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## **Increasing Written Language Skills Utilizing Writing Software and Traditional Methods**

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**Increasing Written Language Skills Utilizing Writing Software and Traditional  
Methods**

BY

**Caroline Larson**

**SENIOR HONORS THESIS**

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS  
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**2010**

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Increasing Written Language Skills Utilizing Writing Software and Traditional  
Methods

Caroline Larson

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### Abstract

A grid based computer program, *Clicker5*, appeared to have many features that logically may assist struggling writers. It utilizes pictures, sound, speech synthesis, word banks and a spelling checker. Karemaker et al. (2008) examined the use of *Clicker5* and observed increased attention and focus during reading, and greater gains in word recognition and rhyme awareness. Scattered research exists on some of the multimedia features that *Clicker5* utilizes (e.g. auditory and visual instruction, specific feedback, student specific examples, Wissick & Gardner, 2000; composition processes and revision facilitation, MacArthur 2000; spell checkers with strategy instruction, and speech synthesis to increase error detection and correction, Borgh & Dickson, 1992). However, no research exists on writing outcomes utilizing *Clicker5*.

The purpose of this study was to evaluate the effectiveness of individual *Clicker* instruction on classroom hand-written products and individually generated computer-assisted written products for children with speech-language deficits who were identified as weak writers by their teachers. A single subject multiple baseline across subjects design was utilized to investigate the research question.

The participants included 2 matched pairs of second grade students from two second grade classrooms demonstrating speech-language deficits and difficulty with writing. They were identified by teachers and the speech-language pathologist (SLP) at the Shelbyville elementary school as being at risk for reading difficulty. In the regular classroom, the Daily 6-Trait Writing program was utilized for writing instruction, and consisted of five days of instruction over a 25 week period. The students in the regular classroom filled in a graphic organizer to a writing prompt on the fourth day, and responded to the prompt on the fifth day. The intervention was



conducted with one student from each matched pair in two phases, one in the fall and one in the spring, and included three 20 minute sessions each week for four weeks. Each Friday, the subjects responded to the writing prompt in the regular classroom, and then responded to it utilizing *Clicker5* independently. These responses were scored on measures of form and content including total number of words, number of different words (NDW), mean length of utterance (MLU), spelling and grammatical accuracy, and local and global coherence.

Results indicated good growth in a relatively short treatment period. The phase 1 intervention subject demonstrated an increase from the initial to final writing samples in the classroom and using *Clicker5* on measures of total number of words, NDW and MLU. The phase 2 intervention subject demonstrated gains on the same measures when using *Clicker5* to respond to the writing prompt. Overall, spelling accuracy was higher when the subjects used *Clicker5* to respond to the writing prompts. The intervention subjects also scored highest on total number of words and NDW when using *Clicker5* across subjects and samples. Clinical implications include that the subjects demonstrated motivation and enjoyment when using the software program. Some limitations may be that the independent response was conducted in the presence of the primary investigator, and there was inconsistency in the classroom instruction from week to week. Future directions include a multiple baseline across subjects design and a longer treatment period with more participants.

## Chapter I

### Introduction

Spoken and written language share a reciprocal relationship including similar semantic and syntactic linguistic foundations. Differences between oral and written language include the physical input and output modalities, temporal differences, and the innate nature of spoken language in contrast to the need for education to develop written language (Catts & Kamhi, 1999; Nelson, Bahr, & Van Meter, 2004). Due to the interrelated nature of language and literacy deficits, the American Speech-Language-Hearing Association (ASHA, 2001) advocates that speech-language pathologists (SLPs) play a role in literacy instruction in collaboration with classroom teachers and other special educators.

Students with language disorders often evidence deficits in connected discourse measures of organization, content, syntax and length when compared to typically developing peers. For example, diffuse organization, poor use of complex sentence structure and vocabulary, and shorter overall length characterizes the spoken narratives of these students (Gillam & Johnston, 1992; Scott & Windsor, 2000; Wetherell, Botting, & Conti-Ramsden, 2007). Additionally, the written discourse of students with LLD reflects deficits similar to their spoken discourse. Composition processes of planning and revision, lexical richness, sentence structure, and length as well as spelling skills are inferior to typically developing peers (Fey, Catts, Proctor-Williams, Tomblin, & Zhang 2004; Hengst & Johnson, 2007; Scott & Windsor, 2000).

Recent research has demonstrated mutual growth in spoken and written expression as a result of an integrated approach to intervention. Nelson et al. (2004)

utilized spoken and written language interactions to address the needs of 53 students from three third-grade classrooms using a collaborative writing lab approach, then followed-up with specific case study information about 7 children with speech-language or special education diagnoses. Gains in written narratives were reported for typically developing children, children with speech-language diagnoses, and children with special education diagnoses on measures of narrative structure and length, syntactic complexity, number of different words, and number of words spelled correctly. Gillam, McFadden, & van Kleeck (1995) compared the whole language and language skills approaches for improving narrative abilities. The whole language approach promoted reciprocal growth by integrating speaking, reading, writing and listening using narrative structures. Post intervention measures indicated significant increases in spoken narrative measures of content for the whole language group as compared to the language skills group. The written productions of the whole language group also evidenced a higher proportion of problem/resolution pairs.

