Strategic and Interactive Writing Instruction: An Efficacy Study in Grades 3-5

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Abstract

A quasi-experimental study was conducted to examine the impact of Strategic and Interactive Writing Instruction on 3rd-5th grade deaf and hard of hearing students' writing and language compared to a business-as-usual condition (N=63). A total of 18 hours of instruction was provided for each of two types of writing—personal narrative (known as recount) and persuasive. Writing samples, collected prior to instruction and after, were scored for writing traits, language accuracy and complexity. Data were analyzed using a two-level, mixed-effects regression. Results show the treatment to be effective for recount and persuasive writing traits, and recount language variables, with effect sizes ranging from 0.46 to 2.01. Treatment effects were also substantial for persuasive writing language outcomes (0.38 to 1.06), although not all were statistically significant at the 0.05 level. The findings suggest the importance of apprenticeship in writing and consideration for the specific language needs of students with hearing loss.

Introduction

Despite advancements in technologies, earlier identification of hearing loss, and greater access to the general education curriculum over the past several decades, low literacy outcomes persist among deaf and hard of hearing (d/hh) students [1, 2]. Further, the language experiences of d/hh children are extremely diverse and directly impact their writing. Recent reviews of research on d/hh writing development and instruction raise alarm that there is little evidence to inform practice with young students [3, 4]. It is our view that there is a need for research interventions that draw upon evidence-based writing practices while accommodating for language differences among d/hh students. Prior research from approximately 2007 to 2012 shows Strategic and Interactive Writing Instruction (SIWI)—an approach to writing instruction founded on evidence-based approaches used with typical and struggling hearing writers, combined with linguistic and metalinguistic components addressing the diverse language needs of d/hh students—to have a beneficial impact on the writing and language outcomes of d/hh students in grades 6-8 [5-11]. In recent years SIWI has been developed for expanded use with d/hh students in 3rd-5th grades, and preliminary data suggest SIWI as a promising practice at this level [12]. The focus of the current study is to further examine the extent to which SIWI impacts the writing and language achievement of d/hh students in grades 3-5.

Theoretical Underpinnings of SIWI

SIWI is a framework for writing instruction guided by three major principles: (1) strategic instruction, (2) interactive instruction, and (3) linguistic competence and metalingustic knowledge. The first two principles incorporate evidence-based practices drawn from research with typically developing and struggling writers [13, 14]. The third major principle is designed to

address the specific language needs of d/hh children. Each major SIWI principle and its theoretical underpinnings are described in greater detail below. SIWI also involves writing with an authentic purpose and audience, and balancing instruction to attend to writing and language objectives.

Strategic instruction

Strategic instruction is informed by cognitive theories of composing [15-19]. This principle is aimed at developing strategic writers by teaching the skills and processes of expert writers. Writing processes, strategies, or skills are explicitly taught to students and then practiced with the support of procedural facilitators [20], such as cue cards, mnemonics or visual scaffolds. For example, the mnemonic GOALS (i.e., Got ideas?, Organize, Attend to language, Look again, and Share) was developed to teach students the writing process. GOALS is represented in a wide circle with the word "Write" in the center to indicate that students may write after and return to any sub-process. Both the classroom poster and GOALS student cue cards have arrows to remind students that they may move between stages of the writing processes in a recursive fashion [16, 21]. Student cue cards for each genre include word and picture scaffolds for the actions associated with each writing sub-process. After teacher modeling and joint practice with visual scaffolds, students gain independence with targeted writing skills or processes, and begin to direct their own performance [22]; at this point, the visual scaffolds are no longer needed to support students' writing.

Interactive instruction

The second overarching principle of SIWI is informed by sociocultural theories of teaching and learning [23-26] which highlight that learning comes about as a result of *interactions* occurring during mediated, social activities [27]. In the teaching and learning of

writing, highly effective strategy instruction programs have broadened to give attention to the social and cultural practices involved in writing, and interactive approaches play an integral role during instruction (see example in [28]). Rather than passively receiving information, students learn about writing by actively engaging in guided or shared writing experiences with more knowledgeable writers. Students and teachers share their ideas, build on each other's contributions, and cooperatively determine necessary writing actions.

During interactive instruction, principles of dialogic pedagogy [29-31] are enacted which require collective problem-solving in shared activity to support the joint construction of meaning. Although teachers of the d/hh may be more inclined to provide didactic instruction due to difficulties many d/hh students face in expressing themselves, exemplary teachers of the d/hh persist with dialogic pedagogical practices of actively engaging students in knowledge building, assessing students' understandings moment to moment, and providing contingently responsive instruction [32]. Learning is theorized to occur through interactions that challenge students to perform slightly beyond their current levels while receiving guidance and support. As students gradually take on greater independence during writing, teachers then release responsibility for specific writing practices. During guided writing of SIWI, members are discussing and negotiating meaning at every stage of the writing process.

Linguistic competence and metalinguistic awareness

The third overarching SIWI principle addresses the unique language needs of d/hh students. Drawing upon language acquisition theory [33, 34] and second language research [35,36], SIWI is designed to develop implicit *linguistic* competence and *metalinguistic* knowledge of English and American Sign Language (ASL), if signers are involved.

