during the tracing and practice time. Less teacher-guided instruction was provided over the course of the year and more independent handwriting activities in which students traced and practiced writing letters were assigned as the school year progressed. Students appeared to become more independent in their tracing and practice as the year progressed.

Measures in Pretest and Posttest Assessment Battery—The following measures, which had been validated in research for use with children in the first and second grade and then nationally normed (Berninger, 2007), were given in the second month of first grade before the instructional study. Test retest reliabilities are based on repeated administration in the national standardization. Subtests of the *Process Assessment of the Learner-2nd edition PAL-II* (Berninger, 2007) were given at pretest and then again at posttest to evaluate change across the year on multiple measures of handwriting and related literacy measures of word spelling and text composing.

Alphabet writing task—15 seconds: For this subtest, children are asked to handwrite in manuscript (unjoined format) the lower case letters of the alphabet from memory as quickly as possible in alphabetic order, but to make sure that others can recognize the letters they write. The raw score is the number of letters that are legible and in correct order during first 15 seconds, which is an index of automaticity of access, retrieval, and production of ordered letters from memory before controlled, strategic processing becomes involved (Schneider & Shiffrin, 1977). The raw score is transformed into a scaled score ($M = 10$, $SD = 3$) for grade (test-retest reliability .58). This measure of the orthographic loop of working memory explains unique variance in many writing skills (Abbott & Berninger, 1993).

Copy paragraph: For this subtest, children were asked to copy a short paragraph, which is scored for the number of legible accurate letters at 30 seconds, at 60 seconds, and at 90 seconds. The numbers of correctly copied, legible letters completed at 30 seconds (test-retest reliability .73), 60 seconds (test-retest reliability .73), and at 90 seconds (test-retest reliability .80) are transformed into scaled scores ($M = 10$, $SD = 3$) for grade. This measure of sustained handwriting, which tends to show nonlinear patterns across time, is sensitive to identifying during beginning writing children at-risk for completing written assignments (Berninger et al., 2006).

Word Choice: The task is to choose and circle the only choice among the written choices, each of which when pronounced sounds like a real word, that is a correctly spelled word based on the orthography, morphology, and semantics associated with that pronunciation. This task has been shown to assess word-specific spelling (Ehri, 1980; Olson, Forsberg, Wise, & Rack, 1994), which also underlies oral reading fluency (Bowers & Wolf, 1993) and silent reading (Ehri, 1990). The accuracy score is transformed into a scaled score for grade (test-retest reliability .85).

Composition Prompt 1 and Composition Prompt 2 for timed narrative writing: The task is writing for 5 minutes about provided prompt. Two prompts used in prior instructional research are used to assess writing across multiple samples, which provide a more reliable measure of composing ability than a single writing sample (Olinghouse, Santangelo, & Wilson, 2012). The compositions are scored for number of words (test-retest reliability .82) and for number of correctly spelled words (test-retest reliability .79).

In addition to the prior measures of spelling during composing, a measure of dictated spelling was also obtained. The Spelling subtest on the *Wechsler Individual Achievement Test, Third Edition (WIAT III)* (Pearson, 2009) was given. The task is to spell in writing dictated real words, pronounced alone, then in a sentence, and then alone. The number of correctly spelled words between a basal (series of correctly spelled words) and a ceiling (series of errors) as specified by test manual is transformed into a standard score ($M = 100$, $SD = 15$) for grade (test retest reliability .92).

Data Analyses—The treatment and control groups differed significantly at time 1 on alphabet 15, a measure of the orthographic loop of working memory for integrating letters in memory with sequential writing of letters to support writing (Abbott & Berninger, 1993). Thus, this measure was used as a covariate in the analyses of covariance (ANCOVA) with time (pretest or posttest) as a within-participant variable and group (treatment or control) as a between-participant variable. Of interest was whether the time by group interaction was statistically significant, such that the treatment group showed more improvement over time than did the control group, which is interpreted as a treatment effect. A significant main effect for time shows that both groups improved. A significant main effect for groups shows there are significant differences between the groups that remained constant throughout the instructional program from pretest to posttest.

Results

Descriptive statistics—See Table 1 for means and standard deviations for each measure given at pretest and posttest for both the treatment and control groups.