The use of multimedia in literacy instruction may provide opportunities for a teacher or SLP to create a contextualized environment in which basic skills are learned by utilizing features such as videos, pictures, speech synthesis and word processors. Written productions may be facilitated by multimedia due to increased motivation, active involvement and learner control. Specifically, students with language learning disabilities (LLD) require engaging programs correlated to their specific interests by incorporating personal examples while still maintaining curriculum goals (Wissick & Gardner, 2000).

Research evidence has demonstrated the effectiveness of assistive technology on facilitating written discourse in students with LLD. Word processors increase

composition, revision, and quality of writing (MacArthur, Graham, Schwartz, & Schafer, 1995). Spelling and grammar checkers and speech synthesis may increase students' ability to correct errors while composing (Lewis, Ashton, Haapa, Kieley, & Fielden, 1999; MacArthur, Graham, Haynes, & DeLaPaz, 1996; Raskind & Higgins, 1995). Finally, hypermedia (i.e., variety of media such as sound, video and pictures) may be a promising support to writing processes due to the contextualized instruction; however, a paucity of research on its effectiveness exists.

*Clicker5* is a grid based computer literacy program which decreases demand on the composer due to incorporation of pictures, text, video, speech synthesis, spelling and grammar checker, teacher highlighted information, and auditory matching. Each of these features supports various writing processes such as planning, organization, vocabulary, phonemic awareness, syntax and basic concept knowledge (Parette, Hourcade, Dinelli, and Boeckmann, 2009). One study examined the Oxford Reading Tree (ORT), a reading program, on *Clicker5* compared to traditional printed texts of ORT Big Books and found that word highlighting and auditory cue features of ORT using *Clicker5* elicited increased development of literacy processes such as phonemic awareness, word recognition, and comprehension (Perette et al., 2009).

No research was found that investigated the impact of the *Clicker5* literacy software program on writing skills. The purpose of this study was to evaluate the effectiveness of individual *Clicker5* instruction on classroom hand-written products and individually generated computer-assisted written products for four second grade children with speech-language deficits who were identified as weak writers by their teachers. Recent changes in school policy have led to fewer children being diagnosed early with LLD. Instead, children are given modified instruction in a 3-tiered

Response to Intervention hierarchy to determine if modified instruction can assist children; if not, they are later labeled with LLD. The participants in the current study were receiving Tier 2 strategic reading assistance, but none of the participants had yet been formally diagnosed with LLD. Individualized instruction utilized the Clicker5 writing program and elements from Nelson's et al. (2004) Writing Lab Approach to Language Instruction and Intervention while working with components related to the classroom Daily 6-Trait Writing program (2008).

## Chapter II

### Review of Literature

#### **Roles and Responsibilities of the Speech-Language Pathologist**

The reciprocal relationship that exists between verbal and written expression suggests why speech-language pathologists (SLP) may be involved in the remediation process of language and literacy deficits. The American Speech-Language-Hearing Association (ASHA) developed guidelines concerning the roles and responsibilities of SLPs related to literacy. SLPs provide assessment and intervention to children with language deficits, many of whom also exhibit difficulty with learning to read and write. ASHA policy advocates a direct role in literacy intervention and a collaborative partnership between SLPs, teachers and other special educators (ASHA, 2001).

Barriers to language learning may lead to spoken and written difficulties throughout the school-age years. Rather than diminishing over time, these weaknesses can cause a cycle of failure that continues into early adulthood. As a result, functional success may be greatly impacted by SLP involvement in the remediation of literacy deficits (Nelson et al., 2004).

#### **Relationship of Expressive Verbal and Written Language**

Language can be conveyed in spoken or written forms. Written communication uses orthographic forms, thus implementing an alphabet, while verbal communication is expressed in spoken conversation. Reciprocal relationships exist between written and spoken modalities because they utilize the same semantic and syntactic linguistic base (Nelson et al., 2004).

Spoken and written language share vocabulary and sentence structure.

Vocabulary activates concepts stored in the mental lexicon. The content of the mental lexicon includes information such as phonological and visual representations of words, as well as word meaning and association with other words. Furthermore, syntactic and semantic information exists in the mental lexicon to describe parts of speech and the roles of a word (Catts & Kamhi, 1999).

There are also some discourse level similarities between spoken and written language. For example, oral and written narratives require cohesive story components such as setting, theme, characters and cause-effect relationships (Nelson et al., 2004). Discourse is developed based on background knowledge and is organized using metacognitive skills and executive functioning skills. At the word level, oral expressive phonology and morphology are generally produced at a subconscious level, whereas, explicit phonological awareness and morphological knowledge is necessary for spelling written words.

Differences between spoken and written expressive language also include the biologically innate nature of verbal communication, and the physical differences between spoken and written language production. All human cultures exhibit complex spoken communication systems that have evolved over thousands of years. People are able to effectively learn how to speak without formal education (Nelson et al., 2004). However, 40% or more of the world's adult population (Catts & Kamhi, 1999) cannot use written language at all, and much more of the world's population is not able to use a writing system sufficiently to be of practical use. Nevertheless, written language skills are of vast importance in literate cultures, such as our own, and are a prerequisite for power and independence.