Some aspects of SIWI allow for linguistic competence to grow implicitly [9]. For example, students are actively involved in problem-solving during interactive writing. Meaningful exchanges with more proficient users of language (ASL or spoken English) creates a natural environment capable of furthering acquisition. When communication breakdowns occur, the teacher employs repair strategies (c.f. [37]) that promote shared understanding amongst participants. Techniques such as drawing, role play, and use of gesture during SIWI occur in a space separate from the shared writing space known as the *language* zone [38-39]. Once understanding is achieved, teachers expose students to expressive language associated with the concrete objects, drawings or movements that hold meaning to students. These aspects are meant to promote greater language acquisition of an accessible language--either ASL or spoken English.

Frequent readings of co-constructed English text during guided writing also implicitly build linguistic competence by increasing exposure to comprehensible passages of written English. Rereading one's text is essential to the revising process of writing, and it may also be a way d/hh students come to know how English looks, feels, and sounds, similar to a native user. Opportunities for acquisition of English are critically important since implicit competence provides for more efficient writing [40], and there are many aspects of the language that cannot be explicitly taught. During SIWI, the shared text is generated from students' expressions and then is guided by the teacher to a level just beyond what students can do independently. Therefore, the text serves as comprehensible and slightly advanced input [36, 41]. In this way, d/hh students are provided an avenue to implicit English competence through rereading their ideas in slightly elevated English.

Explicit language instruction and/or comparison of English and ASL is intended to build metalinguistic knowledge [9], and is another route to developing English ability (c.f. [6, 36] that can assist students while writing. As the need arises, the SIWI teacher goes to the *language zone* to contrast grammars, explicitly teach linguistic aspects of ASL and/or English, or expand English vocabulary. For example, when students generate ideas for the shared writing text by offering a close approximation to English with minor necessary revisions, the teacher writes this on the English board, which is separate and distinct from the language zone. However, if an idea is offered that cannot readily be written in English due to visual, spatial, gestural, and syntactical properties of the expression, the class can hold the idea in the language zone using videos, pictures, drawings, or gloss (a technique for capturing ASL signs and grammatical properties in print). Ultimately, the teacher guides the class to identify or distinguish features of the languages, and then construct an equivalent expression in English, translating the idea from the language zone to the English board. During this process, participants build their metalinguistic knowledge of the language/s through explicit comparison, clarification and elaboration of language structures [10].

Prior SIWI Studies in the Middle Grades

Studies of SIWI in the middle grades have included students with mild to profound hearing losses. In these studies, students have used diverse communication methods (e.g., ASL, an English-based sign, speech, or a combination) and demonstrated a range of expressive language proficiency (from severely delayed to on target). We describe one efficacy study, as well as other related research, which demonstrate SIWI as a promising instructional approach that can promote language and literacy achievement among d/hh middle grades students.

A quasi-experimental study of information report writing in grades 6-8 (N= 33 students) found statistically significant gains on writing, language and word identification outcomes among students receiving SIWI [7, 9, 39]. Students in the treatment group received approximately 2½ hours of SIWI a week for eight weeks, and the teacher's fidelity to SIWI was approximately 95%. Students in the comparison group spent the same amount of time weekly on a structured language curriculum with some opportunities to write for real purposes supported by one-on-one teacher conferencing. Pre- and post-writing samples were collected from students for information report (the taught genre) and narrative writing (an untaught genre), and were scored using trait rubrics for genre-related features, contextual language, and conventions. A second rater scored approximately 15% of the papers, and inter-rater reliability was above 0.9. Pre-and post-word identification ability was measured using the Slosson Oral Reading Test-Revised (SORT-R; [42]).

A multivariate analysis of variance (MANOVA) was performed along with the necessary follow-up univariate analyses. The treatment group demonstrated significantly greater gains with information report writing on genre-related features as well as contextual language and conventions with large effects sizes (Cohen's d=1.27 to 2.65). Further, students in the treatment group showed significantly greater gains with the untaught genre of narrative writing (d=2.07) and writing fluency as measured by length (d=1.53). Word identification ability (d=0.39) was also statistically significant. On average, students in the treatment group demonstrated improvements of 0.45 grade level over the eight-week intervention period, whereas the comparison group did not show gains in word identification.

Additional SIWI studies, exploratory in nature, show similar positive outcomes for *genre-related writing* skills and *word identification* among students [8] as well as *written*

language accuracy, written language complexity, and writing fluency among middle school children [9, 11]. Students have also demonstrated greater ability to *edit and revise* their writing [39], and *reduce the ASL grammatical features* present in their writing [10]. Themes generated through qualitative analyses of student interviews, teacher journaling, and student writing indicate students exposed to SIWI showed *an increase in motivation* to write independently outside of class, became more likely to *self-identify as authors*, and exhibited *increases in self-confidence* in their communication and awareness of their writing ability (Dostal et al., 2015). Finally, there is evidence that SIWI supports greater *expressive/receptive language development*, likely due to the interactive nature of the classroom environment. D/hh students, grades 4-6, receiving SIWI when ASL was the language of instruction, grew in their ability to express increasingly clear and complex language as measured by gains in mean length of ASL utterances and declines in unintelligible utterances [6]. Unlike the equivocal outcomes of other programs implemented with d/hh students (see [3]), these findings suggest that a comprehensive writing program comprised of *evidence-based approaches* as well as *specific components designed to respond to d/hh students' unique and diverse language needs* has the ability to significantly improve writing and language outcomes. The purpose of the current study is to examine the extent to which SIWI impacts the writing and language outcomes of later elementary d/hh students.

