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Developing language and writing skills of deaf and hard of hearing students: A simultaneous approach

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Author's Note

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Developing Language and Writing Skills of Deaf and Hard of Hearing Students: A Simultaneous Approach

Abstract

In school, deaf and hard of hearing students (d/hh) are often exposed to American Sign Language (ASL) while also developing literacy skills in English. ASL does not have a written form, but is a fully accessible language to the d/hh through which it is possible to mediate understanding, draw on prior experiences and engage critical thinking and reasoning (Allington & Johnston, 2002, Vygotsky, 1987; Wertch, 1991). This study investigates the impact of Strategic and Interactive Writing Instruction (SIWI) on the development of signed expressive language (ASL) and written English. Our analysis demonstrates that a focus on ASL did not detract from students' writing growth in English. Instead a focus on building ASL and written English proficiency simultaneously resulted in significant gains in both language and writing.

Developing Language and Writing Skills of Deaf and Hard of Hearing Students: A Simultaneous Approach

Students who are deaf and hard of hearing (d/hh) have historically experienced significant difficulty developing literacy skills past elementary grade levels (Musselman & Szanto, 1998; Yoshinaga-Itano & Downey, 1996; Yoshinaga-Itano, Snyder, & Mayberry, 1996). One of the sources of challenge for d/hh students is that they are often learning to read and write in English while simultaneously developing a language[1] for communicative purposes (Clark, Gilbert, & Anderson, 2011). English is not easily acquired by d/hh students (Jackendoff, 1994), and while sign language is fully accessible to d/hh for acquisition, it is not often readily available in home environments. As such, many d/hh are language deprived due to inaccessible or impoverished language environments (Kuntze 1998), Without the use of complex language as a tool to mediate understanding of events, draw on prior experiences, and engage students in critical thinking and reasoning (Vygotsky, 1989; Wertsch, 1991), learning is severely impacted. We view development of expressive language as a necessary prerequisite to literacy achievement, and that persistent language deprivation among d/hh students is the greatest contributor to literacy struggle.

Strategic and Interactive Writing Instruction (SIWI) is an instructional approach that has been linked with improvements in word-, sentence-, and discourse-level English writing skills (Wolbers, 2008, 2010; Wolbers, Dostal, & Bowers, 2012). One central aspect of the SIWI approach not investigated in previous studies is the development of students' communication skills for sharing and responding to others' ideas in a collaborative setting. Dialogic, or interactive, instructional approaches can build students' conceptual understanding and have been

[1] In this paper, the term *expressive language* is used to describe the language participants used to communicate outside of written expression. In this case, it is ASL.

identified as model or effective practice in deaf education (Mayer, Akamatsu, & Stewart, 2002). The current study is an attempt to document the American Sign Language (ASL) development of students participating in the dialogic SIWI environment where the instructional focus is on English writing. While the focus of the study is primarily on students' development in ASL, we supplement with an evaluation of students' written expression on three English fluency and complexity variables to indicate whether English language gains are comparable with outcomes in previous SIWI studies.

Review of Literature

The literacy development of some d/hh learners may be characterized as a specific case of bilingual language and literacy acquisition that is similar in many ways to the literacy development of other bilingual populations (Hinkel, 2001). In this section, we will describe the similarity between d/hh and other bi- or multilingual populations and review how researchers have investigated the role of metalinguistic awareness in the language and literacy development of d/hh students.

D/hh learners are similar to other bilingual learners in that they are able to draw upon well-developed conceptual knowledge and prior experiences in one language to bring more "cognitive power" to the literacy tasks using a second language (Cummins, 2006). That is, Cummins' (1979, 1989) theory of interdependence applies even when languages cross modalities (signed and spoken). As with students working between two spoken languages, there is cross linguistic transfer between sign language and spoken language (Menendez, 2010).

Like many indigenous languages, signed languages do not have a written form, which makes it impossible for students to develop print literacy in ASL, even if it is their first language. Though Mayer & Wells (1996) have argued that linguistic transfer from ASL to English literacy

skills is “unlikely” (p. 105), Cummins (2006) notes, in a broader sense, that the interdependence hypothesis “appears to apply equally to the relationship between ASL and English as it does to the relationship between spoken languages” (p. 11). Citing research that demonstrates consistent positive relationship between ASL proficiency and English literacy (Goldin-Meadow & Mayberry, 2001; Hoffmeister, de Villiers, Engen, & Topol, 1998; Padden & Ramsey, 2000; Strong & Prinz, 2000), as well as writing literacy (Singleton, Supalla, Litchfield, & Schley, 1998), Cummins argues that “conceptual knowledge about language is just as relevant for literacy development as ‘linguistic knowledge, defined narrowly” (Cummins, 2006, p. 5). As Goldin-Meadow and Mayberry have noted, “apparently, knowing a language - even a manual language with different structure from the language captured in print - is better for learning to read than not knowing any language” (2001, p. 226).

Given this similarity between language and literacy acquisition for d/hh and other bilingual learners, it follows that instruction for d/hh students include elements that support bilingual, rather than only monolingual, language and literacy development. Niederberger and Prinz (2005) argue that the implication of the research “...is straightforward and powerful: Deaf children’s learning of English appears to benefit from the acquisition of even a moderate fluency in ASL” (p. 37). Padden and Ramsey (1998) posit that instruction that draws attention to the correspondences between ASL and English may be uniquely supportive of literacy development and should therefore be cultivated.

In some cases, however, d/hh students may not be exposed to an accessible language for acquisition. For example, hearing loss limits their exposure to spoken language, and children may not have language models for signed languages. They may therefore demonstrate language deprivation because they do not have access to enough comprehensible input to fully develop an

expressive language. This means d/hh learners may arrive at school without a complex expressive language that can be used for communication or learning, and are therefore best described as dual language learners. Often, d/hh dual language learners are simultaneously developing a manual language for communication (i.e., ASL) as well as English.

Because of these unique developmental histories, which often include language delays in the primary expressive/receptive language, d/hh students exhibit challenges in learning to write effectively and fluently (Wolbers, 2010). Researchers within deaf education consistently point to a pattern of little progress in reading achievement for d/hh students in middle and high school (Gallaudet Research Institute, 2003; Yoshinaga-Itano & Downey, 1996). As Mayer (2010) has noted, d/hh student writing often persistently contains simplified sentences, grammatical errors or non-standard usages. Others have described trends in d/hh student writing that include text that is typically shorter, less complex, and sentences that are comprised of repetitions of basic grammatical patterns (Marschark, Lang & Albertini, 2002; Marschark, Mouradian & Halas, 1994; Mayer, 2010; Singleton, Morgan, DiGello, Wiles & Rivers, 2004; Spencer, Barker, & Tomblin, 2003); and the introduction of new topics without full development of ideas (Singleton et al, 2004).

Luckner, Sebald, Cooney, Young, and Muir (2006) and Luckner and Handley (2008) note, there is a significant lack of evidence-based practices for instruction that specifically addresses the language and literacy needs of d/hh students. Moreover, there is a significant lack of research on instructional approaches or interventions that address expressive language development, bilingual development or development of metalinguistic awareness among d/hh students. Based on Cummin's theory of interdependence and a consideration of the specific language needs of d/hh students, we suggest that language and literacy instruction with d/hh

students should aim to accomplish three goals. First, it should be interactive and dialogic in nature in order to expose students to an accessible language and create language learning opportunities by repairing communication breakdowns and pairing new language with shared understandings. Second, it should aim to develop linguistic competence. In this case, students abstract implicit patterns and structures of English through repeated readings of grammatical and complex English, and they develop greater competence in ASL through classroom communications and discussions with others who are proficient in ASL. Finally, it should aim to heighten metalinguistic awareness, for example, by making explicit comparisons between ASL and English. As demonstrated by (Wolbers, 2008; Wolbers, Dostal, & Bowers, 2012), Strategic and Interactive Writing Instruction (SIWI) is an example of an instructional approach for d/hh students that is designed to address each of these principles.