Physical differences between spoken and written language occur in the form of primary sensory input modalities and motor output modalities. The differing primary sensory modalities of input include audition for internalizing verbal communication and vision for processing orthographic messages. The motor modalities of output include oral motor for speaking and fine motor hand skills for writing. The physical differences also encompass the durable nature of writing and the fleeting nature of speech, thus affecting temporal availability. Verbal expression must be planned, organized, and executed instantly under the pressure of an immediate audience. The spoken message does not exist without a speaker and listener (Catts & Kamhi, 1999). Conversely, written expression is relatively permanent in nature, and may be reflected on and improved. The writer also has the power to determine when the message is ready to be communicated (Nelson et al., 2004), thus the orthographic message remains available for revision. Finally, nonlinguistic contextual supports underscore the contrasting physical natures of spoken and written language. Spoken language is supported in topic selection, cues about breakdowns, word finding, and sentence generation by the immediate presence of a communication partner (Nelson et al., 2004). Conversely, orthographic expression may be supported by a range of cues, such as a variety of fonts, colors, and pictures.

### **Oral Language in Students with Language Learning Deficits**

Spoken discourse measures derived from oral narratives have been frequently reported. The ability to convey personal experience narratives forms a basis for social communication, and the ability to comprehend and retell fictional narratives is a foundational elementary school skill. Students with language learning deficits



(LLD) differ from their typically developing peers on oral narrative measures of organization, content, syntax and length, and may be characterized by oral language disorders such as Specific Language Impairment (SLI). These students demonstrate inferior and highly diffuse organization in spoken productions, as well as little cohesion and structure. They also have a higher degree of unconnected constituents and mazes, and fewer complete cohesive ties. Furthermore, oral narratives of students labeled as LLD exhibit greater need of listener support to convey the story (Gillam & Johnston, 1992, Wetherell, et al., 2007). These weaknesses underscore the difficulty these students have in creating and implementing a narrative plan.

Oral grammar also differentiates students labeled as LLD from their typically developing peers. They generate fewer complex sentences and use of poorer complex sentences on measures such as percent of grammatical T-units and errors in simple and complex sentences (Gillam & Johnston, 1992, Scott & Windsor, 2000, Wetherell, et al., 2007).

The content quality of spoken discourse produced by students labeled as LLD is also inferior to typically developing peers. The length of these compositions tends to be significantly shorter, which impacts a listener's perception of the production (Gillam & Johnston, 1992, Scott & Windsor, 2000). These students also evidence less lexical diversity as characterized by smaller vocabulary, and high frequency use of a few words and of nonspecific words. Additionally, measurements of number of different words (NDW) indicate a significant inferiority to typically developing peers (Greenhalgh & Strong, 2001).

**Writing Abilities in Students with Language Learning Disabilities**

SLI is characterized by spoken language deficits which often carry over to writing difficulties. There is a significant overlap between children with SLI who develop reading and writing deficits and the learning disabled (LD) populations. The SLI and LD literature indicate that similar strategies are used to remediate writing deficits. The term LLD will be used comprehensively to refer to children with SLI and learning disabilities who demonstrate writing weakness (Hengst & Johnson, 2007). Writing deficits in LLD are evident in many forms (Wetherell et al., 2007) and many of the deficits present in the spoken discourse of students with LLD are also present in written discourse.

The first area of difficulty for students with LLD is in organization. Lack of planning, and use of cohesive devices and mazes, indicate poor organization in writing as compared to typically developing peers (Gillam & Johnston, 1992; Gillam et al., 1995; Hengst & Johnson, 2007). The composition processes used in written productions, such as planning, structuring and revising, are lacking in students with LLD and result in inferior compositions. Also, there is a smaller percent of dyadic constituents (i.e., linked constituents forming problem resolution units; a measure of hierarchicalization of plot structure).

Another area in which students with LLD demonstrate difficulty is in content, or vocabulary used in discourse. The quality of content is measured by lexical richness of the composition in terms of number of different words (NDW). This measurement is typically lower for students with LLD when compared to their typically developing peers, which results in a reduced vocabulary diversity and content quality (Fey et. al, 2004; Scott & Windsor, 2000).

Students with LLD evidence deficits in written syntax. Language form deficits are manifested in increased grammatical error rates, fewer complex sentences and overall difficulty with sentence structure as compared to typically developing peers (Fey et al., 2004; Gillam & Johnston 1992; Gillam et al. 1995; Mackie & Dockrell, 2004; McFadden & Gillam, 1996; Scott & Windsor, 2000). Examples include weakness in auxiliary verbs, grammatical morphemes, percent of grammatical T-units (terminable unit), and a large percentage of grammatically unacceptable sentences, regardless of sentence complexity (Hengst & Johnson, 2007).

Students with LLD also tend to produce shorter compositions than their typically developing peers. Written discourse evidences shorter episodes and fewer words, sentences and episodes per composition (Gillam et al., 1995; Hengst & Johnson, 2007; Mackie & Dockrell, 2004). These deficits underscore the increased difficulty students with LLD have in generating text and narrative ideas. Scott and Windsor (2000) reported students with LLD produced written narratives summarizing a film that were 62% as long as their peers and expository compositions that were 49% as long.

### **Spoken and Written Intervention in Students with LLD**

Butler & Silliman (2002) stated, “writing problems do not exist in a linguistic vacuum” (p. 222), and an ever expanding body of literature provides evidence of the inextricable ties between verbal and orthographic language. Current research demonstrates mutual growth in spoken and written expression as a result of an integrated approach to intervention. Nelson et al. (2004) stated “the key to successful intervention is to capitalize on intermodality distinctions, similarities and reciprocal relationships” (p. 48) in speaking and writing when addressing the

expressive language needs of students. The acquisition of knowledge by way of comprehensive and useful language tasks helps students with LLD organize information into accessible tracts for any form of communicative output.