Method

There is one overall research question: To what extent does SIWI lead to improved outcomes in writing, language, and word identification? Results will be reported for two genres: personal narrative/ recount and persuasive writing. We predict that students receiving SIWI will make significantly greater gains in writing and language compared to students receiving regular

instruction. A maintenance writing sample was additionally collected for recount writing to examine whether treatment effects maintained after the removal of SIWI instruction for the genre.

This quasi-experimental study involved a convenience sample of 63, 3rd-5th grade d/hh students in SIWI treatment (N=41) and business-as-usual (BAU) comparison conditions (N=22). The students were instructed by 10 different teachers in 6 programs across 5 eastern and southeastern states. Five treatment group teachers were involved in an IES grant project focused on developing SIWI for use in the later elementary grade levels. Five comparison group teachers had no previous exposure to SIWI. Three programs self-identified as total communication programs (TC), two as ASL-English bilingual programs and one as listening and spoken language (LSL) housed within a public school. While neither students nor classes were randomly assigned to conditions, an attempt was made to ensure students from all three communication philosophies were represented in each condition at similar proportions. Of the students in the treatment group, 23 were instructed in TC classes, 14 in LSL classes and 4 in a bilingual class. In the comparison group, 12 were instructed in TC classes, 7 in bilingual classes, and 3 in an LSL class. Student participants were similar in age (SIWI, M = 9 years, 10 months; BAU, M = 10 years, 1 month) and grade (SIWI, M = 3.95; BAU, M = 4.14). There was 0% student attrition.

Student Participants

Participating teachers completed demographic surveys for each of their students. Teachers indicated 49% of treatment group participants were female in contrast to 59% of students in the comparison group. In terms of racial or ethnic group, 58% of treatment group students were Caucasian, followed by 30% African American, 7% Hispanic/Latino, and 5% Multiracial. Of comparison group participants, 50% were African American, followed by 27%

Caucasian, 14% Hispanic/Latino, and 9% Multiracial. Both aided and unaided levels of hearing loss can be viewed in Table 1. Approximately 59% of treatment group participants used hearing aids, 34% had at least one cochlear implant, and 7% did not use amplification of any kind. In the comparison group, 73% of participants used hearing aids, 18% had at least one cochlear implant and 9% did not use amplification.

Table 1. Students' Unaided and Aided Levels of Hearing.

Levels of Hearing	**Treatment**		**BAU**	
	Unaided	**Aided**	**Unaided**	**Aided**
0-15dB normal limits	0%	4.9%	4.5%	9%
16-25dB slight	0%	7.3%	0%	22.7%
26-40dB mild	2.4%	39%	9.1%	36.5%
41-55dB moderate	7.3%	22.1%	13.6%	9.1%
56-70dB moderately-severe	19.5%	7.3%	27.4%	0%
71-90dB severe	17.1%	2.4%	22.7%	0%
91dB+ profound	53.7%	9.7%	22.7%	0%
information unavailable	0%	7.3%	0%	22.7%

Note: BAU = Business as usual. N = 41 Treatment; 22 BAU.

Teachers reported nine students in the treatment group as having additional disabilities including ADHD, Retinitis Pigmentosa or other visual impairment, Auditory Processing Disorder, Cerebral Palsy, fine motor deficits, Intellectual Disability, and Functional Delay. Two students in the comparison group were reported as having ADHD and hypotonia. Teachers indicated the method through which their students primarily express themselves (see Table 2) as well as the level of fluency in expressing their ideas. Of the 41 treatment group participants, 61% could fluently express many to most ideas while 39% evidenced moderate to severe difficulties in fluently expressing themselves. In the comparison group, 64% of participants fluently expressed their ideas and 36% experienced moderate to severe difficulties in expression.

Table 2. Students' Primary Form of Expression.

Form of Expression	**Treatment**	**BAU**

ASL	17.1%	31.8%
English-Based Sign (EBS)	0%	13.6%
A Combination of ASL and EBS	24.4%	13.6%
Spoken English or Sign Supported Spoken English	43.9%	36.4%
Severe Language Delay	14.6%	4.5%

At the beginning of the study, student word identification ability was assessed on the SORT-R. The mean raw score for the treatment group was 61 or a 2.2 reading grade equivalency, while the mean raw score for comparison group students was 72 or a 2.7 reading grade equivalency.

Teacher Participants

All ten teacher participants were Caucasian females. Most of the teachers had a Master's degree, and all held a Bachelor's degree with some additional graduate credits. Years of teaching experience ranged from 3 to 20 years (M=7.8) for the five treatment group teachers and 7 to 32 years (M=17.4) for the five comparison group teachers. It is worth noting that one of the treatment group participants was a speech therapist, and therefore could only implement SIWI with her students for 1 hour each week as opposed to the other teachers who taught SIWI 2 hours per week. There was one profoundly deaf teacher in the treatment group and two in the comparison group; all other teacher participants were hearing within normal limits. Teachers who used sign language during instruction were asked to rate their abilities to fluently express ideas in ASL on a 5-point scale, with 5 being an ability to express most anything fluently in ASL. The mean rating of the treatment group teachers was 4, and the comparison group teachers' mean rating was 4.6. Teachers also rated their preparation for the teaching of writing (excluding SIWI training) on a 3-point scale (i.e., 3=exceptional, 2=adequate, 1=minimal). Comparison group teachers reported that they were more prepared to teach writing (M=2.4) than treatment group teachers (M=1.8). On a 5-point scale, comparison group teachers additionally reported that they like writing (M=4.6) slightly more than treatment group teachers (M=4.2).