Strategic and Interactive Writing Instruction (SIWI)

Strategic and Interactive Writing Instruction (SIWI) is a classroom approach to teaching d/hh students to write for a variety of purposes and audiences. SIWI is comprised of seven driving principles (see Table 3), with three overarching, theoretical-based principles (see Table 3). First, WI draws on 20 years of evidence-based research with strategy instruction in writing (Englert, Raphael, Anderson, Anthony, & Stevens 1991; Graham, 2006), whereby the strategies or processes of expert writers are explicitly taught to novice writers who do not yet demonstrate use of the strategies independently.

Second, SIWI builds on a substantial foundation of research in interactive writing (Englert & Dunsmore 2002; Englert, Mariage, & Dunsmore 2006; Mariage 2001; Wolbers, 2008). During collaborative writing, teachers, and sometimes students, model, think-aloud and scaffold students with the writing process and with the use of more advanced writing skills.

Over time, the teacher steps back and transfers more responsibility to students when engaged in shared or independent writing activity.

Third, SIWI aims to build students' metalinguistic knowledge and implicit competence by providing both implicit and explicit language opportunities (Krashen, 1994). Within SIWI, teachers use a two-surface approach where one surface (e.g., screen or whiteboard) holds group co-constructions of English text and another surface is used to hold sketches and glosses of ASL ideas. This allows students to express their idea in ASL, "hold" it for discussion by representing it on one surface, and collaboratively translate this expression into written English on a separate surface. This translation provides an opportunity for explicit instruction in metalinguistic awareness. During this process, participants build their understandings of the grammars of ASL and English through explicit discussion of the languages and language equivalence. The English text that is co-constructed during collaborative writing is generated by the students or in partnership with the teacher. Therefore, the English is comprehensible and provides meaningful input that can be read and reread to increase implicit competence of English.

When students have difficulty communicating their ideas in ASL or English due to an expressive language delay, the teacher utilizes the ASL holding zone or space to develop the students' ASL expression before translating. The teacher will use a variety of techniques such as drawing pictures, inserting pictures, using objects, using gesture or role play to arrive at a point of common understanding. Once all participants share understanding, the teacher uses the accessible object, picture, or gesture to then attach meaningful ASL expressions to understood concepts. Thus, the teacher models ways of expressing the ideas in ASL, and expressive language development becomes the initial focus of instruction prior to English writing.

SIWI has been implemented with students who have mild to severe hearing losses and who use a range of communication methodologies. It has also been implemented with students with varying language proficiencies. Past research has shown that SIWI has a significant impact on students' word identification abilities, motivation, and writing outcomes at the word-, sentence- and discourse-levels (Wolbers, 2008, 2010; Wolbers, Dostal, & Bowers, 2012). In this study, we investigate the impact of SIWI on signed and written expression in order to explore the possibility that working between English and ASL supports the development of both.

SIWI is different from traditional approaches to writing instruction in two ways. First, SIWI is intended specifically for students who are developing or working between multiple languages and, in this case, multiple modalities. There is a focus on developing students' metalinguistic knowledge of the languages through explicit language instruction, language contrasting and guided translation. In addition, ASL cannot be written as other languages, which results in unique approaches to capturing and discussing ASL in the holding zone. Second, SIWI is also used with children who exhibit severe language deprivation. As such, there are embedded approaches that support expressive language development, deemed unnecessary for the mainstream school population.

Table 3

Driving Principles of SIWI with Definitions

Principle	Definition
Strategic	The instruction is strategic in the sense that students are explicitly taught to follow the processes of expert writers through the use of word or symbol procedural facilitators.
Interactive	WI is interactive in the sense that students and the teacher share ideas, build on each other's contributions, and cooperatively determine writing actions. Through this process, the student externalizes his/her thoughts in a way that is accessible to his/her peers.

Linguistic and Metalinguistic	Persons have two separate routes to develop ability in a second language—acquiring implicitly and learning explicitly. The implicit and explicit approaches of WI aid in developing linguistic competence and metalinguistic knowledge among d/hh students (Wolbers, Dostal, & Bowers, 2012).
Balanced	While writing as a group, the teacher identifies balanced literacy objectives for his/her students that are slightly beyond what students can do independently. The teacher is cognizant to target a mixture of word-, sentence-, and discourse-level writing skills that will be emphasized during group guided writing.
Guided to Independent	When the teacher has the ability to step back and transfer control over the discourse-level objectives (e.g., text structure demands) to the students during guided writing, s/he will then move students into paired writing. The teacher will circulate the room to observe what students can do in a less-supported environment. If students exhibit good control over the objectives, the teacher then moves students into independent writing.
Visual Scaffolds	Showing promise in supporting the learning of d/hh students (Fung, Chow, & McBride-Chang, 2005), visual scaffolds offer another mode of accessing the knowledge of more-knowledgeable-others. In WI, students use visual scaffolds to recognize and apply new writing strategies or skills they are in the process of learning.
Authentic	During WI, the students and the teacher generate, revise, and publish pieces of text for a predetermined and authentic audience. Writing instruction and practice is always embedded within purposeful and meaningful writing activity.

Research Questions

The following research questions shaped the design of the study:

(1) Do d/hh students receiving Strategic and Writing Instruction (SIWI) demonstrate significant growth in expressive language (ASL)? (2) Do students with higher and lower language proficiencies exhibit significantly different growth in ASL? (3) Do d/Dhh students receiving SIWI demonstrate significant gains in written English over time? (4) Do students with higher and lower language proficiencies make significantly different growth in written English

over time? We then contextualize the quantitative results in two student examples (one from each proficiency group).

Methods

This ten-week quasi-experimental repeated measures study involved providing SIWI as a writing intervention in five classrooms (one fourth, two fifth, and two sixth grade) for five weeks. The students received SIWI for four 45 minute sessions and one 30 minute session each week for a total of five weeks. The SIWI intervention that occurred during the second 5-week period replaced the regular 30-45 minutes of writing instruction occurring during the first 5-week period.

In order to address research questions 1 and 2, analyses of the growth of students' mean length of ASL utterance (MLU) and incorporation of unintelligible utterances (UU) during pre-, mid- and posttest signed interviews were performed. MLU, calculated by dividing the total number of signed morphemes by the total number of utterances (c.f., Adrian, 1995), is used as an indication of language productivity in children.

Researchers have often used MLU as a measure of growth in spoken language, yet morpheme analysis in ASL is quite different. When calculating MLU in spoken English, researchers count the number of English morphemes in an utterance. For example, the phrase: "My sister is tall" would have four morphemes. In ASL, however, the sign for sister is made up of two morphemes (girl + same), and instead of the verb "to be" (is) there would be a subject reference, (pointing or signing "herself") so the phrase would contain five ASL morphemes. There is no standardized scale of ASL MLU with which you can compare age level development, but it is a method that can reveal ASL growth over time. Though standardized expressive or receptive sign language assessments are currently under development (e.g., Enns &

Zimmer, 2009; Hoffmeister, Benedict, Henner, & Kim, 2012; Singleton & Supalla, 2005), researchers still need to be able to account for relative growth in expressive language in this modality.

The inclusion of UU in written English may be related to a lack of holistic meaning in written English (e.g., "I 2 so play"), thus a decrease in the average number of UU indicates an increase in linguistic competence. Since d/hh students have diverse language backgrounds, it is also important to investigate the impact of SIWI for students with varying levels of proficiency with language. The lower language proficiency and the higher language proficiency groups were compared to determine if there were significant differences between changes in MLU and the total number of UU.

To explore research questions 3 and 4, we looked within and across students' writing samples in order to identify changes in overall text length and T-units. Length is used as one of many possible proxy measures for overall growth in writing fluency because it implies growth in use of English to communicate ideas. Further, Hunt's (1965) analysis of grammatical structures suggests that the mean length of T-unit is an acceptable way of measuring sentence complexity.

The quantitative findings were contextualized in two student examples--one from each proficiency grouping. The students were chosen, with the input of the teacher and the researchers' observations, to represent their respective language proficiency group and to provide a context in which to discuss specific expressive language development.

Setting/Participants

The research was conducted at a southeastern residential state school for the deaf in one fourth grade classroom, two fifth grade classrooms, and two sixth grade classrooms. These classes include the entire middle grades (grades 4-6) population of the school. Parental consent

and student assent were collected for all students in 4th-6th grade. The school's official communication philosophy is total communication (TC); however, it is applied as simultaneous-communication (sim-com).