Inferential statistics—Two-way ANOVA with repeated measures on group and time showed a significant main effect for group, $F(1,47) = 26.99$, $p < .001$, and time, $F(1,47) = 13.23$, $p < .001$, but not an interaction with group and time for alphabet 15 (treatment-specific effect). Generally all the first graders improved in alphabet 15 over time. See Table 1 for means.

If alphabet 15 was not used as a covariate, Copy 30 sec was significant, $F(1,47) = 4.05$, $p < .05$. See means in Table 1. However, Alphabet 15 was used as a covariate in other analyses because one-way between groups ANOVA showed a significant time 1 difference on this measure between groups (treatment and control), $F(1,47) = 13.92$, $p < .001$. For each of the other measures, ANCOVA with alphabet 15 as covariate was performed to evaluate whether there were significant main effects for time (improvement from pretest to posttest), or significant main effects for groups (groups remain consistently different), or significant interactions between time and group, showing differential change across for the groups and

thus an intervention effect because one group shows relatively more change than the other, if alphabet 15 was kept constant.

As shown in Table 2, there was a significant group by time interaction (treatment effect) on both measures of spelling. The means in Table 1 show that in each case those in the treatment group that received the Slingerland instruction either improved more than control group from pretest to posttest (word choice spelling) or improved while the control group decreased (dictated spelling). There was also a significant time effect for copy task at 60 sec and 90 sec, word choice, and number of words for both composition prompts. Interestingly, the covariate effect was never significant for alphabet 15, suggesting that access to and retrieval from memory of the ordered alphabet was not yet automatic during first grade when the students were learning to form legible letters.

The following outcomes not shown in Table 2 had significant treatment effects (time by treatment group interaction) (see partial eta squared in parentheses for effect sizes): (a) if number of words during composing at time 1 for prompt 1 was used as a covariate, for number of words for prompt 1 composing, $F(1,45) = 17.00, p < .001 (.270)$; (b) if number of words at time 2 for prompt 1 was used as a covariate, for correctly spelled words during prompt 1 composing, $F(1,45) = 7.06, p < .05 (.011)$; (c) if number of words during composing for prompt 2 at time 1 was used as covariate: number of words for prompt 2 composing, $F(1,44) = 9.86, p < .01 (.183)$; and (d) if number of words during composing for prompt 2 at time 2 was used as a covariate, number of correctly spelled words for prompt 2, $F(1,44) = 4.98, p < .05 (.102)$. See Table 3 for means and SDs.

Discussion

The first hypothesis—that first graders who received Slingerland structured language instruction (handwriting embedded in other levels of language) would show more gains than the controls in handwriting and writing skills at other levels of language—was partially supported. Copying a paragraph during the first 30 second interval showed a treatment effect if alphabet 15 was not a covariate, and during the second 30 second interval at 60 seconds and the third 30 second interval at 90 seconds if alphabet 15 was a covariate. Two spelling measures— word choice and dictated spelling—also showed treatment effects (significant group by time interaction). The five significant group effects in Table 2 serve as a reminder that individual differences in instructional groups may remain constant across instruction despite instructional strategies taught. In the current era calling for evidence-based instruction, often the focus is just on what the teacher does for the instructional group—namely, provide explicit instruction. However, individual differences in the learner may also interact with teacher instruction, which poses challenges for teachers in implementing research findings based on groups into instructional practice.

STUDY 2—GRADE 2

Method

Participating Children and Teachers—Second graders in two different schools (one the same and one different from the first study) received one of two contrasting treatments: a

second year of manuscript handwriting instruction ($n = 29$, 16 girls, 13 boys, 29 right handers, 1 left hander) or a **first year of cursive handwriting instruction** ($n = 24$, 11 girls, 13 boys, 20 right handers, 4 left handers). On average the manuscript treatment group was 7 years 8 months and the cursive treatment group was 8 years 0 months at the beginning of the study. Most participating children were European American except for one Asian, two Hispanics, and one mixed in ethnicity. No child had participated in Study 1, even though Study 2 included children from a school that had participated in first grade. However, during first grade all children in Study 2 had had similar Slingerland multimodal manuscript handwriting instruction embedded in literacy activities as in the Study 1 treatment group in Study 1.