Instructional fidelity of intervention agents

The SIWI Observation and Fidelity Instrument was used to rate teachers' instructional fidelity to SIWI principles. The instrument includes 53 items that are scored with a 1 (incorporated instructional element faithfully) or 0 (did not incorporate), and then calculated for an overall percentage of implementation. Observations for the purpose of collecting implementation fidelity were made approximately 2-4 times during the study period for each treatment group teacher. The lessons reviewed for fidelity were randomly selected from a database of videotaped lessons uploaded to a secured server. Teachers' fidelity to SIWI ranged from 60.4%-89% with an average of 75%. Fidelity data are consistent with those of a 3-year longitudinal study examining the impact of length of SIWI professional development (PD) on instructional fidelity. In the longitudinal study, teachers performed with approximately 74% fidelity after 1 year of the SIWI training program and then at 85% and 94% with 2 and 3 years of PD respectively [38]. Four of the five treatment group teachers had previously received training for the implementation of SIWI in the middle grades, but the recently developed elementary curriculum was new to them.

Comparison group instruction

Comparison group teachers were asked to indicate the amount of time spent weekly on writing, reading, or language arts, and to describe their literacy instruction practices. Teachers reported spending 8-12 hours a week on literacy, with approximately 3-5 hours of that time focused on writing and language arts. Whereas treatment group teachers spent a similar number of hours weekly on literacy instruction, they implemented SIWI approximately 2 hours a week. When asked to describe their writing instruction, all comparison group teachers reported incorporating English grammar practice (e.g., parts of speech, sentence structure and syntax,

word scramble worksheets, using spelling or vocabulary in semantically appropriately ways). The next most commonly reported practices included engaging students in process writing (e.g., brainstorming, organizing using graphic organizer, drafting, conferencing with teacher to revise), teaching mechanics of writing (e.g., capitalization, punctuation), and exposing students to different genres of writing (e.g., persuasive, expository, personal narrative). Three teachers reported that their students write about the stories they read. Instructional practices reported by one teacher each include: using model text to illustrate author techniques, teaching text structure or language; publishing one's writing and sharing with the class; translating between ASL and English.

Measures

We report on 17 measures in the areas of writing, language, and word identification. Writing samples were collected immediately preceding and following instruction in the genre of writing (i.e., recount and persuasive). Approximately 18 hours of instruction were provided for each genre. A maintenance writing sample was collected for recount writing nine weeks after instruction for that genre had ended. Students were given prompts similar to the 4th grade National Assessment of Educational Progress (NAEP; [43]) which asked them to convey an experience or persuade through writing. Prompts were rotated by class to prevent the topic from influencing outcomes, and students had unlimited time to respond in writing to the prompts. Writing samples were scored for writing and language variables which are further detailed below. Word identification data were collected from students at the start and conclusion of the study using the Slosson Oral Reading Test-Revised (SORT-R3; [42]). The SORT-R3 is a norm-referenced test that has achieved high reliability ratings (e.g., test–retest and split-half Spearman-

Brown were 0.98) and criterion validity scores (e.g., 0.83 correlation with Peabody Individual Achievement Test).

Writing

Three measures each were constructed for recount and persuasive writing. Measures were designed to evaluate three broad domains of writing: development of ideas, organization of ideas, and content. Traits associated with recount writing included orientation, events and organization, while those associated with persuasive writing were opinion, reasons, and organization. The rubrics were informed by the NAEP (2011) holistic scoring guidelines, whereby each trait is scored on a six-point scale (i.e., 1=little to no skill, 6=effective skill). Two researchers scored slightly more than 20% of the writing samples, and a Cronbach's alpha reliability coefficient of 0.93 indicated good internal consistency between raters.

Language

There were five language measures for each genre of writing. The Structural Analysis of Written Language (SAWL; [44]) was used to score the writing samples for three levels of word efficiency ratio (WER), words per t-unit, and percentage of complete sentences. WER I represents the ratio of perfect grammar units, WER II represents the ratio of perfect grammar units plus any flawed units containing all of the major grammar constituents, and WER III represents the previous two plus perfect word strings of three or more words. Increases in the WER ratios, as well as percentage of complete sentences, suggest greater linguistic accuracy in a student's writing, and increases in words per t-unit indicate greater linguistic complexity [45]. Interrater reliability associated with 20% of the samples ranged from 0.86 - 0.97 across measures with an average Cronbach's alpha of 0.93.

Design and Analysis

Instruction was provided sequentially for two types of writing, recount and persuasive. Students were given pretest measures and then retested after 9 weeks of treatment. A maintenance retest was given nine more weeks after treatment had ended (recount only). Because there were only one to three teachers per school, we modeled clustering at the teacher level, acknowledging that this variability is due to both the instructional group as well as the school. While the sample was small, we modeled the essential design features of pretest, treatment, grade level, and clustering due to teacher/instructional group. We fit multilevel models of a posttest predicted by pretest, fit within teacher (i.e., a two level mixed-effects regression or hierarchical linear model). Classrooms contained students in grades three, four, or five. The conceptual form of the analysis model for student *i* with teacher *j* has the general form:

$$Posttest_{ij} = Intercept + Pretest_{ij} + Treatment_j + Teacher_j + e_i \qquad (1)$$

where $Posttest_{ij}$ and $Pretest_{ij}$ are the student's respective scores on the outcome, and *Intercept* is the model-predicted mean when all predictors are zero. $Treatment_j$ is the teacher's randomly assigned status. $Teacher_j$ is a random deviation for the instructional group of the student (i.e., a random intercept term). e_{ij} is random error. Overall, this model estimates treatment effects while controlling for pretest and instructional group differences (at the teacher/classroom level).