In order to simultaneously adhere to principles of sim-com and SIWI instructional principles, the teacher used the following techniques: 1) repeat and use students' ASL expressions; 2) use sim-com to introduce ASL concepts; 3) introduce students to other signers through classroom visitations and videos, and discuss ASL usage; 4) incorporate ASL features in sim-com; 5) utilize a conceptually accurate version of manually coded English; 6) repeat sign expressions using ASL (for emphasis and clarity) and then sim-com the same message.

Description of participants. The teacher is a hearing female who has taught middle school language arts at a residential school for the deaf for five years. She has also worked as an educational interpreter in public elementary, middle, and high schools, and as a residential counselor with middle school students at a state school for the deaf for six years. Her ASL proficiency was rated in the range of Advanced Plus-to-Superior Plus on the Sign Language Proficiency Interview (SLPI-ASL). At the time of the study, she held a bachelor's degree in educational interpreting, master's degree in education, and was a certified reading specialist serving as the school writing intervention coordinator. She had engaged in three years of SIWI training and mentorship, and had implemented SIWI with fidelity in grades 6-8. Grades 4-6 were selected for this study because these students had not yet been exposed to SIWI instruction. Instead, writing instruction had been guided by a packaged English/Language Arts curriculum program that involved a focus on grammar practice and writing responses to program prompts.

There were a total of 23 student participants—seven students in grade four, eight in grade five, and eight in grade six. The following demographics were obtained from all student

participants: age, gender, race, hearing loss (dB), cochlear implant, parental hearing status, reading level based on results from the Stanford Achievement Test for the hearing impaired (SAT-HI), and primary communication method. Table 1 displays demographics of student participants. Table 2 provides descriptive statistics of student participants by attending grade level for all numerical data including age, hearing loss and reading level. Commonly accepted loss for a child classified as hard of hearing is 35-70 decibels (dB), and a child with a loss of 70 dB or greater is classified as deaf (Northern & Downs, 1984). As Paul (2001) reminds readers, "of course, these designations of degree of loss say nothing about the language of a child with hearing impairment" (p. 123).

Table 1

Demographics of Student Participants

Student	Grade	Month/ Year of Birth	Gender	Race/ Ethnicity	Hearing Loss (dB)	Cochlear Implant	Parental Hearing Status	Reading Level	Language Proficiency	Comm. Method
4.1	4	9/99	M	C/W	72	No	D	2	H	MCE/V
4.2	4	12/99	M	C/W	87	No	-	1.3	L	MCE
4.3	4	12/99	M	C/W	113	Yes	-	2.1	H	V
4.4	4	5/98	M	C/W	65	Yes	-	1.3	L	MLS/ MCE
4.5	4	7/99	F	C/W	90	No	-	1.3	L	MLS/ ASL
4.6	4	3/99	M	C/W	115	No	-	1.2	L	MLS/ MCE
4.7	4	3/99	F	AA	62	No	D	2.2	H	ASL/V
5.1	5	8/97	F	LA	47	Yes	-	1.5	L	MCE/V/ MLS
5.2	5	9/97	F	AA	110	No	-	1.4	L	MCE/ MLS
5.3	5	5/99	F	C/W	93	No	-	3.1	H	MCE/V
5.4	5	2/98	M	AA	112	No	-	1.6	L	MLS/ MCE
5.5	5	2/98	M	AA	63	No	-	1.3	L	MLS/ MCE

5.6	5	10/98	M	C/W	100	No	-	1.6	L	MLS/ ASL
5.7	5	1/99	M	C/W	45	No	-	1.7	H	MCE
5.8	5	1/99	M	C/W	72	No	-	2.2	H	MCE/V
6.1	6	5/97	F	C/W	110	No	-	2.6	H	MCE/ ASL
6.2	6	8/97	M	C/W	100	No	-	1.4	L	ASL
6.3	6	2/97	M	C/W	108	Yes	-	1.4	L	MCE/V
6.4	6	12/97	M	C/W	97	No	-	1.4	L	MLS/ V/MCE
6.5	6	2/98	M	LA	98	No	-	1.7	H	MCE/ ASL
6.6	6	5/97	M	C/W	98	No	-	2.1	H	ASL
6.7	6	8/96	M	AA	87	No	D	1.9	H	ASL
6.8	6	3/97	F	C/W	113	No	D	2.1	H	ASL

AA=African American; C/W=Caucasian/White; LA=Latino; D=Deaf; H=Hearing;
ASL=American Sign Language; MCE=Manually Coded English; V=Voice; MLS=Minimal Language Skills

Table 2

Descriptive Statistics of Students' Age, Hearing Loss, and Reading Level by Grade Level

	Grade 4		Grade 5		Grade 6	
	M	*SD*	*M*	*SD*	*M*	*SD*
Age	10.14	0.38	10.88	0.83	12.00	0.53
Hearing Loss (dB)	86.29	21.60	80.25	27.15	101.38	8.48
Reading Level	1.63	0.45	1.81	0.59	1.83	0.43

Language proficiency groups. There was great variability in students' proficiency in and exposure to ASL. According to the teacher's ratings, the student participants ranged from having extremely impoverished language proficiency to near age-appropriate language proficiency. This study explored whether language growth happens consistently across levels of language proficiency. For one portion of the quantitative analysis, students were divided into language groups (low and high) based on initial language proficiency to determine whether both language

proficiency groups exhibited statistically significant expressive language growth. Students' Stanford Achievement Test-Hearing Impaired (SAT-HI) reading comprehension scores and teacher rating forms were considered when placing them into language groups. The rating form asked their typical classroom teacher to score each student's ability to express their thoughts and feelings based on a scale of 1 (weak/rarely ever) to 5 (strong/almost always). Students who scored a 1 or 2 on the teacher rating form and scored a 1.6 or lower on the reading comprehension section of the SAT-HI were placed in the lower language proficiency group for the purpose of analysis. Students who scored a 4 or 5 on the teacher rating form and scored a 1.7 or higher on the reading comprehension section of the SAT-HI were placed in the higher language proficiency group.

Data Collection

Expressive language samples. Expressive language samples were obtained during individual interviews conducted five weeks prior to implementation of SIWI, immediately before the intervention was implemented at week 6, and at the conclusion of the study at week 12. These data were analyzed to chart expressive language growth during the time period when there was no SIWI intervention and then while engaged in SIWI.

Language samples were collected during the academic day by scheduling individual 15-minute sessions with each student. This study adhered to Owens' (1995) recommendation to vary subject matter (e.g., expository, narrative) by providing the students with two types of video clips that had fictional and non-fictional content. All of the videos were silent and wordless, and therefore did not limit students' expressive language to a predetermined set of vocabulary (Loban, 1976). The students were presented with 12 one-minute video clips of animals and asked to select three to view. Then, they selected one of three five-minute silent comedies (i.e.,

two Charlie Chaplin films and one Popeye film). To eliminate the possibility of a decrease in motivation by removing video selections, all choices remained and the students were allowed to self-select any video from each genre at pre-, mid-, and post-assessment.

After viewing the videostimuli, the following prompts were used to elicit language: (1) Describe the animal videos you watched (expository) and describe an experience you have had with an animal (personal narrative); (2) Tell me about the comedy you watched and predict what happens at the end of the movie (narrative); (3) Explain how to make popcorn (expository). Very few follow-up questions were asked to avoid constrained utterances in which students provide language in response to questions presented. Instead, the conversation remained open in prompting (e.g., tell me more), and provided non-verbal feedback (Owens, 1995).

After all language samples were collected, video files of each were imported to Eudico Linguistic Annotator (ELAN). ELAN is a language archiving software program that was designed by Hellwig (2008) at the Max Planck Institute for Psycholinguistics for the analysis and documentation of signed languages. ELAN was used in this study to facilitate the counting of morphemes and document language growth patterns.