Butler and Silliman (2002) explained that explicit instruction in text structure, whether spoken or written, had positive effects on spoken and written compositions. The impact of text structure instruction on verbal expression, although less researched, is theorized to be positive.

Swanson, Fey, Mills, and Hood (2005) investigated the use of narrative based oral language intervention with students with SLI and demonstrated gains in narrative quality, organization, content and linguistic sophistication. Participants included ten 7 to 8 year old children with SLI who received six weeks of narrative based intervention. Therapy sessions targeted oral story content, sentence form, and grammatical structure via verbal story imitation and retell, and story generation paired with retell. Significant gains were evidenced in spoken narrative quality including content, organization, and language sophistication. Increased use of story elements and language of literacy (e.g. sophistication of character, setting and plot description) was informally observed post intervention. No significant gains were evidenced in the post intervention written narratives on NDW or measures of syntax.

Studies have also demonstrated the efficacy of integrated intervention, such as in Gillam et. al's (1995) comparison of whole language and language skills approaches to improving narrative abilities. The whole language approach promoted reciprocal growth by integrating speaking, reading, writing, and listening using narrative structures. The approach immersed children in narratives based on the commonalities in spoken and written forms, and in developmental patterns. In the

language skills approach, discreet subskills that facilitate comprehension and production of stories were systematically taught, and concentration was on one modality at a time. Eight children with language disorders between nine and twelve years with at least average nonverbal IQ were matched for age, verbal intelligence, reading and writing abilities. The subjects were then separated into language skills and whole language approach groups. Post intervention measures indicated significant increases in spoken measures of content such as ideas per T-unit, episodes, and embedded dyads (i.e., problem-resolution pairs) for the whole language group as compared to the language skills group. The written productions of the whole language group also evidenced a higher proportion of problem-resolution pairs. Conversely, the language skills group demonstrated higher measures of language form. For example, longer sentences and a higher probability of grammatic acceptability were demonstrated in the spoken and written narratives of the language skills group. However, small sample size and posttest-only comparison of spoken and written discourse may have distorted the results.

Graham and Harris (1999) investigated the progress of a twelve year old boy with LLD and severe writing difficulties when utilizing the self-regulated strategy development (SRSD) model of intervention. SRSD includes explicit teaching of goal setting, self-monitoring and self-instruction when writing a composition. The subject of this research was taught planning and writing and a peer revision strategy by the SLP. Post intervention results included gains in advance planning, amount and quality of revisions, story length, organization, content and attitude about writing. This study supported the importance of explicit instruction on the writing process, as well as the specific impact that self-regulatory skills have on written compositions.

Nelson et al. (2004) utilized spoken and written language interactions to address the needs of 7 students with special needs who were receiving either special-education services, speech-language services, or both. The subjects expressed various patterns of error when generating spoken and written discourse, such as spelling difficulty, avoidance of oral discourse and impaired phonological representation. The participants' written and oral discourse deficits were addressed using the computer-supported writing lab approach in inclusive classrooms. Children participated in writing lab activities three times per week, twice in their 3<sup>rd</sup> grade classrooms and once in a computer lab, throughout a school year. The classroom teachers, special education teacher, and two university investigators met bi-weekly to plan lessons and activities. The school SLP addressed many of her students' IEP goals as part of the writing lab instruction. The SLP and university investigators/graduate students were present for the writing lab activities. The approach included writing process instruction, computer support, and inclusive instructional practices. The students were engaged in projects that incorporated all aspects of the writing process including planning, organizing, drafting, revising, editing, publishing, and presenting. Team members provided instructional scaffolding and mini-lessons on specific topics. Writing occurred in a computer lab once each week, but the authors did not specify the software utilized. Measures were taken via story writing probes at the beginning, middle and end of the school year. Objectives included growth at the discourse, sentence, and word level. Results indicated significant growth at the discourse level on a hierarchy of narrative story grammar features (i.e., isolated description, complex/multiple episodes) for all the students, regardless of special education needs. At the sentence level, assessment of

participants' discourse was based on terminable units (T-unit) and words per T-unit which demonstrated significant change between the first and second probe, but not between the second and third probes. Assessment also included coding sentences as simple incorrect, simple correct, complex incorrect and complex correct. These measures evidenced significant growth from the first to second probe, but not the second to third. However, qualitative analysis evidenced complete disappearance of simple incorrect sentences, and increased frequency of simple correct and complex correct sentences overall. At the word level, analysis included measures of number of different words (NDW) and spelling accuracy. Results indicated significant growth between the first, second and third probes for NDW, and significant overall growth for spelling accuracy.

### **Multimedia Instructional Principles for Students with LLD**

Wissick and Gardner (2000) examined instructional principles related to multimedia software programs used successfully by special educators. Multimedia is a computer based learning environment that employs a variety of media such as graphics, video, text and sound. Wissick and Gardner advocate that educators incorporate multimedia programs based on sound instructional principles such as basic skill development, automaticity, mastery learning, and written composition. Educators should examine how a software program addresses each principle before its integration in therapy or the classroom.