A multilevel model similar to Equation 1 was also fit to all pretest scores to determine whether there were preexisting differences between treatment groups (i.e., if unhappy randomization occurred). No group differences were statistically significant for pretests (all $p > .05$). In addition, the model shown in Equation 1 was also fit including effects for grade level differences. No grade effects were significant and the substantive conclusions were the same, so grade effects were excluded for parsimony.

Results

Table 3 presents descriptive statistics for the BAU and SIWI treatment groups for the three measures of recount writing: orientation, events, and organization. Means for each of the three waves (pre, post, maintenance) appear in columns, with SD in parentheses. There are increases of approximately 0.7 - 0.8 points in the pre to post treatment means for recount orientation (from 0.7 to 1.4), events (1.2 to 2.0), and organization (1.2 to 1.9) that are not seen in the BAU means for orientation (1.3 to 1.4), events (1.8 to 1.9), and organization (1.9 to 1.7) which implies that children responded more favorably to SIWI. Overall, there appears to be greater gain from pretest to posttest in the treatment group, with little change or slight declines toward the maintenance wave. Table 4 presents descriptive statistics for the three measures of persuasive writing, following the format of Table 3. Similar to recount writing, there is an average increase of 0.8 points in treatment group means for opinion, reasons, and organization, while there is little observed movement in BAU means.

Table 3. Descriptive Statistics for Recount Writing Outcomes.

Writing Trait	**Group**	**Pretest**		**Posttest**		**Maintenance**	
Orientation	BAU	1.3	(1.3) [a]	1.4	(1.2)	1.4	(1.1)
	Treatment	0.7	(0.7)	1.4	(1.1)	0.8	(0.9)
Events	BAU	1.8	(1.1)	1.9	(1.0)	1.8	(1.1)
	Treatment	1.2	(0.6)	2.0	(0.8)	1.8	(0.8)
Organization	BAU	1.9	(1.3)	1.7	(1.4)	1.9	(1.3)
	Treatment	1.2	(0.7)	1.9	(0.8)	1.7	(0.8)

[a] SD in parentheses.

Table 4. Descriptive Statistics for Persuasive Writing Outcomes.

Writing Trait	**Group**	**Pretest**		**Posttest**	
Opinion	BAU	2.3	(1.3)[a]	2.4	(1.3)
	Treatment	1.1	(0.6)	2.0	(0.8)
Reasons	BAU	2.2	(1.5)	2.3	(1.5)
	Treatment	1.1	(0.5)	1.8	(0.9)
Organization	BAU	2.2	(1.4)	2.3	(1.4)
	Treatment	1.1	(0.6)	1.9	(0.8)

[a] SD in parentheses.

Tables 5-6 present descriptive statistics for the five language measures for recount (Table 5) and persuasive language (Table 6). Present across both genres, treatment group participants showed an average mean gain of 0.1 to 0.2 in most WER ratios, and there were no demonstrated improvements in the BAU means. The BAU group increased words per t-unit from pretest to posttest by approximately 0.5 words while the treatment group demonstrated mean gains of 1.5 to 2 words per t-unit. Lastly, the percentage of complete sentences written by treatment group participants improved by approximately 20% in recount writing and 30% in persuasive writing while the BAU means showed no gains on the same measure. Table 7 presents descriptive statistics for word identification. The raw score mean on the SORT-R3 for the BAU group increased an average of 5 points from pretest to posttest while the treatment group mean increased approximately 10 points from pretest.

Table 5. Descriptive Statistics for Recount Language Outcomes.

Outcome Test	**Group**	**Pretest**		**Posttest**	
WER I	BAU	0.2	(0.3)[a]	0.2	(0.2)
	Treatment	0.1	(0.1)	0.2	(0.2)
WER II	BAU	0.6	(0.3)	0.6	(0.3)
	Treatment	0.4	(0.3)	0.6	(0.3)
WER III	BAU	0.8	(0.3)	0.7	(0.3)
	Treatment	0.5	(0.3)	0.7	(0.3)
Words per T-unit	BAU	5.1	(2.6)	4.6	(2.4)
	Treatment	3.8	(2.3)	5.3	(2.1)
% complete sentences	BAU	0.7	(0.3)	0.7	(0.3)
	Treatment	0.5	(0.3)	0.7	(0.3)

Note: SD in parentheses.

Table 6. Descriptive Statistics for Persuasive Language Outcomes.

Outcome Test	**Group**	**Pretest**		**Posttest**	
WER I	BAU	0.3	(0.3)	0.2	(0.2)

	Treatment	0.1	(0.1)	0.1	(0.2)
WER II	BAU	0.6	(0.3)	0.5	(0.3)
	Treatment	0.3	(0.3)	0.5	(0.3)
WER III	BAU	0.8	(0.2)	0.7	(0.3)
	Treatment	0.5	(0.3)	0.7	(0.3)
Words per T-unit	BAU	6.1	(2.6)	6.5	(4.8)
	Treatment	4.1	(2.9)	6.3	(3.7)
% complete sentences	BAU	0.7	(0.3)	0.6	(0.4)
	Treatment	0.4	(0.3)	0.7	(0.3)

[a] SD in parentheses.

Table 7. Descriptive Statistics for Word Identification (SORT-R3).