Coding procedures. Students' language samples pre-, mid-, and post-study were analyzed for MLU and UU. All samples were divided into T-units and 20% of the language samples were coded (i.e., number of ASL morphemes, UU) by one of the researchers. Then a certified teacher of the deaf whose first language is ASL divided 20% of the language samples into T-units and coded 100% of the samples. Then, their T-units and codes were compared to ensure the researcher was reliably dividing the data into T-units and that codes of these T-units were accurate. Interrater agreement for coding was calculated using Intraclass Correlation Coefficient (ICC). An ICC of .997 (number of ASL morphemes per T-unit), .993 (number of T-

units per sample), and .990 (unintelligible utterances) was determined, indicating a very high level of agreement between coders.

Written Language Samples. In addition to expressive language samples, four writing samples, representing four different genres of writing, were collected from each student at the beginning, middle, and end of the ten-week study, for a total of twelve samples per student. For the purpose of this paper, only the personal narrative samples from each data collection point were analyzed (n=66). For these personal narrative samples, students were provided with an open-ended writing prompt that asked them to share a personal experience. This prompt was administered in class and no time limit was set for completion.

Coding Procedures. Students' personal narrative writing samples pre-, mid-, and post-study were analyzed for total words per sample, total T-units and words per T-unit. Twenty percent of the writing samples were double-coded. An ICC of 1.0 was determined for both total words and T-units per sample.

Results

Analysis

A Repeated Measures Analysis of Variance (ANOVA) was completed to test the equality of means within student performance with and without intervention to determine if there was a significant difference between T1 and T2 (pretest to midtest) and between T2 and T3 (midtest to posttest). The dependent variables for the expressive language samples included the average number of morphemes per T-unit (MLU) and unintelligible utterances (UU), while the dependent variables for the written language samples included total word count, total T-units, and number of words per T-unit. The between subjects variable included the language proficiency groups (high and low). A post hoc analysis was done to determine significance between times.

Research question 1. Language samples were analyzed using repeated measures ANOVA to answer research question 1. After five weeks of regular instruction (i.e., with no SIWI intervention), the students' MLU remained at similar levels—2.71 at pretest to 2.68 at midtest. The post-intervention language samples (after five weeks of SIWI) revealed an increase from 2.68 to 5.28 in MLU. Pretest data shows that the students used an average of 8.73 unintelligible utterances per language sample, and at posttest they used an average 2.68 unintelligible utterances. All participants made gains between T2 and T3. Figures 1 and 2 display means for MLU and UU at T1, T2, and T3.

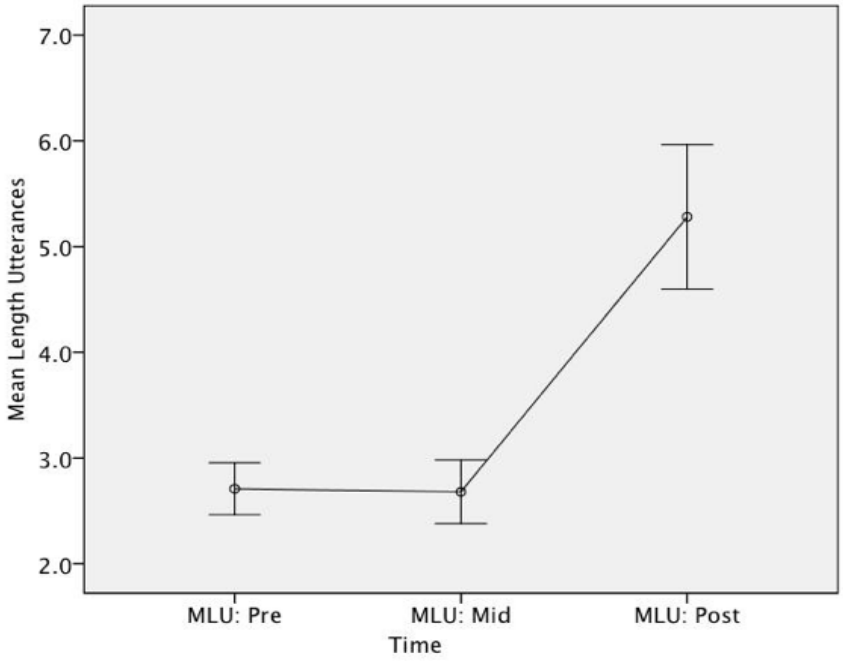

Figure 1. Display of estimated marginal means for MLU over time.

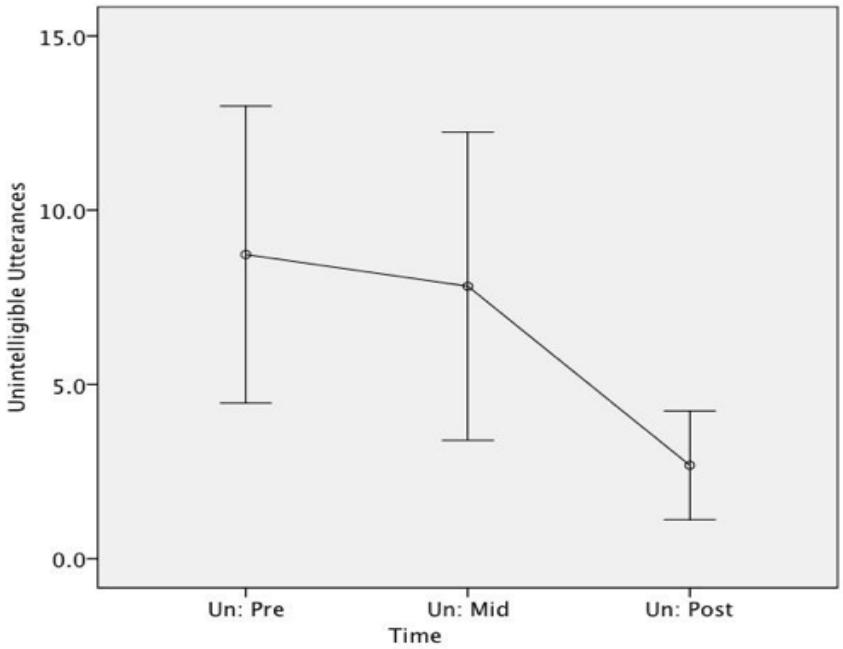

Figure 2. Display of estimated marginal means for UU over time.

Sphericity—the assumption that data are uncorrelated—could not be assumed based on Mauchly's Test of Sphericity (significance was below .05), therefore a repeated measures ANOVA using a Greenhouse-Geisser correction determined there was a statistically significant difference in MLU between time points $F(1.306, 27.42) = 71.857$, $p < .001$. The effect size was large. The partial Eta squared was .789, which means that SIWI accounted for 78.9% of the overall variance.

Post hoc tests using the Bonferroni correction revealed that SIWI had a statistically significant impact on MLU from T1 to T3 ($p < .001$), and T2 to T3 ($p < .001$). However, the T1 MLU was not statistically significantly different from T2 MLU ($p = 1.00$). We can therefore conclude that five weeks of SIWI elicits a statistically significant increase in MLU compared to five weeks without SIWI.

Regarding the UU data, Mauchly's Test of Sphericity indicated that sphericity could be assumed ($p > .05$), and a repeated measures ANOVA determined there was a statistically

significant difference in the number of UU students produced between time points $F(2, 42) = 7.436$, $p = .002$. The effect size was medium. The partial Eta squared was .436, which means that SIWI accounted for 43.6% of the overall variance.

Post hoc tests using the Bonferroni correction revealed that SIWI had a statistically significant impact on UU from T1 to T3 ($p = .003$), and T2 to T3 ($p = .027$). T1 UU were not statistically significantly different to T2 UU ($p = 1.00$). We can therefore conclude that five weeks of SIWI elicits a statistically significant decrease in UU compared to five weeks without SIWI.