Multimedia may provide opportunities to create a contextualized environment in which basic skills are best learned and automaticity is reinforced. The combination of auditory and visual instruction with specific feedback, as well as overlearning opportunities, can foster increased acquisition of basic skills. Multimedia programs

that employ individual strategies allow teachers to present examples specific to each student. Advanced skills may also be encouraged by multimedia software due to holistic instructions that support problem solving and reasoning. Contextualizing basic skill development within a realistic environment cultivates these and other functional skills. Other features of multimedia programs that aid in written production include viewing and reviewing video, recording and hearing speech, visual aids in vocabulary definitions and word prediction. These features may encourage the composition of written productions in groups or independently. More characteristics that are conducive to writing development are active involvement, learner control, and motivation. Students with LLD require engaging programs correlated to their specific interests while still maintaining curriculum goals. In fact, many programs can incorporate personal photographs, video and text to further contextualize the learning process and sustain student interest (Bahr, Nelson, and Van Meter, 1996; MacArthur, 1996; MacArthur 2000).

Some features of multimedia programs, however, may facilitate written productions or compound writing deficits. Feedback that is slow or highly detailed may be ignored or consume too much processing energy to be useful. Furthermore, feedback that is not varied or relevant may facilitate boredom and disengagement in the program. Multimedia may be nonlinear in nature, meaning the navigator has the ability to move throughout a document without sequential order. Characteristics such as clicking icons, numerous choices, movement according to interest, and free interaction result in nonlinear information. For example, a student may navigate a program alphabetically, by genre, or chronologically. Students may get lost or overwhelmed in a search, but educator instruction can increase awareness and



exploration capability for students with LLD (Bahr et al., 1996; MacArthur, 1996; MacArthur, 2000).

### **Computer Technology and Writing Skills in Students with LLD**

MacArthur (2000) reviewed research on the use of computer software programs in writing instruction for students with LLD. Studies have documented word processors' assistance in composition processes and revision. Utilizing word processors is motivating to students who struggle with transcription when paired with typing instruction. MacArthur (1988) used a multiple probe design to study the impact of pairing revision strategy instruction and the use of word processors in the compositions of students with LLD. Results emphasized increases in the total number of revisions to correct errors, substantive revisions, and overall quality of the production. In another study, MacArthur, C. A., Graham, S., Schwartz, S. S., & Schafer, W. D. (1995) investigated the efficacy of integrated writing instruction that included word processing, strategy instruction, and a process approach in 12 classes of elementary students with LLD. Greater gains in the quality of writing were evident in the experimental classes as compared to the control classes that received only a process approach to writing instruction.

**Spell checker.** MacArthur et al. (1996) investigated the number of spelling errors that middle school students with LLD corrected with and without a spelling checker by middle school students with LLD. During two 45 minute periods each day for one month, the subjects wrote on teacher chosen topics using a word processor and spelling checker. Subjects independently corrected 27% of their misspellings when revising the compositions, and with spell checker, corrected 65% to 70% of errors. Limitations of using the spell checker consisted of not identifying

37% of misspellings and failure to suggest the correct spelling for 42% of misspellings. The students selected incorrect suggestions 22% of the time, made no change 30% of the time, and typed an alternative 48% of the time when the spell checker did not suggest the correct spelling. Strategies taught to the students to reduce spell checker limitations have proven effective. Additionally, spell checkers with definitions, speech synthesis and limited lists may aid in increasing the proportion of corrected errors (MacArthur, 1996).

**Speech synthesis.** Research on speech synthesis as a support to written product revision is limited and suggests that variables, such as quality and specific design of the software program, impact results. Raskind and Higgins (1995) examined speech synthesis with a screen-reading program that highlights a textual word as it is read. The study compared use of speech synthesis, a human reader and no reader. The participants included college age students with LLD. Results indicated that significantly more errors were detected using the speech synthesis as compared to the human reader and no reader conditions.

Borgh and Dickson (1992) studied the effects of speech synthesis for children's written productions. The study included 48 typically developing students randomly chosen from two second-grade and two fifth-grade classrooms at two public schools. Each student wrote two picture prompted stories under a speech synthesis and two under a non speech synthesis condition during an out of class writing session. The speech synthesis software allowed for a sentence at a time to be repeated or changed, and the text spoken in its entirety. Production length was measured by total keystrokes, keystrokes in final story, and number of sentences. None of these measures were statistically significant, but they were all higher for

stories in the speech synthesis condition. A significant relationship was found between the spoken feedback condition and increased editing at the sentence level. Remarks from the subjects supported this result because they alluded to an increased awareness of what “doesn’t sound quite right” (Borgh & Dickson, 1992). Measures of story quality did not evidence significance in either condition, but motivation was significantly increased in the spoken feedback condition as compared to the non-spoken feedback. Students found the speech synthesis to be more “exciting,” and it made them “feel happy” that someone was reading their story (Borgh, & Dickson, 1992).

MacArthur (1998) reported on the effects of word prediction paired with speech synthesis in spelling errors of nine and ten year old students with spelling deficits. The students used a word processing program with these features to compose journal entries. Measures displayed an increase in the percentage of correctly spelled words by 90% to 100%. The size of the program’s vocabulary and its correlation to the writing tasks presented limitations in the word prediction software. The greatest positive effects may be seen in elementary students because they require a smaller target vocabulary than older students.