Group	Pretest		Posttest	
BAU	71.9 [a]	(44.5) [b]	76.2	(44.8)
Treatment	60.4	(24.1)	70.1	(26.9)

[a] Based on raw score.

[b] SD in parentheses.

Table 8 presents results of the multilevel regression for each of the three writing trait outcomes for recount and persuasive writing. As shown in Equation 1, there are three fixed (i.e., average) effects and two random effects (intercept variability due to classroom and residual error). For each outcome, these five parameter results are shown in the Estimate column. For fixed effects, standard error, degrees of freedom, and a p-value are shown. For random effects, the variance estimate and a standard deviation are shown. In addition, the rightmost column shows an effect size for the treatment, calculated as the model-predicted mean difference divided by the pooled residual SD, akin to a Hedge's *g* estimate [46].

Table 8. Multilevel Model Results for Recount and Persuasive Writing.[a]

Outcome	Type	Effect	Est.	SE [c]/SD [d]	*df*	*t*	*p*	Size [e]
Recount Orientation	Fixed	Intercept	0.55	(0.34)	15	1.62	0.13	— [b]
		Pretest	0.58	(0.15)	33	3.77	<.01	—
		Treatment	0.46	(0.36)	17	1.27	0.22	0.53
	Random	Intercept	0.21	0.45	—	—	—	—

		Residual	0.74	0.86	—	—	—	—
Recount Events	Fixed	Intercept	0.78	(0.33)	15	2.32	0.03	—
		Pretest	0.58	(0.13)	32	4.28	<.01	—
		Treatment	0.65	(0.29)	16	2.27	0.04	1.20
	Random	Intercept	0.16	0.40	—	—	—	—
		Residual	0.30	0.54	—	—	—	—
Recount Organization	Fixed	Intercept	0.50	(0.40)	14	1.23	0.24	—
		Pretest	0.50	(0.13)	52	3.82	<.01	—
		Treatment	1.11	(0.34)	38	3.26	<.01	2.01
	Random	Intercept	0.50	0.71	—	—	—	—
		Residual	0.31	0.55	—	—	—	—
Persuasive Opinion	Fixed	Intercept	0.42	(0.31)	16	1.34	0.20	—
		Pretest	0.87	(0.11)	22	7.95	<.01	—
		Treatment	0.57	(0.26)	15	2.17	0.05	1.05
	Random	Intercept	0.08	0.28	—	—	—	—
		Residual	0.30	0.54	—	—	—	—
Persuasive Reasons	Fixed	Intercept	0.18	(0.32)	12	0.58	0.57	—
		Pretest	0.92	(0.11)	17	8.41	<.01	—
		Treatment	0.69	(0.28)	15	2.49	0.03	1.44
	Random	Intercept	0.13	0.35	—	—	—	—
		Residual	0.23	0.48	—	—	—	—
Persuasive Organization	Fixed	Intercept	0.28	(0.28)	11	0.98	0.35	—
		Pretest	0.88	(0.10)	14	8.92	<.01	—
		Treatment	0.60	(0.25)	12	2.45	0.03	1.27
	Random	Intercept	0.08	0.28	—	—	—	—
		Residual	0.23	0.48	—	—	—	—

[a] Est. = Estimate (regression fixed effects or variance for random effects: see Equation 1).
[b] Dashes indicate that an estimate is not applicable.
[c] SE = standard error in parentheses.
[d] SD = standard deviation for random effect.
[e] Size = treatment effect size (divided by the residual SD, akin to a Hedges' *g*).

Together with the appropriate means from the descriptive statistics tables, Table 8 gives the model-based estimates of change and treatment in the presence of classroom differences. For example, for the first row regarding recount orientation, the intercept (0.55) and pretest effects (0.58) imply that student with an average pretest score (1.30; Table 3) in an average classroom in the BAU group would have a model-predicted posttest score of 1.30 (0.55 + 0.58 x 1.30 = 1.30). The treatment effect of 0.46 implies that an average student (with an equal pretest) in the treatment group would score almost half a unit higher on the posttest.

The random effects imply that a classroom one SD higher than average would score 0.45 units higher, and students vary with a SD of 0.86 units. The effect size of 0.53 implies that the treatment resulted in scores one half of a SD higher than the control group. The rest of the effects in Table 8 can be interpreted in a similar manner. Overall, Table 8 shows that the treatment was highly effective, resulting in effect sizes ranging from 0.53 to 2.01.

Table 9 shows the results of the multilevel analysis for the language outcomes and for the word identification test, following the format of Table 8. For the five recount language outcomes, the treatment effects were large (0.46 to 1.20). For the five persuasive language outcomes, treatment effects were also substantial (0.38 to 1.06), although not all were statistically significant at the 0.05 level. We suspect that non-significance of persuasive writing language variables is an indication of small sample size since the estimate of treatment effects were comparable to those of recount writing, and means show modest effects in favor of the treatment.