Research question 2. To address research question 2, MLU data were analyzed using repeated measures ANOVA on two factors, language proficiency group and time. Mauchly's Test of Sphericity indicated that sphericity could not be assumed (significance was below .05). A repeated measures ANOVA with a Greenhouse-Geisser correction determined that there was not a statistically significant difference in MLU by language group over time $F(1.314, 26.286) = .508$, $p = .53$). UU were also analyzed using repeated measures ANOVA on the same two factors. Mauchly's Test of Sphericity indicated that sphericity could not be assumed, therefore a repeated measures ANOVA with a Greenhouse-Geisser correction determined that there was not a statistically significant difference in number of UU by language group over time $F(2,40) = 1.457$, $p = .245$). Figures 3, 4, 5 and 6 report the estimated marginal means for each dependent variable by language proficiency group. We can therefore conclude that regardless of language proficiency all students made gains in MLU and UU. Interestingly, UU increased for students in the high language proficiency group during the five weeks of regular instruction, but decreased significantly for both groups after the five-week SIWI intervention.

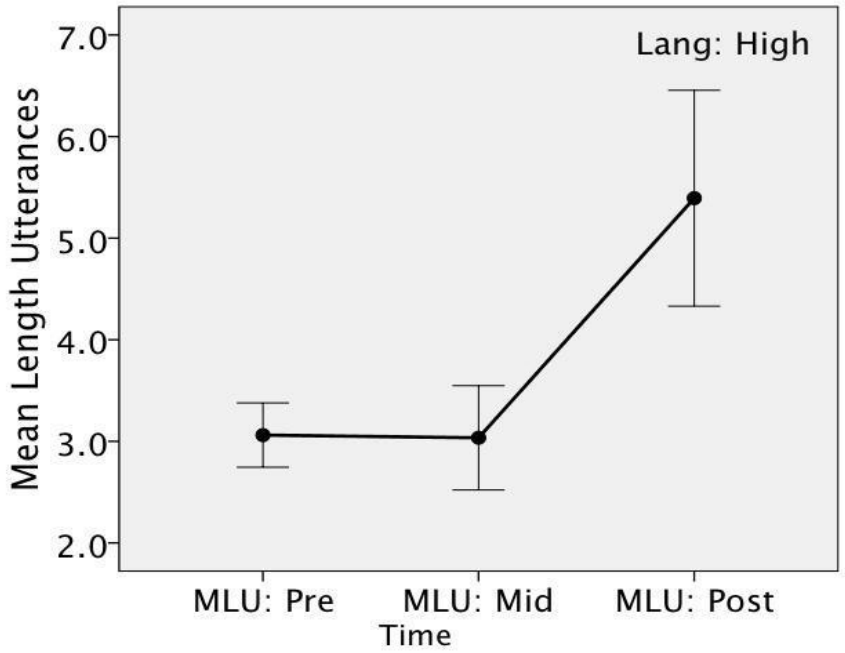

Figure 3. Display of estimated marginal means for MLU by higher language proficiency

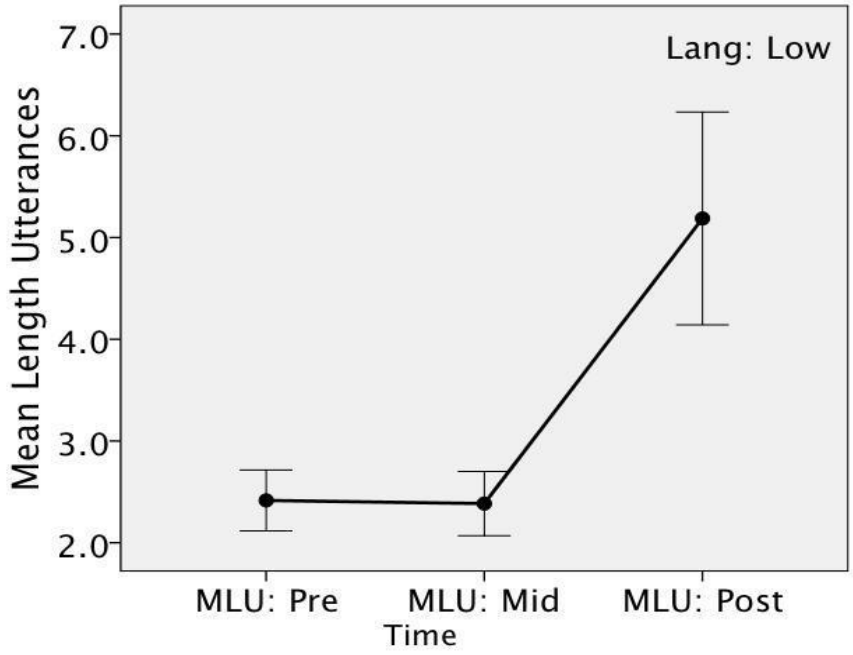

Figure 4. Display of estimated marginal means for MLU by lower language proficiency group over time.

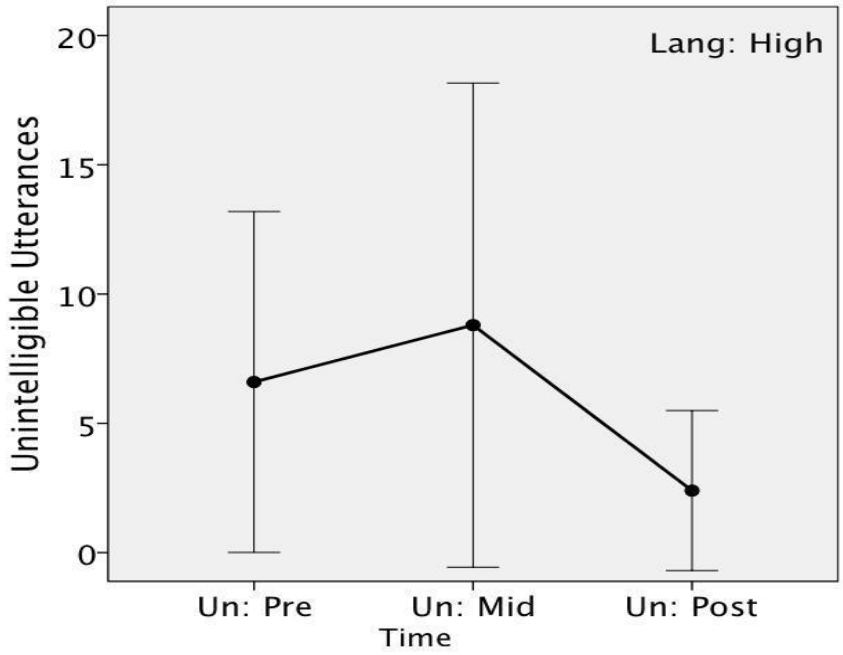

Figure 5. Display of estimated marginal means for unintelligible utterances by higher language proficiency group over time.

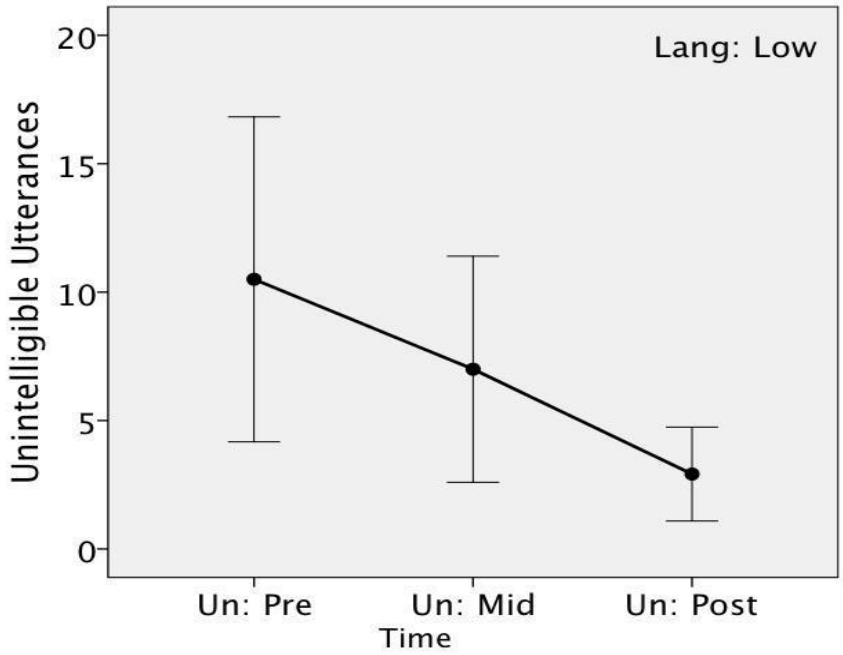

Figure 6. Display of estimated marginal means for unintelligible utterances by lower language proficiency group over time.