**Hypermedia.** Hypermedia software programs incorporate a variety of media such as sound, video and pictures, and permit nonlinear links among elements of reading and writing. Daiute and Morse (1994) measured the impact of using a hypermedia software program on the writing of students with poor writing skills from diverse cultural backgrounds. Results indicated increased motivation, composition length and quality of communication. Bahr et al. (1996) evaluated the effects of writing software that incorporated graphics and sound on the compositions of

elementary students with LLD as compared to productions using text-based software. Differences in length and quality were not significant across the two conditions.

### ***Clicker5***

**Features.** Parette et al. (2009) reviewed grid-based writing technology that emphasized the interrelated nature of reading and writing, and served as an aid in word selection when generating a written product. This program presents words or symbols in a predetermined, organized grid from which the student selects a word. Difficulty with composition processes is eased and fluency increased by this software feature, due to reduced demand on the writer. The *Clicker5* screen is divided into two halves; the top is a word processing section and a grid is located at the bottom. This grid contains a selection feature allowing the student to choose between activities predetermined by the teacher (i.e., words, phrases, pictures). The student clicks on a selection to generate a sentence that can be highlighted and read aloud if desired. Speech synthesis provided by *Clicker5* fosters development of phonemic awareness and semantic knowledge. The teacher may also highlight important information, and record his or her voice and the student's voice to increase interaction with the program. This provision provides contextualization for what is being learned to increase comprehension.

*Clicker5* presents features that support key emergent literacy skills. Phonemic awareness is reinforced by the picture and sound association activities in which pictures may be matched to their beginning sound or letter. The combination of visual, auditory and orthographic representations available in *Clicker5* may facilitate increased word recognition and word naming skills. The student may say a word and then listen to the word prerecorded with correct pronunciation by the student or

teacher. Print concepts, such as left to right reading and writing, grammatic sentence structure, capitalization, punctuation and spacing, are supported by the *Clicker5* grid. The students must compose sentences left to right, due to limits on the word choice availability. For instance, correct word options appear in color and are available for selection whereas incorrect options appear in gray and cannot be selected. Also, teachers can compose example sentences which may be read back to the students at any time via speech synthesis. The example sentence is available to the students for comparison to their sentence, facilitating self correction of errors. Letter and sound associations presented by *Clicker5* support phonemic awareness as well. Following alphabet mastery, students may access *Clicker5* ‘talking books’ either prepackaged or created by the teacher, thus allowing for curriculum alignment. Additionally, students may compose ‘talking books’ including a variety of multimedia such as text, pictures, video, and sounds (Parette et al., 2009).

**Research.** Karemaker, Pitchford, and O’Malley (2008a) investigated the effects of the multimedia software Oxford Reading Tree (ORT) on *Clicker5* compared to printed texts utilizing the same reading program (traditional ORT Big Books). Measurements included software validity, reading processes facilitated by the software, and software feature effectiveness. ORT on *Clicker5* provided visual highlighting and audio cue features upon the student’s request, whereas the print text did not. The teacher of the class provided instruction one hour a day, five days a week. Instruction began with shared work with the whole class exploring and reading a text aloud. Next, the whole class worked on word and sentence activities, such as producing new sentences with a target word, word bank creation, and sentence completion. Then the literacy hour consisted of an individualized focus on word and

sentence comprehension practice. Examples of activities included writing simple sentences, word order exercises, identifying spelling problems, and questions based on story content. Finally, the session was concluded by a whole class review of what had been taught during that session.

A group of 61 typically developing students age 5 to 6 years in four separate classes underwent pre- and post-intervention assessment of written word naming, phonological awareness (i.e. grapheme, rhyme and segmentation), and written word recognition. Two classes participated in print only instruction and two participated in ORT on *Clicker5* instruction. Outcomes indicated greater gains using ORT on *Clicker5* as compared to traditional printed texts. ORT on *Clicker5* resulted in significantly greater gains on measures of written word recognition, written word naming, rhyme awareness, segmentation proficiency and grapheme awareness compared to the printed text condition. Each of the measured reading processes demonstrated significant gains post ORT on *Clicker5* intervention. The authors hypothesized that specific features of the software program that positively affected the outcome were the visual and auditory cues provided as a word was highlighted and read back via speech synthesis. This feature emphasized the relationship between spoken and written language, and contributes to the formation and reinforcement of mental mapping connections between orthography and phonology. Informal observations also revealed increased attention and focus during the software program instruction as compared to the printed text instruction. This study supported the effectiveness of implementing multimedia software to facilitate literacy acquisition in a classroom setting.

The same authors, Karemaker et al. (2008b), also investigated the effectiveness of ORT on *Clicker5* compared to traditional printed texts of ORT Big Books using a counterbalanced, within group design (AB-BA). Twenty-seven typically developing students comprised the sample and were divided into two groups ranging in age from 66 to 77 months. Measurements consisted of whole word recognition skills, written word naming and phonological awareness (i.e. grapheme, rhyme, segmentation). Activities were consistent in reading scheme and content, and were performed for one hour a day, five days a week for five weeks. Instruction was carried out in the same manner as the previous study. Significant gains were demonstrated in written word recognition and rhyme awareness in the ORT on the *Clicker5* condition as compared to ORT Big Books.