Table 9. Multilevel Model Results for Language Outcomes and Word Identification. [a]

Outcome	**Type**	**Effect**	**Est.**	**SE** [c]**/SD** [d]	***df***	***t***	***p***	**Size** [e]
Recount	Fixed	Intercept	0.05	(0.06)	15	0.87	0.40	— [b]
WER I [f]		Pretest	0.43	(0.12)	59	3.73	<.01	—
		Treatment	0.08	(0.07)	13	1.18	0.26	0.46
	Random	Intercept	0.00	0.24	—	—	—	—
		Residual	0.03	0.41	—	—	—	—
Recount	Fixed	Intercept	0.11	(0.07)	27	1.43	0.16	—
WER II		Pretest	0.75	(0.09)	58	8.71	<.01	—
		Treatment	0.20	(0.07)	16	2.90	0.01	1.20
	Random	Intercept	0.01	0.26	—	—	—	—
		Residual	0.03	0.41	—	—	—	—
Recount	Fixed	Intercept	0.18	(0.08)	28	2.16	0.04	—
WER III		Pretest	0.67	(0.09)	58	7.45	<.01	—
		Treatment	0.18	(0.07)	14	2.41	0.03	1.09
	Random	Intercept	0.01	0.30	—	—	—	—
		Residual	0.03	0.40	—	—	—	—
Recount	Fixed	Intercept	1.53	(0.62)	16	2.48	0.02	—
Words per T-unit		Pretest	0.61	(0.09)	40	6.78	<.01	—
		Treatment	1.56	(0.55)	9	2.84	0.02	1.13

	Random	Intercept	0.29	0.73	—	—	—	—
		Residual	1.91	1.17	—	—	—	—
Recount	Fixed	Intercept	0.21	(0.08)	29	2.69	0.01	—
% complete sentences		Pretest	0.66	(0.08)	59	8.47	<.01	—
		Treatment	0.18	(0.07)	18	2.49	0.02	1.09
	Random	Intercept	0.01	0.30	—	—	—	—
		Residual	0.03	0.41	—	—	—	—
Persuasive	Fixed	Intercept	0.04	(0.06)	26	0.62	0.54	—
WER I		Pretest	0.41	(0.14)	60	2.93	<.01	—
		Treatment	0.08	(0.07)	13	1.11	0.29	0.38
	Random	Intercept	0.00	0.14	—	—	—	—
		Residual	0.05	0.46	—	—	—	—
Persuasive	Fixed	Intercept	0.11	(0.10)	27	1.06	0.30	—
WER II		Pretest	0.67	(0.12)	60	5.59	<.01	—
		Treatment	0.17	(0.10)	24	1.60	0.12	0.78
	Random	Intercept	0.02	0.37	—	—	—	—
		Residual	0.05	0.46	—	—	—	—
Persuasive	Fixed	Intercept	0.22	(0.09)	31	2.45	0.02	—
WER III		Pretest	0.63	(0.09)	60	6.77	<.01	—
		Treatment	0.16	(0.08)	24	2.05	0.05	1.06
	Random	Intercept	0.01	0.33	—	—	—	—
		Residual	0.02	0.39	—	—	—	—
Persuasive	Fixed	Intercept	1.55	(1.33)	27	1.16	0.26	—
Words per T-unit		Pretest	0.81	(0.17)	54	4.87	<.01	—
		Treatment	1.21	(1.18)	13	1.02	0.32	0.38
	Random	Intercept	1.18	1.04	—	—	—	—
		Residual	10.06	1.78	—	—	—	—
Persuasive	Fixed	Intercept	0.25	(0.12)	25	2.19	0.04	—
% complete sentences		Pretest	0.50	(0.11)	59	4.41	<.01	—
		Treatment	0.16	(0.11)	26	1.39	0.18	0.69
	Random	Intercept	0.03	0.41	—	—	—	—
		Residual	0.05	0.48	—	—	—	—
SORT-R3	Fixed	Intercept	12.91	(5.63)	22	2.29	0.03	—
		Pretest	0.89	(0.05)	55	16.36	<.01	—
		Treatment	1.20	(4.91)	17	0.24	0.81	0.11
	Random	Intercept	43.45	2.57	—	—	—	—
		Residual	120.60	3.31	—	—	—	—

[a] Est. = Estimate (regression fixed effects or variance for random effects: see Equation 1).

[b] Dashes indicate that an estimate is not applicable.

[c] SE = standard error in parentheses.

[d] SD = standard deviation for random effect.

[e] Size = treatment effect size (divided by the residual SD, akin to a Hedges' *g*).

[f] WER = word efficiency ratio.

The final outcome, word identification measured by the SORT-R3, showed no substantial difference between groups (effect size = 0.11). Students' word identification outcomes varied substantially by teacher.

Maintenance effects were also analyzed (not reported here) using a similar model to Equation 1, in which the post-test was used to predict the score in the maintenance wave. No statistically significant differences were found, and effect sizes were scattered around zero. Therefore, there is neither regression nor continued growth to report after 9 weeks of discontinued recount instruction.

Discussion

Overall findings of the study indicate an advantage to students in the SIWI treatment group over participants in the BAU group with respect to writing traits, language accuracy and language complexity. In approximately 9 weeks (or 18 hours) of instruction for each genre of writing, means on writing traits among students in the treatment group improved 0.7 - 0.9 points (on a 6-point rubric) compared to students in the comparison group who made negligible improvements, on average, of 0.1 points. The results of the multilevel analysis for writing traits associated with both genres indicate that SIWI was highly effective, with effect sizes ranging from 0.53 to 2.01. In regard to language accuracy, students in the treatment group showed gains in word efficiency ratios of 0.1 - 0.2 on average, and an increase in complete sentences by 20-30%, while students in the BAU group demonstrated no gains on these variables. Language complexity, as measured by words per t-unit, increased by 1.5 words per t-unit on recount writing and 2.2 words per t-unit on persuasive writing among treatment group students in comparison to declines (-0.5 words per t-unit) or negligible gains (+0.4 words per t-unit), on average, among students in the comparison group. Treatment effects for the language outcomes

were large, ranging from 0.38 to 1.20; however, not all persuasive language outcomes were statistically significant at the 0.05 level. There were no substantial differences identified between groups on the SORT-R word identification variable.