Research question 3. Writing samples were analyzed using repeated measures ANOVA to answer research question 3. During the five-weeks of SIWI all students made significantly greater gains compared to the five-weeks with no intervention.

Mauchly's Test of Sphericity indicated that sphericity could not be assumed for total words. A repeated measures ANOVA with a Greenhouse-Geisser correction determined that there was a statistically significant difference in total words over time $F(1.158, 25.487) = 10.447$, $p = .002$. The effect size was medium. The partial Eta squared was .322, which means that SIWI accounted for 32.2% of the overall variance.

Mauchly's Test of Sphericity indicated that sphericity also could not be assumed for total T-units. A repeated measures ANOVA with a Greenhouse-Geisser correction determined that there was a statistically significant difference in total T-units over time $F(1.178, 25.917) = 12.330$, $p < .001$. The effect size was medium. The partial Eta squared was .395, which means that SIWI accounted for 35.9% of the overall variance.

Post hoc tests using the Bonferroni correction revealed that SIWI had a statistically significant impact on total words and T-units from T1 to T3 (p is less than .05), and T2 to T3. Pretest results were not statistically significantly different to mid-test results ($p > .05$). We can therefore conclude that five weeks of SIWI elicits a statistically significant increase in total words and total T-units compared to five weeks without SIWI. Figures 5 and 6 display means for text length and total T-units at T1, T2, and T3.

Mauchly's Test of Sphericity indicated that sphericity could be assumed ($p > .05$) for words per T-unit, and a repeated measures ANOVA determined there was not a statistically significant difference in the number of words per T-unit produced over time $F(2, 42) = 7.436$, $p = .002$.

Research question 4. Total words and total T-units were also analyzed using repeated measures ANOVA on two factors, language proficiency group and time. Mauchly's Test of Sphericity indicated that sphericity could not be assumed. A repeated measures ANOVA with a Greenhouse-Geisser correction determined that there was not a statistically significant difference in total words $F(1.166, 24.494)=2.314$, $p = .111$ or total T-units $F(1.19, 25) = 1.481$, $p = .24$ by language group over time. We can therefore conclude that regardless of language proficiency all students made gains in total words and total T-units. Means for these variables across time are displayed in Figures 7 and 8.

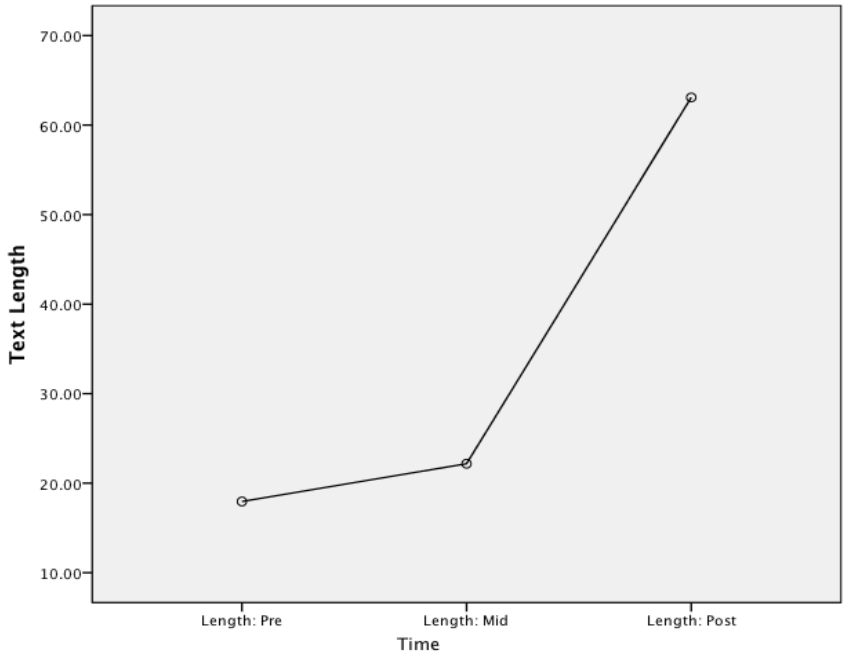

Figure 7. Display of estimated marginal means for text length over time.

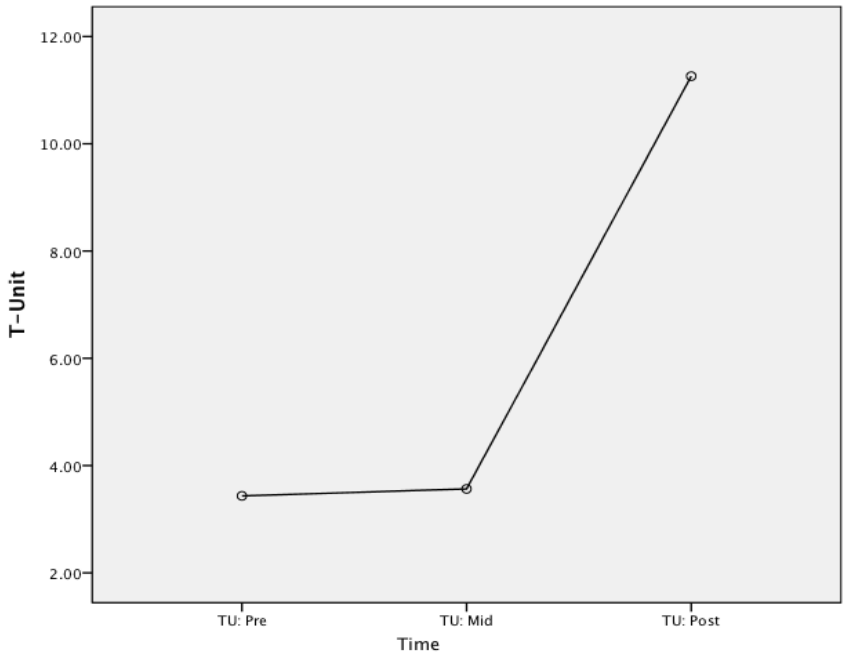

Figure 8. Display of estimated marginal means for T-units over time.