All teachers in both treatment groups in Study 2, like the teachers in the Treatment Group in Study 1, had received two or more years of training (demonstration, lecture, practicum) from the first author in the Slingerland Adaptation of the Orton Gillingham Approach (Slingerland, 2008), which meets the IMSLEC standards. The training includes demonstration, lecture, and practicum and meets the standards of The International Multisensory Structured Language Education Council (IMSLEC). The first author, who supervised all the teachers in both instructional groups in Study 2, had observed in their classrooms over a period of two or more years prior to the study, and monitored the participants regularly during the course of this study to ensure the teachers' fidelity to the basic principles of the approaches being compared in second grade, as described next.

Alternative Treatments—Study 2 employed an alternative treatments design in contrast to Study 1 which employed a treatment control design. One group received the **Continuing Manuscript Treatment**. The students were drawn from two classes at the same school and received only multi-modal manuscript (unjoined letters) handwriting instruction, embedded in literacy activities (see Appendix and description of this treatment in first study). The other group received the **Cursive Treatment** in which they learned a new multi-modal handwriting format after having had manuscript handwriting instruction during first grade. The cursive instruction focused on forming joined letters and their connecting strokes, with special attention to difficult connections such as those with b, o, v, and w. See Wolf (2005). All instruction for spelling and composing was the same for the manuscript and cursive condition and drew from recommended second grade instructional activities in Slingerland (2008)—only the handwriting format differed.

Pretest and Posttest Measures—The same measures of handwriting, spelling, and composing as used in Study 1 were given at pretest and posttest in Study 2. See Study 1 Measures under Methods for details. However, grade 2 norms were used in Study 2 in contrast to the grade 1 norms in Study 1.

Data Analyses—The same approach to data analyses was used as in Study 1 for the ANOVA for alphabet 15 and the ANCOVAs with alphabet 15 as a covariate.

Results

Descriptive statistics—See Table 3 for the means and standard deviations by treatment group for each of the measures given at pretest and posttest.

Inferential statistics—ANOVA showed marginally significant effects in second grade on alphabet 15 for group, $F(1,47) = 3.74$, $p = .059$ and significant effects on alphabet 15 for time, $F(1,47) = 4.51$, $p < .05$. As shown in Table 4, based on ANCOVA with alphabet 15 as covariate, in contrast to Study 1, there was a treatment effect (significant time by group interaction) at all three time intervals (30 sec, 60 sec, and 90 seconds) on the copy task.

Without covariates in the analyses for spelling and composing, there were no significant treatment group $\times$ time interactions (treatment-specific effects), but there were (a) constant significant time effects, indicating both groups improved significantly, for dictated spelling, $F(1, 50) = 4.86$, $p < .05$ (.081); word choice, $F(1, 51) = 15.01$, $p < .001$ (.228); Prompt 1 number of words, $F(1, 51) = 33.18$, $p < .001$ (.394) and correctly spelled words, $F(1, 51) = 25.35$, $p < .001$ (.332); and Prompt 2 number of words, $F(1, 50) = 6.27$, $p < .05$ (.111) and correctly spelled words, $F(1, 50) = 11.79$, $p < .001$ (.191); and (b) constant significant differences between groups, indicating consistent differences between them, on Dictated Spelling, $F(1, 50) = 5.08$, $p < .05$ (.092); Prompt 1 number of words, $F(1, 51) = 34.33$, $p < .001$ (.402) and correctly spelled words, $F(1, 51) = 22.91$, $p < .001$ (.354); and Prompt 2 number of words, $F(1, 50) = 9.11$, $p < .01$ (.154) and correctly spelled words, $F(1, 50) = 18.70$, $p < .001$ (.272), but not word choice. Partial eta squared is in parentheses. See Table 3 for means and SDs.

However, with alphabet 15 as a covariate, there was a significant time effect, indicating both groups improved significantly, for copy task at 30 sec and 60 sec and word choice, and a significant group effect, indicating consistent differences between the groups, for all time intervals on the copy task, dictated spelling, and number of words on both composition prompts. Also of instructional importance, there were significant treatment effects (group by time interactions) on the paragraph task at 30 seconds, 60 seconds, and 90 seconds in the second graders, with those who received a second year of manuscript instruction outperforming those with one year of earlier manuscript followed by one year of cursive. For all these outcomes, except word choice, dictated spelling, and spelling for prompt 1 composing, the covariate effect itself was significant, consistent with the individual differences in automatic alphabet letter writing from memory influencing response to some written language instruction in second graders.