The success of a short SIWI intervention when compared to BAU is evidence of the power of integrating research on writing instruction from three distinct perspectives on literacy development (i.e., strategy instruction, apprenticeship through interactive writing, and attention to metalinguistic/linguistic) to spark innovation in practice that changes trajectories of achievement for students. Outcomes were especially encouraging in light of two study drawbacks. First, instructional fidelity to SIWI averaged 75%, which is lower than desired albeit typical of teachers who have received only one year of SIWI training. Based on previous research, instructional fidelity increases among teachers to approximately 95% with 2 additional years of training [38], and as teachers become more proficient users of SIWI, we project a greater impact on student outcomes. Second, this study occurred simultaneous to development of SIWI curriculum and materials at the later elementary level. While teachers were provided PD on the importance of strategy instruction in writing, and encouraged to incorporate strategy instruction similar to the approach taken in middle grades SIWI classrooms [9], the GOALS mnemonic and cue cards specifically for later elementary students were not fully developed nor implemented during this study. The benefits of strategy instruction in writing at the elementary level are clear [14], and we predict that with full implementation, student gains would be greater. With reduced integration of strategy instruction in this study, we believe learning was largely mediated through interactive, co-constructed writing (c.f., [27]) during which attention was given to the specific language needs of d/hh students using the language zone.

It is likely that by establishing authentic purpose and audience for writing, and then collaboratively engaging students in the problem solving and decision making that occurs during the writing process, students are apprenticed in how to *think about*, *talk about*, and *do* the writing [47] which then transfers to their independent attempts. Successful classroom interactions about writing, whether occurring in English or ASL, fully engage participants in the task, and in doing so, develop new conceptual understandings. Regardless of the language through which the initial learning happens, new understandings developed about genre features or complete, complex sentences, for example, should transfer to written English [48, 49].

In taking a closer look at the writing outcomes of this study and interpreting achievement more broadly, we can see that d/hh students show substantial delay compared to their hearing counterparts. On average, d/hh students began this study with writing scores for genre-related traits of 1 (demonstrates little to no skill) to 2 (demonstrates marginal skill). These writing scores are low considering 86% of 4th grade students are at or above a basic level, constituted largely by a score of 3 or higher on similar NAEP rubrics [50]. Over the course of the SIWI intervention, the mean scores of students in the treatment group increased nearly a point on writing traits such as organizing according to the text structure of the genre, detailing of events (recount), or justifying one's opinion with reasons (persuasive). While posttest scores remained subpar, we can identify a trend toward basic writing skills that was not present in the comparison group.

Perhaps a more striking finding is that students engaged in SIWI evidenced considerable progress with written language clarity and complexity which was not observed among students in the comparison group even though all comparison group teachers reported spending considerable time on English grammar practice. We speculate two possible reasons for this. First, SIWI as a guided, collaborative writing process requires students to actively participate and

communicate with their classmates and teachers. When a teacher or student's comments are not understood, the group moves to the language zone to repair breakdowns in communication and arrive to a point of shared understanding. This ensures that the classroom talk about writing is occurring at a level of complexity that is fully accessible to students, which creates an optimal environment for language learning. Prior research indicates that, as a result of SIWI, students become increasingly more able to express their ideas through ASL (among signing students) as well as written language [6]. Second, students involved in SIWI are provided with English grammar practice, but it is contextualized within purposeful writing. For example, in writing a letter to the principal to persuade her that the school should invest in a set of iPads, the class might begin by planning an argument with supporting examples, and it's this complex thinking that drives the need for complex written language [51]. The authenticity of the writing activity also drives frequent rereading and revising in order to publish a piece that is grammatically correct.

Limitations and Future Directions

This study was based on a small convenience sample of teachers and their respective students who were participating in the development phase of an IES grant. While there was an attempt to match groups of students and teachers on a number of important variables, some notable differences still existed that could have had a bearing on outcomes. The students in each group differed by race/ethnicity, hearing loss, primary form of expression, number of students with a language delay and number of students with additional disabilities. Teacher participants of each group differed by years of experience and preparedness to teach writing. A randomized controlled trial as well as a larger sample are recommended for future research in order to have greater confidence in the outcomes.

Another future direction is to explore the potential impact that SIWI has on word identification ability and other reading skills. While a statistically significant difference between groups on word identification ability was not found in this study, a moderate effect has been reported in a previous SIWI study [7]. Further, when looking at the disaggregated SORT-R output by teacher, it was observed that most of the treatment group classes did as well or slightly better than the BAU classes, and among the treatment group classes, there were two teachers in particular whose students' gains far surpassed the gains made by any other class. A closer examination of the reading and rereading practices in these two classes may reveal ways in which teachers strategically promote greater word awareness and recognition during SIWI.

Conclusion

This quasi-experimental study involved 63, 3rd-5th d/hh students across SIWI and BAU conditions. In 9 weeks of instruction on recount writing, the treatment group made significantly greater progress with genre-specific writing skills as well as written language complexity and accuracy. Effect sizes ranged as high as 2.01. Outcomes after 9 weeks of persuasive writing followed the same trends of improvement although not all variables were statistically significant at the 0.05 level. The findings of this study reflect the power of implementing evidenced writing approaches with d/hh students, while additionally being attuned to their diverse language needs.

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