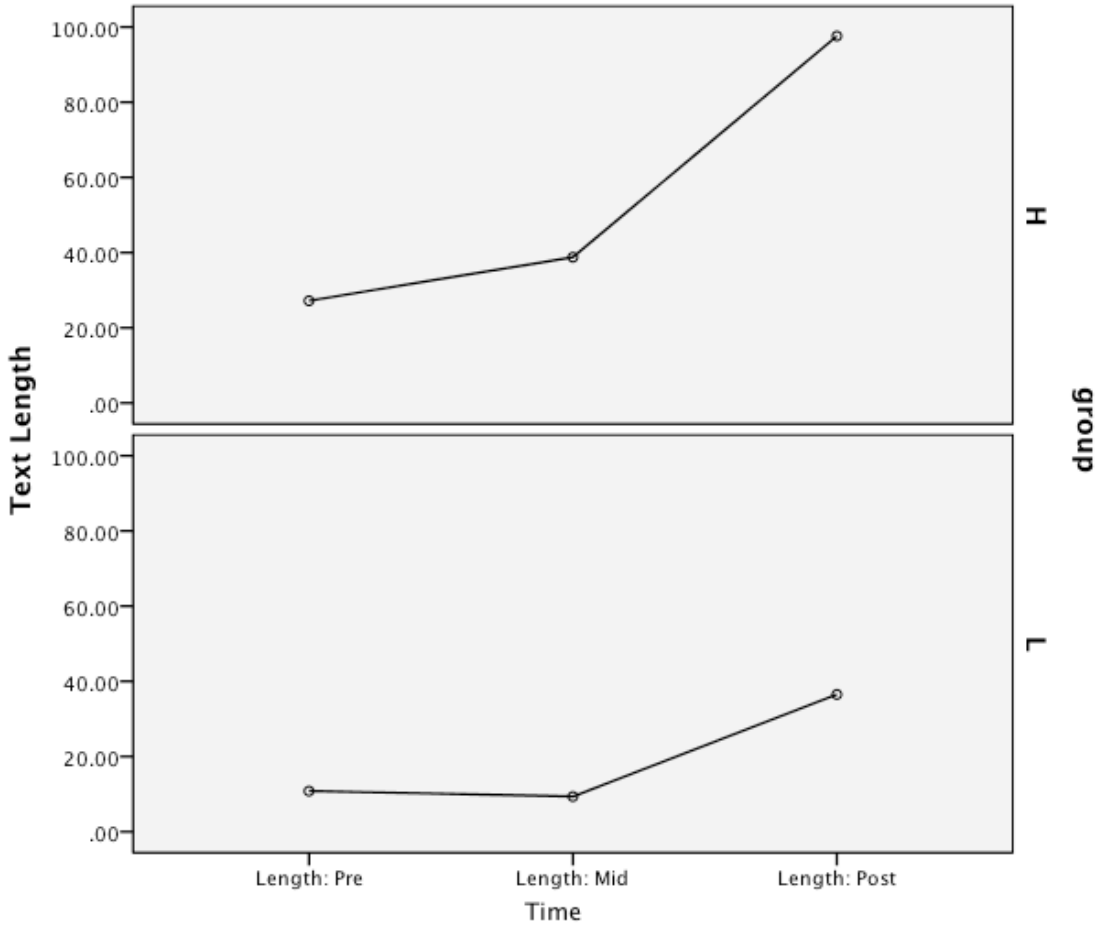

Figure 9. Display of estimated marginal means for text length by language proficiency group over time.

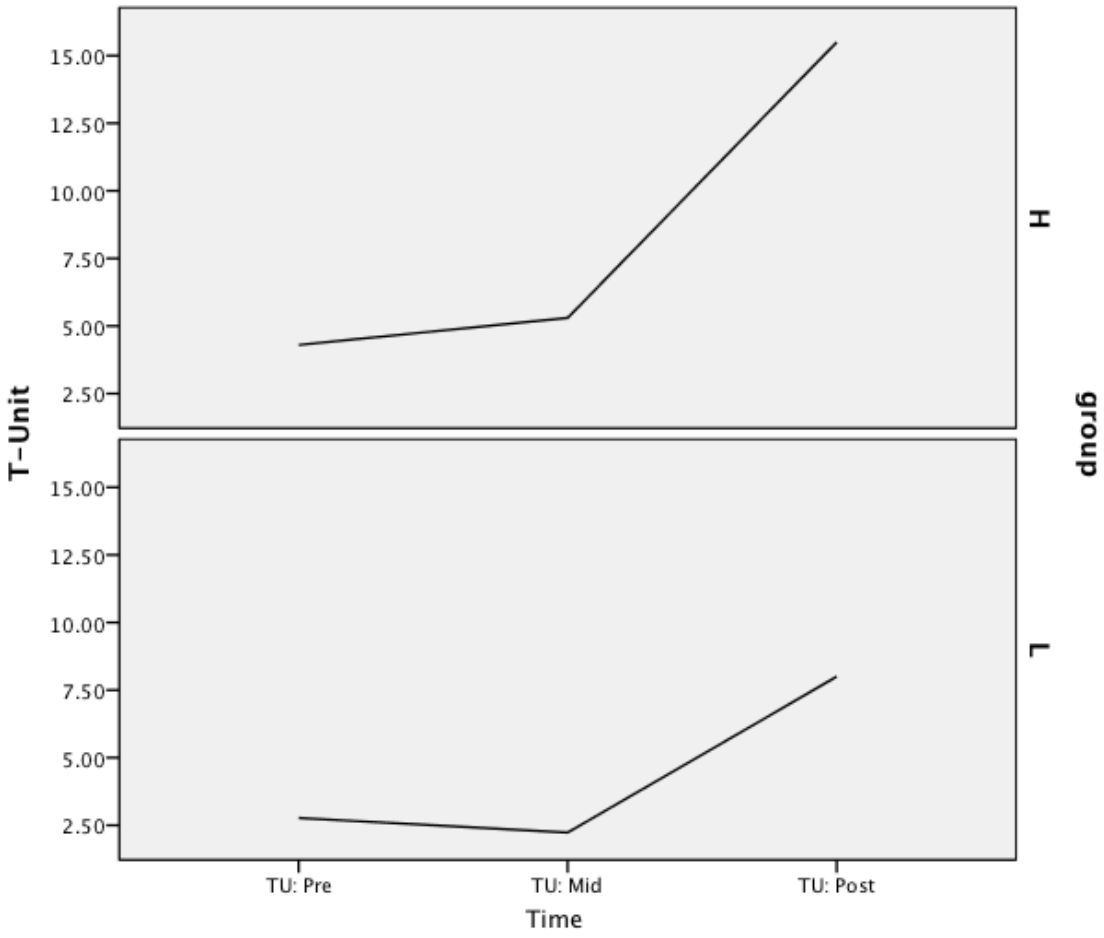

Figure 10. Display of estimated marginal means for T-units by language proficiency group over time.

Student examples. To further illustrate the language and writing development of students who differ by language proficiency group, we offer the following two descriptions.

Student 1: Lee (lower language proficiency group). Lee's (pseudonym) pretest language sample was made up of almost half UU (35 out of 77) with average utterances (MLU) containing 1.9 ASL morphemes per T-unit. He was constantly signing something, but the signs were disconnected, nonsensical and repetitive. At T2, his pattern of continuous, repetitive and nonsensical signing was similar. Out of 26 utterances at T2, 7 were unintelligible and his MLU

averaged 2.5 morphemes per T-unit. Some responses at pretest and midtest included signed statements like, “BEAR, SEE, SAVE” and “WINDOW, NOISE, MOUSE”.

During SIWI, Lee was eager to participate and frequently wanted to share his ideas. As instruction progressed he learned how to focus his comments and make them less repetitive by observing his peers’ interactions, the teacher’s think-alouds and responding to prompts that asked him to evaluate whether his comments were relevant. His thoughts were often first made visual through drawings or gestures. The teacher and his peers would ask for clarification while pairing the visual representation of his thoughts with expressive language. For example, when talking about the Titanic he signed the equivalent of, “boat, big, boat, you know, boat.” The teacher drew a big boat in the ASL holding zone, and he interacted with the initial drawing to clarify or provide additional details. In this case, he erased the water under the boat and drew a flat line underneath the boat to show it was on land. Then he added a picture of a ticket booth and stick figures of him and his father and siblings. He used the picture to act out paying, then walking in and looking around. After adding movement to his drawing, he drew an iceberg and signed, “broke, broke.” His classmates asked him, “Where was the boat?” He did not know. They asked, “Did you get in the car? Did you drive there? Did it take a long time?” Another student used the internet to pull up pictures of the Titanic Museum. As soon as Lee saw it he pointed at his picture and signed, “THAT! THAT!” Once the teacher and students arrived at a common understanding of Lee’s experience they were able to discuss how to represent that experience in ASL.

After the fifth week of SIWI and interactions like the ones described above, Lee’s awareness of language and expressive abilities had improved. At the post-test, out of 39 utterances, 7 were unintelligible, but the average length of utterance had almost doubled. With

almost twice as many morphemes per utterance, Lee had begun to communicate his ideas more fully, and used signed phrases like, “MOM GO HOSPITAL SICK, HEAD HURT” and “MONKEY EAT GRASS, BUT NOT LIKE GRASS”. With longer, more meaningful utterances, and fewer UU, Lee was able to communicate his ideas more completely after five weeks of SIWI.

Lee’s writing samples (see Appendix A) also show considerable growth during the 5 weeks of SIWI. In his first two samples, Lee was unable to relay his experiences in English text. His writing consisted of confused phrasing and words that collectively carried no meaning. After SIWI, Lee was able to relay details of an experience using mostly comprehensible text.