To summarize, when alphabet 15 was used as a covariate, the second year of continuing manuscript handwriting resulted in improved sustained handwriting over time needed for completing written assignments. However, when the other instruction for spelling and composing was held constant for each treatment group in second grade, there was a significant time effect for all spelling and composing measures—all improved across the year. It is not surprising that no treatment effects were observed for spelling or composing because both groups received the same spelling and composing instruction during second grade.

Discussion

Some results supported the second hypothesis that a second year of instruction in the same handwriting format (manuscript) results in greater improvement in handwriting and other written language skills than does introduction of a different handwriting format (cursive) than used in the first year of handwriting instruction (manuscript). Overall the results show the benefits of continuing handwriting instruction with the same format beyond grade 1 into grade 2 (Study 2), at least for sustained handwriting over time and spelling. Continuing instruction and practice in grades 3 and 4 in cursive (joined) handwriting may be needed to observe the unique contributions of cursive handwriting to both spelling and composing in grades 4 to 7 reported by Alstad et al. (2015) in a longitudinal assessment study of typically developing writers.

However, in the current instructional study, even when a new handwriting format was introduced, both those who received manuscript instruction and those who received cursive instruction in second grade following manuscript handwriting instruction in first grade, showed improvement from beginning to end of second grade (significant main effect for time) on sustaining handwriting and multiple spelling measures. As in Study 1, main effects for group showed there are significant individual differences in learners which result in consistent group differences and are likely to affect individual students' response to instruction in real world classrooms. Incorporating covariates in the statistical analyses can control for these individual differences to some degree in drawing inferences about treatment effects, but does not eliminate individual differences in response to the same instruction.

General Discussion of Both Studies

Education in the 21st century has witnessed a paradigm shift from relying solely on teachers' professional judgment regarding instruction to relying on evidence from research to inform practice (Fixsen, Naoom, Blase, Friedman, Wallace, 2005; IES of Department of Education, 2003; Mayer, 2011). However, much educational research in this evidence-based era uses group research designs that do not always translate simply into classroom practice at specific grade levels. In fact, a second paradigm is emerging during the evidence-based era that emphasizes teachers evaluating the effectiveness of their instruction in local school settings. The current study illustrates the second kind of translation science—an experienced teacher gathering her own evidence for what works in classrooms. She trained and supervised teachers to evaluate the effectiveness of widely used instructional strategies in the Slingerland program. To our knowledge this was the first time this Slingerland program was evaluated with a controlled, quasi-experimental research design.

Shadish, Cook, and Campbell (2002) made an important distinction between experimental designs based on random assignment to treatment and control groups and quasi-experimental designs based on comparisons of treatment groups with control groups without random assignment or alternative treatment groups without random assignment. Both can support cautious causal inferences based on treatments as causes and observed changes in educational outcomes as effects. Given the reality of having to compare treatments in existing classrooms for students whose parents had given informed consent, it was possible in the current studies to employ a quasi-experimental design in which two groups could be

compared in existing classrooms in local schools to evaluate the effectiveness of a teacher implementation of a systematic instructional program.

In Study 1, a treatment group received a treatment in which handwriting instruction was embedded in spelling and composing instruction in a systematic program and was compared to a control group in which handwriting, spelling, and composing were not taught using a systematic program and relied mainly on teacher's professional judgment. A point of clarification is in order In Study 1 teachers in the treatment group could use professional development in responding to individual students' response during the systematic, structured language instruction, especially those struggling in learning the taught skills (Wolf, 2011), but they had to use systematic written language instruction. In contrast, in the control group the day to day literacy instruction and activities were left up to teacher judgment and children were not provided with a systematic approach across the school year in mind.

In Study 2, alternative treatments were provided with all other instructional components held constant except for the format of letter formation—the same as in first grade (manuscript) or introduction of a new one (cursive). Again because the Slingerland methods were used teachers could exercise professional development in responding to individual students during the structured, systematic lessons. Importantly, Study 1 and Study 2 collectively provide a cross – sectional comparison of effective beginning *handwriting instruction embedded in multi-leveled, structured literary instruction*.