### **Summary and Purpose**

Several studies have documented the writing difficulties experienced by children with language learning deficits (Fey et. al, 2004; Gillam & Johnston, 1992; Gillam et al., 1995; Hengst & Johnson, 2007; Mackie & Dockrell, 2004; Scott & Windsor, 2000; Wetherell et al., 2007). Research has demonstrated mutual growth in spoken and written expression as a result of an integrated approach to intervention. Nelson et al. (2004) evaluated the effectiveness of utilizing interaction between spoken and written discourse in writing intervention for students with special needs who evidenced various error patterns, such as spelling difficulty, avoidance of oral discourse, and impaired phonological representation. The participants' discourse deficits were successfully addressed using a computer-supported writing lab approach, as evidenced on discourse measures at sentence and word levels. Written production may be facilitated by computer-based multimedia software due to

increased motivation, active involvement and learner control. Specifically, multimedia software supports written productions in students with LLD because it creates a more contextualized learning environment (Wissick & Gardner, 2000). Research evidence demonstrates that assistive technology, such as spell and grammar checkers, and speech synthesis, may increase students' ability to correct errors while writing (Lewis et al., 1999; MacArthur et al., 1996; Raskind & Higgins, 1995).

*Clicker5* is a grid-based computer literacy program which decreases demand on the composer due to incorporation of pictures, text, speech synthesis, spell and grammar checkers, teacher highlighted information and auditory matching, all of which aid in the writing process by promoting sound-letter awareness. Each of these features supports various writing processes such as planning, organization, vocabulary, phonemic awareness, syntax and basic concept knowledge (Parette et. al, 2009).

No research was found that investigated the impact of the *Clicker5* literacy software program on writing skills. Recent changes in school policy have led to fewer children being diagnosed early with language learning deficits; they are instead given modified instruction in a 3 tiered Response to Intervention hierarchy. These students are considered at-risk for learning disabilities rather than labeled LLD, and receive increasingly supportive instruction according to their learning needs.

The purpose of this study was to evaluate the effectiveness of individual *Clicker5* instruction on classroom hand-written products and computer-assisted written products for children with speech-language deficits who were identified as weak writers by their teachers. The research questions were as follows:



1. Is there a difference in classroom hand-written products during periods of individual instruction utilizing the *Clicker5* writing program and elements from Nelson's Writing Lab Approach to Language Instruction and Intervention for children with speech-language deficits identified as weak writers?
2. Is there a difference in individually generated computer-assisted written products during periods of individual instruction utilizing the *Clicker5* writing program and elements from Nelson's Writing Lab Approach to Language Instruction and Intervention for children with speech-language deficits identified as weak writers by their teachers?
3. Is there a difference between handwritten and independently generated computer-assisted written products for children with speech-language deficits identified as weak writers?

### Chapter III

#### Methods

##### Subjects

Four second grade students demonstrating speech-language deficits and difficulty with writing were recruited to participate in the current study. Identification of potential subjects was completed by teachers and the speech-language pathologist (SLP) at the Shelbyville elementary school. Students selected were from two second grade classrooms. Parental permission forms were completed and returned to the SLP, and child assent was received after the primary investigator provided a verbal description of the study (Appendix A). The four students had been identified as at-risk for reading difficulty through the Response to Intervention (RTI) process. The children had been receiving tier 2 strategic reading instruction for weak reading skills, but had not received any extra instruction for writing and had not been formally diagnosed with LLD.

The students were administered a battery of tests to evaluate their language skills. The results are summarized in Table 1. The *Peabody Picture Vocabulary Test* (PPVT) was administered to assess receptive vocabulary. Participants' standardized scores ranged from 92 to 107. The *Dynamic Indicators of Basic Early Literacy Skills* (Dibels) for second grade assessed oral reading fluency and retell fluency. Scores on the oral reading fluency portion of the Dibels ranged from 13 to 31, and fall into the at risk for reading deficits category. Dibels scores of 60 and above indicate low risk for reading difficulty, 44 to 59 indicate some risk, and 0 to 43 are at risk for reading difficulty. The *Oral and Written Language Scales* (OWLS) assessed written expression (WE) in the areas of spelling, punctuation, syntactical forms (i.e., sentence

structures), and meaningful communication (i.e., organization, cohesion). Oral expression (OE) and listening comprehension (LC) measures include vocabulary, grammar, higher order thinking skills (i.e. supralinguistics)

*Table 1.* Standard Scores for PPVT and OWLs Assessments, Dibels scores and Speech-Language Deficits for the Four Participants.

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	PPVT	Dibels	OWLS- Listening Comprehension	OWLS- Oral Expression	OWLS- Written Expression	Speech- Language Deficit
Intervention						
Participant 1	92	31	70	93	106	Language
Control 1						
Control 1	106	30	92	80	115	No Services
Intervention						
Participant 2	111	29	107	95	94	Language
Control 2						
Control 2	106	13	92	100	99	Artic.

---

and functional communication skills. Oral expression standardized scores ranged from 80 to 100. Standardized scores on the listening comprehension portion ranged from 70 to 107. The written expression standardized scores ranged from 94 to 115.

The students evidenced articulation deficits and incomplete written thoughts, as reported by the school SLP. The 2 intervention subjects had received speech-language services for language deficits, including story comprehension and vocabulary. Control subject 1 has received no speech-language services, but was reported to have incomplete written thoughts. Control subject 2 evidenced articulation deficits and began receiving speech services in first grade. All subjects were receiving tier 2 RTI and experiencing difficulty with written expression.