Student 2: Dora (higher language proficiency group). At pretest Dora (pseudonym) could answer questions directly, but without detail or explanation. Her MLU was 3.3 morphemes per T-unit, which allowed her to respond clearly, but briefly, with answers like, “DOG ATE STICKS” or “HUNTING DOGS SLEEP TOGETHER.” In class, she constantly had something to share and often had to be reminded to allow other students to have a turn to communicate in order to engage in a conversation. The teacher expanded on Dora’s willingness to express herself by demonstrating, for example, how to add adverbs and adjectives in ASL. By T3, Dora’s MLU had nearly tripled, to 8.8 morphemes per T-unit, and ASL grammatical features were incorporated more frequently. In all cases, ASL features either doubled or tripled during the collection of her language sample. Her appropriate use of ASL features often increased her MLU, which indicates the expression of more complex thoughts. Rather than “DOG EAT STICK”, her utterances included phrases like, “BEACH, E-L-F SEAL ROLL, REST ON-SAND, and “WHITE ROBIN FLY, SIT BIG-TREE ON-BRANCH.” The quantity of her expressive communication more than doubled in the five weeks of SIWI.

Dora's writing samples also show tremendous growth in her writing of English (see Appendix B). Her T1 and T2 samples are intelligible but very brief with only one or two sentences. After the SIWI intervention, she conveys her experience with a paragraph containing multiple details. Not only is she writing much more text, she is also showing she knows how to write introductory clauses, a series of items, and compound sentences. These features add greater complexity to her English text.

Discussion

The pattern of little or no growth during typical instruction resonates with the substantial research base demonstrating plateaus and little progress in literacy among d/hh students (Antia, Reed, & Kreimeyer, 2005; McAnally, Rose, & Quigley, 1994; Moores & Miller, 2001; Musselman & Szanto, 1998; Yoshinaga-Itano, Snyder, & Mayberry, 1996). SIWI was designed to emphasize the development of expressive signed language, linguistic competence, and metalinguistic awareness in ASL and English to be supportive of d/hh students as dual language learners. During the five-weeks of SIWI all students and each language proficiency group made significantly greater gains in ASL and written English compared to the five-weeks with no intervention. At T3 the lower language proficiency group surpassed the higher language proficiency group's MLU at T1 and T2 in signed expressions. During T1 and T2 students' use of UU remained consistent, but after the implementation of the intervention, students significantly reduced the amount of UU used even though utterances lengthened considerably.

One of the most significant differences between the SIWI and regular instruction is the degree to which students had access to strong models of a full language; in this case either ASL or English. During regular instruction, teachers enact the school's Total Communication philosophy by using Sim-Com, which compromises the integrity of input in both ASL and

English (Johnson, Liddell & Ertling, 1989; Marmor & Petito, 1979; Swisher, 1984). SIWI purposefully separates and discusses ASL, English and any other forms of communication students use in order to build metalinguistic awareness and allow greater linguistic competence. This means students are exposed to robust models of each language, along with explicit discussions of the differences between them. As findings from this study demonstrate, SIWI promotes significant gains in the development of both languages.

After five weeks of SIWI all participants made significant gains in total word count and T-units per writing sample but not with number of words per T-unit. The lack of growth in words per T-unit is not surprising in a short five-week study when much instructional time was needed for basic writing instruction, an introduction to SIWI and development of expressive language skills. When explicit instruction on complex sentence structures and sentence combining is provided within SIWI, students have been known to make gains with complexity measures (Wolbers, 2008). Taken together, these findings suggest that SIWI positively impacted both signed and written communication for all participants, regardless of beginning language proficiency, but more time is needed to provide instruction that can influence English language complexity at the sentence level. Importantly, the focus on ASL in the context of English instruction did not detract from students' writing growth. Instead, our findings support the literature that hypothesizes interdependence: a focus on building ASL and written English proficiency simultaneously resulted in significant gains in both.

Implications

It is beyond the scope of this study to identify which individual aspects of SIWI are most important or powerful predictors of student growth. Still, patterns in student growth across indicators and language proficiency groups suggest that some aspects of SIWI may be

particularly supportive of the language and literacy development of d/hh students. For example, students in the higher language proficiency group made more growth in ASL than the lower language proficiency group. This suggests that greater linguistic or metalinguistic knowledge, as found in the higher language proficiency group, supports greater growth. If so, SIWI's focus on metalinguistic awareness may be an important lever for growth across students with varied levels of proficiency.

Since both language proficiency groups made some growth in ASL, regardless of their beginning language proficiency, we suggest that the interactive nature of SIWI may have supported growth for both groups by providing and extending opportunities to communicate using ASL. If this is the case, it follows that it would be important for teachers have strong ASL skills and deep metalinguistic awareness of English and ASL themselves in order to accomplish the focus on metalinguistic awareness and interaction. Such awareness will help teachers make connections and comparisons across languages, and will allow them to understand the ways in which students may be working between the two languages.

When it comes to writing, we hypothesize that growth across language proficiency groups supported the emphasis on strategic instruction, that is, instruction that explicitly addresses certain aspects of writing conventions, style or craft are contributing to writing development. The guided to independent process of writing may also have been a source of support for growth. The patterns of our findings suggest that *metalinguistic awareness* in an *interactive setting* through the *guided to independent process* are likely to be the most important elements of the SIWI approach. Future research could investigate the contribution of each of these elements in order to identify their unique contributions.

Limitations and Future Directions

This study was limited by its application in a single residential school setting which represents one of many possible philosophies of communication and instruction. The sample was further limited to d/hh students in grades 4, 5, and 6 for the purpose of exploring language growth during the upper elementary and middle school years.

The success of a short SIWI intervention when compared to no measurable growth during regular instruction raises significant questions for further research. These include research questions about the meaning of "accessibility" in investigations of the impact of contrived communication strategies on students' ability to develop metalinguistic awareness and linguistic competence. Given that MLU is not a standardized measure for ASL growth, but a proxy measure with the ability to achieve high reliability, future studies might strengthen their analyses by adding standardized assessments of ASL, once available.

To date, the longest study of SIWI is a single school year (approximately 9 months) (Wolbers, Dostal & Bowers, 2012). Given the growth in ASL after 5 weeks and significant growth in written English growth after a year, it is possible that multiple years of exposure to SIWI would mean upward trends in the language and literacy achievement and academic trajectory of individuals who are d/hh.

Conclusion

The purpose of this study was to investigate the impact of SIWI on the ASL expressive language and the written English of d/hh students. The focus on ASL, a signed language without a written form, did not detract from students' writing growth in English. Instead, our findings support the literature that hypothesizes interdependence: a focus on building ASL and written English proficiency simultaneously resulted in significant gains in both.

Findings from this study have two important implications for general education teachers working with students who have diverse language histories and diverse language proficiencies. First, if students have diverse language proficiencies, an interactive environment allows each student's unique understanding and unique way of communicating to support a collective understanding of the idea. Additionally, if given explicit focus, interacting across varied languages and modalities builds students' awareness of language, connections between languages, and uses of language for communication. This may simultaneously support the development of students' language proficiencies by strengthening their metalinguistic awareness through multiple opportunities for exposure, comparison and translation.

Second, our findings support the broad range of research advocating for strategic instruction (CITE), yet strategic instruction is difficult to accomplish if teachers and students do not have a shared language for communication. In these cases, opportunities to co-construct meaning by capturing ideas in an accessible forms (as in a holding zone), and using language to collaboratively elaborate initial ideas from students (whether presented in English or not), has the potential to support the development of expressive language by encouraging students to link their understandings with language form. SIWI provides a space within literacy instruction for necessary linguistic and metalinguistic teaching and learning to occur among linguistically diverse populations.

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Appendix A

Lee's Writing Samples: An Example from the Lower Language Proficiency Group

Pre-study writing sample

I Two so Paly

Mid-study writing sample

Play in Go good
And Two

Post-study writing sample

MoM sick Nurse
911 go go Justin DaD
car Justin see MoM
2 day

Appendix B

Dora's Writing Samples: An Example from the Higher Language Proficiency Group

Pre-study writing sample

My favorite Coloris: Lime green
I love to play outside

Mid-study writing sample

I love Spring because it is So beautiful!

Post-study writing sample

Mother's Day

At Mother's Day, I gave my Mom prenset, I gave her Shower gel, flower yankee candle, flower body
bar. My dad gave her Indian earring. We went out to eat and I made blueverry pancakes for breakfast. I love mother's day!