The current studies also illustrate the school-researcher partnerships that are developing to evaluate whether research-supported instruction works with individual students in specific school populations in specific school settings when teachers implement the instruction. University researchers assisted the first author in evaluating and interpreting the results for an instructional study she designed and conducted to evaluate an instructional approach widely used. Hopefully this research inspires other teacher-researcher research collaborations for translating research into educational practice.

Collectively, the research findings supported prior research showing the value of teaching handwriting for transfer to other written language skills such as spelling and some aspects of composing early in written language development of English speaking beginning writers (e.g. Berninger et al., 1997; Graham et al., 2000; Jones & Christensen, 1999). Specifically, the research findings provided evidence for the Slingerland method, which has been used by many teachers over the years, for teaching handwriting linked to spelling and composing. Moreover, a method of providing handwriting instruction embedded in other literacy activities, which previously was thought to be needed only for students with specific learning disabilities, has been shown to benefit typically developing writers in the general education classroom, as originally envisioned by Slingerland (1974).

Teachers who understand the general principles emerging from research that support teaching to all levels of language close in time in systematic ways should be able to draw skillfully on multiple instructional resources including multi-modal Slingerland to create a systematic multi-modal programs for teaching beginning writing that works for the populations and school settings in which they teach writing. Examples of other instructional

resources that have been incorporated in other early intervention for writing to improve writing outcomes include, but are not restricted to, the following: handwriting programs (e.g., Rubel, 1995; Zaner-Bloser, n.d.), word reading and spelling programs (e.g., Fry, 1996; Henry, 1988, 1989, 1990, 2003), and composing programs (e.g., Carlisle, 1996; Nelson, Bahr, & Van Meter, 2004).

Moreover, future research should evaluate the validity of specific aspects of multi-modal written language instruction. Eye and Pen (Alamargot, Chesnet, Dansac, & Ros, 2006), for example, has already shown and also still has enormous potential for clarifying, from the earliest to continuing stages of handwriting acquisition, the contribution of visual feedback from the hand's writing to the eye during the language bursts and pauses while composing written language.

Additional research is needed on (a) how long to teach one format—manuscript or cursive—before introducing the other format, and (b) how long to continue the review and practice of handwriting and related skills throughout the elementary and middle school grades.

Indeed some cultures and educational systems begin with cursive format. A limitation of the current research is that it may be specific to schools and cultures that introduce manuscript in kindergarten and first grade and defer cursive instruction until later grades (typically third), whereas in some schools and cultures cursive is introduced first. Therefore future research should investigate the best ways to teach handwriting with transfer to spelling and composing in mind to beginning writers and readers (a) within the context of educational practices of specific different countries and written languages, and (b) for students of diverse socioeconomic backgrounds, not just middle class as in the current studies, and ethnic backgrounds, not just primarily of European heritage as in the current studies. These studies did not address whether manuscript or cursive should be taught first but rather the advantage of teaching the same format for at least two years until mastered sufficiently to support sustained handwriting. This should be kept in mind in interpreting and generalizing the results.

Finally, in both of the current studies teachers who delivered the treatment were highly trained and supervised in the methods. Future research should examine how teacher training programs can more effectively prepare teachers for teaching handwriting embedded in systematic literacy lessons, which integrate handwriting, spelling, and composing as well as reading and aural/oral language instruction effectively across the grades. Preservice and Inservice Educators should have the necessary foundational skills for implementing evidence-based practices in their own classrooms and gathering evidence for whether their implementation of evidence-based practices or teacher-designed instruction is working for their students in general and for individual students.

Once both handwriting modes are mastered, individual differences in preferred handwriting format are likely to be observed (Graham, Berninger, & Weintraub, 1998). That should not be a problem, because as handwriting becomes automatized in older students, it may contribute indirectly to composing (Limpo & Alves, 2013), which still draws on spelling that needs to be integrated with the construction of sentences and text (e.g., Abbott et al., 2010).

Yet, in typically developing beginning writers, spelling ability may also interact with handwriting during composing (e.g., Sumner, Connolly, & Barnett, 2014). Thus, the cognitive processes of planning, translating, reviewing, and revising during language bursts and pauses (e.g., Alves & Limpo, 2015) should also be kept in mind in designing, implementing, and evaluating beginning handwriting instruction embedded in systematic, multi-modal instruction aimed at all language systems linked to different sensory and motor end organs, and the multiple levels of language within each functional language system. The ultimate goal in teaching developing writers, from the beginning and throughout writing development, is to nurture their ability to integrate sensor-motor, language, cognitive, social emotional, and attention executive processes to self-regulate their communication with others, both as sender and recipient of messages. This challenging task will truly benefit from the contributions of both researchers and teachers in partnership.

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Appendix: SLINGERLAND®Format for Instruction for Learning to Write

1. Teaching formation of single letters of the alphabet (lower case <u>and</u> upper case/manuscript and/or cursive) 2. Practice new letters after teaching 3. Reviewing letters taught 4. Learning how to connect cursive letter forms	
LESSON FROM AUDITORY STIMULUS	LESSON FROM VISUAL STIMULUS
A. SOUND-SYMBOL ASSOCIATION (ALPHABET CARDS) <u>Sound</u> spoken as initial auditory stimulus for complete simultaneous A-V-K association	A. SYMBOL-SOUND ASSOCIATION (ALPHABET CARDS) <u>Letter(s)</u> on card shown as initial visual stimulus for complete simultaneous V-A-K association
B. ENCODING (Spelling Strategy) Teaching/practice for encoding (segmentation) as the next larger unit—a word. First functional use of sound-symbol (phoneme-grapheme) association for <u>spelling</u>	B. DECODING (Word Identification Strategy) Teaching/practice of decoding (blending) as next larger unit—a word. First functional use of symbol-sound (grapheme-phoneme) association for reading
C. SPELLING <ul style="list-style-type: none"> ■ Teaching students to spell words in different categories <ul style="list-style-type: none"> ○ Green Flag: Phonetic—Predictable ○ Yellow Flag: Ambiguous—Containing Sounds with Multiple Spellings ○ Red Flag: Non—Phonetic-Unpredictable 	C. PREPARATION FOR READING (PRE-TEACHING) (Vocabulary and Key Concepts—phrases or single words) <u>Pre-Teaching Concepts in Phrases</u> <ul style="list-style-type: none"> 1 Teacher reads word or phrase. Students repeat for complete A-V-K association. 2 Teacher reads word or phrase (random order). Individual student finds and reads word/phrase. If student is correct, class repeats—A stimulus for A-V-K association

<ul style="list-style-type: none"> ■ Teaching students to use these words functionally in increasingly larger units of written language (writing): <ul style="list-style-type: none"> ○ Root-words (and later Greek and Latin Roots-Stems) with Suffixes and Prefixes (including meaning of prefixes and function of suffixes) ○ Phrases ○ Sentences 	<p>3 Teacher says: “Find and read the word/phrase that means (gives clue based on meaning and concept—but does not say the word or words in the phrase). Individual student finds and reads word/phrase. If student is correct, class repeats—Auditory stimulus requiring short-term memory and comprehension of concept for complete A-V-K association and performance.</p> <p>4 Students take turns reading the 6–8 words/phrases and class repeats after each word/phrase is read—if student reads correctly—complete A-V-K association.</p>
<p>D. DICTATION Functional Use of Learned Concepts</p> <ul style="list-style-type: none"> ○ Spelling—syllable types, phoneme-grapheme associations, morphemes ○ Writing Conventions—punctuation, capitalization ○ Grammar ○ Syntax—words, phrases, clauses in sentences; sentences in paragraphs, etc. ○ Semantics—vocabulary; relationships of words, phrases, clauses within sentences; sentences within paragraphs, etc. ○ Purposes for Writing—narrative, expository ■ Teaching of New Concepts & Extension of Learned Concepts (from all categories listed above) for written expression: <ul style="list-style-type: none"> ○ Phrases ○ Sentences ○ Paragraph ○ Compositions (Bk 2/pgs 157–189 and/or Bk 3/pgs 116–144.) 	<p>D. STRUCTURED READING (STUDYING): (Reading Connected Text—narrative or expository) Teacher follows structured steps progressing through stages that provide less and less scaffolding as students demonstrate more independence in use of strategies: (Bk 3/pgs 251–255 and pgs 256–257.)</p> <p>1 Teacher structures: Teacher uses targeted directions to prompt student to <i>chunk words into meaningful phrases</i>. EX: “Read the phrase that tells how.” (Bk 3/ pgs 249–250.)</p> <p>2 <u>Studying aloud</u>: Individual student <i>studies and then orally structures text</i>, making meaningful connections and chunking words into meaningful phrases. Teacher assists <i>only if needed</i></p> <p>3 <u>Studying silently</u>: Group/class study a paragraph or two or a page, <i>silently chunking text into meaningful phrases</i>, as they search for specific information. Followed by individuals taking turns to orally read a part of the studied assignment. Teacher spot checks during silent studying. Teacher offers assistance <i>only if requested</i></p> <p>4 <u>Independent study</u>: Independent study followed by oral reading.</p> <p>Teacher determines success based on evidence:</p> <ul style="list-style-type: none"> a. Phrasing—chunking words into meaningful phrases b. Functional use of decoding strategies—accuracy when identifying unfamiliar words in the text c. Conceptualizing—depth and correctness of responses to teacher questions. d. Independent use of study strategies—at school and at home
<p>E. THE GOAL: INDEPENDENT WRITING</p> <p>Students choose to write for a variety of purposes:</p> <p>Responses to questions</p> <p>Notes/Letters</p> <p>Expository—essays, etc.</p> <p>Narrative—creative writing (poems, stories)</p>	<p>E. THE GOAL: INDEPENDENT READING</p> <p>Students choose to read text (independent reading level) for a variety of purposes, including access to information and for pleasure:</p> <p>Narrative—poems, stories, etc.</p> <p>Expository-Nonfiction</p> <p>Content Area—Textbooks</p>

Table 1

Means (M) and Standard Deviations (SDs) for Treatment Group (N = 33) and Control Group (N = 16) on Each Pretest Measure Repeated at Posttest in Study 1 (First Graders)

<u>Measure</u>	<u>Pretest</u>				<u>Posttest</u>			
	<u>Treatment</u>		<u>Control</u>		<u>Treatment</u>		<u>Control</u>	
	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>
Alphabet 15	13.39	3.86	9.25	3.26	16.30	3.58	11.25	3.82
Copy 30	13.42	3.06	12.73	3.37	15.35	2.94	12.60	3.42
Copy 60	13.71	2.89	11.67	3.52	17.00	2.14	12.33	4.82
Copy 90	11.77	2.55	9.67	3.98	15.70	2.92	11.40	4.31
Dictated Spelling	90.97	4.61	92.81	11.91	102.16	11.86	89.37	15.71
Word Choice	7.30	3.86	7.44	4.38	13.97	3.87	9.86	4.98
Composing								
Prompt 1 # words	10.00	2.45	8.44	1.55	10.97	1.19	8.94	1.73
Composing								
Prompt 2 # words	9.61	1.38	8.19	1.28	10.45	1.31	8.81	1.68
Composing								
Prompt 1 # cor spell	9.16	1.37	7.56	2.76	10.72	1.35	10.38	3.72
Composing								
Prompt 2 # cor spell								
Composing	9.45	1.31	8.44	2.42	10.67	1.56	8.63	2.68

Table 2

Mixed ANCOVAs (Treatment Group between Participants and Time within Participants) Using Alphabet 15 Time 1 (First Graders) as Covariate in Study 1 (see text). Partial eta squared in parentheses.

Measure	Time Effect $F(1,46) \text{ } ^a, \text{ } ^b =$	Group Effect $F(1,46) \text{ } ^a, \text{ } ^b =$	Covariate Effect $F(1,46) \text{ } ^a, \text{ } ^b =$	Time x Treatment Group Interaction $F(1,46) \text{ } ^a, \text{ } ^b =$
Copy 30 sec	.15 (.003)	.79 (.017)	1.22 (.026)	2.696 (.055)
Copy 60 sec	.54 (.012)	7.39 ** (.138)	.98 (.021)	2.67 (.055)
Copy 90 sec	2.93 (.061)	6.44 * (.125)	1.54 (.033)	3.40 (0.70)
Dictated Spelling	1.46 (.032)	2.32 (.049)	0.10 (.002)	15.76 *** (.259)
Word Choice	3.97 * (.079)	4.02 * (.080)	.53 (.011)	6.93 ** (.131)
Composing Prompt 1 # words	.20 (.004)	10.47 ** (.013)	.61 (.004)	.22 (.005)
Composing Prompt 2 # words	0.17 (.004)	13.54 *** (.235)	1.54 (.034)	.96 (.002)
Composing Prompt 1 # correct spell	7.50 ** (.143)	2.92 (.061)	.04 (.001)	.29 (.001)
Composing Prompt 2 # correct spell	1.75 (.038)	7.53 ** (.146)	.16 (.004)	.01 (.000)

*
 $p < .05$

**
 $p < .01$

 $p < .001$

^a $F(1,44)$ = prompt 2 number words, correctly spelled words

^b $F(1,45)$ = Copy 90 sec., Dictated Spelling, prompt 1 correctly spelled words

Author Manuscript

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Author Manuscript

Author Manuscript

Table 3

Means (M) and Standard Deviations (SDs) for Number Correct in Manuscript Treatment Group (N=27) and Cursive Treatment Group (N=24) on Each Pretest Measure Repeated at Posttest in Study 2 (Second Graders)

<u>Measure</u>	<u>Pretest</u>				<u>Posttest</u>			
	<u>Manuscript</u>		<u>Cursive</u>		<u>Manuscript</u>		<u>Cursive</u>	
	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>
Alphabet 15	12.30	2.70	11.95	1.81	13.96	2.85	12.14	2.23
Copy 30	12.21	2.80	12.38	2.78	15.00	2.70	10.63	3.23
Copy 60	13.41	2.53	11.96	2.65	15.24	2.18	10.96	2.96
Copy 90	13.14	2.46	11.29	2.01	15.55	2.15	11.13	2.58
Dictated Spelling	94.93	9.66	86.13	10.53	95.46	12.85	91.38	11.93
Word Choice	12.29	3.45	11.71	2.93	13.93	1.41	12.71	2.60
Composing								
Prompt 1 # words	8.57	0.96	7.25	1.03	9.68	1.09	8.00	1.38
Composing								
Prompt 2 # words	8.57	1.97	8.00	1.41	9.82	1.33	8.21	1.86
Composing								
Prompt 1 # cor spell	8.71	1.08	7.42	1.21	10.29	2.01	8.33	1.24
Composing								
Prompt 2 # cor spell	9.04	1.00	8.04	1.16	9.96	1.14	8.54	1.67

Table 4

Mixed ANCOVAs (Treatment Group between Participants and Time within Participants) Using Alphabet 15 Time 1 as Covariate in Study 1 (Second Graders). Partial eta square in parentheses.

Measure	Time Effect $F(1,50) \text{ } a, b =$	Group Effect $F(1,50) \text{ } a, b =$	Covariate Effect $F(1,50) \text{ } a, b =$	Time x Treatment Group Interaction $F(1,50) \text{ } a, b =$
Copy 30 sec	5.31 * (.096)	11.37 *** (.185)	8.12 ** (.140)	26.10 *** (.343)
Copy 60 sec	6.95 *** (.122)	25.19 *** (.335)	7.47 ** (.130)	15.08 *** (.236)
Copy 90 sec	1.47 (.029)	49.38 *** (.497)	7.60 ** (.132)	8.87 ** (.151)
Dictated Spelling	.52 (.010)	4.85 * (.090)	2.60 (.050)	3.10 (.059)
Word Choice	4.65 * (.085)	1.84 (.035)	1.32 (.026)	.93 (.018)
Composing Prompt 1 # words	2.66 (.05)	35.10 *** (.412)	4.07 * (.075)	1.45 (.028)
Composing Prompt 2 # words	.06 (.001)	9.26 ** (.159)	7.86 ** (.138)	3.00 (.059)
Composing Prompt 1 # correct spell	6.08 * (.108)	27.35 *** (.354)	1.15 (.022)	1.93 (.037)
Composing Prompt 2 # correct spell	1.96 (.038)	20.000 *** (.290)	9.12 ** (.157)	1.15 (.023)

* $p < .05$

** $p < .01$

*** $p < .001$

^a $p < .10$. $F(1,46)$ alphabet 15

^b $F(1,49)$ Dictated Spelling, Correct Spelling during Composing Prompt 1.