### **Research Design**

A single subject case study design was used. Participants included matched pairs of subjects from two classrooms as determined by the classroom teacher and school SLP. Pairs were matched based upon classroom performance, Dibels scores, and speech-language therapy history. During the study, one participant from each pair received individualized instruction at a time so the effects of individualized instruction were differentiated from the classroom instruction. One participant from the first classroom initially received instruction from the school SLP using the *Clicker5* program in the second half of the fall semester. Individual sessions occurred for three 20 minute sessions each week for approximately four weeks. A matched pair from the same classroom served as the control subject in an extended baseline period. During the first month of the spring semester, a matched pair from the second classroom received instruction with the *Clicker5*.

### **Writing Instruction**

**Classroom writing program.** The second grade classes began using the *Daily 6-Trait Writing* program during the middle of October. The program consisted of 25 weeks of mini-lessons divided into five units. Each unit provided five weeks of

instruction with scaffolding, and focused on one or more traits of Developing Ideas, Organizing, Choosing Words, Developing Sentence Fluency, and Developing Voice. During each week, one or more writing convention skills, such as grammar, spelling and punctuation, were also taught. Activities on the first three days of the week provided models for students to analyze, revise, or add to in worksheet form. On the fourth day of each week, students completed a pre-writing worksheet/graphic organizer. On the fifth day of each week, the students wrote to a prompt. Trait and convention targets, topics/activities, and graphic organizers utilized across the 25 weeks in the classroom writing program are summarized in Appendix B. Classroom lessons during the first instruction period of the current study were lessons 5-8. Classroom lessons during the second instruction period were 12-17.

The first five weeks of the classroom program focused on developing ideas and details to write about; this included choosing appropriate topics, adding strong details, and staying on topic were weekly concentrations. Writing conventions focused on capitalization, compound words, plural nouns, and periods. Writing prompts during the first five weeks required production of descriptive texts such as describing favorite bread, what makes your school special, your shoe telling about its life, and personal narratives including a journal entry about a musical experience and an experience with a pet. The intervention subject from the first instruction period received classroom instruction from weeks 1-4 before receiving *Clicker5* intervention.

The second five weeks' focus was on organization. Sequencing complete sentences, writing a strong beginning, middle and ending, grouping together ideas and details, and grouping similarities and differences were concentrations for this portion

of the program. Writing conventions included complete sentences, possessive apostrophes, ending punctuation, and compound sentences using *but*, *is* and *are*. Writing prompts included sequential/procedural texts of how to make a leaf animal, a personal narrative of a fun time with family, a description of new paper money designed by a student, compare-contrast texts of how a baseball and basketball are the same and different and how the student looked as a baby, and how he/she looks now. The first period of individual intervention occurred during weeks 5-8.

Weeks 11-15 focused on word choice. Weekly concentrations included describing action and using strong verbs, adjectives and exact nouns. Writing conventions of irregular plural nouns, capitalization, contractions, and question marks were targeted. Writing prompts required personal narratives of lunch time at school and what you do on a favorite day of the week, a descriptive letter about a new favorite fictional snack, a description of a castle, and a description of your school. The second phase of individual instruction began at week 12.

The next five weeks concentrated on sentence fluency which included writing long sentences and correcting run-on and choppy sentences. Writing conventions included using *I* and *me*, commas, compound sentences, comparative words and superlative words. Writing prompts utilized a descriptive procedural composition about a bake sale, fictional narratives about June Bug's picnic and a rain forest adventure, a personal narrative letter telling about a fun place you've been, and a sequential/procedural narrative describing the life cycle of a frog. The second individual instruction period concluded at week 17.

The final five weeks focused on voice, such as using formal and informal language, different writing styles, creating a mood and writing from different points

of view. Writing conventions focused on using *was*, *were*, articles, words ending in *ing*, exclamation points and avoiding *ain't*. Writing prompts required production of personal descriptive text about an interesting animal, descriptive text about a landmark in the area, a poem about food, a fictional narrative ending for the three little pigs, and a fictional letter from Red Riding Hood's point of view. All of the subjects continued the classroom writing program through week 25.

**Individual instruction using *Clicker5* and Writing Lab components.**

Individual instruction occurred three times per week for 20-minute sessions for four weeks. The individual instruction utilized the *Clicker5* writing program and elements from the Writing Lab Approach to language instruction and intervention while working with components related to the classroom writing program's Friday prompt. The first 20-minute session focused on the planning and organizing component of the writing process. The subject planned and organized the composition verbally and in writing on the graphic organizer provided by the classroom writing program. The second 20-minute session focused on drafting the product using the completed graphic organizer on the *Clicker5* program. The third 20-minute session focused on revising and editing the composition. Intervention included discourse style scaffolds, including graphic organization, sentence level scaffolds for grammar and linking ideas, vocabulary fluency and specificity scaffolds, and occasional spelling and writing convention scaffolds.

The first session each week focused on planning and organizing, and began with a verbal discussion to activate prior knowledge about the week's topic. The SLP and student discussed the writing prompt, generated ideas, and brainstormed a general plan. Concepts related to the topic were discussed. The classroom graphic organizer

from the Daily 6-Trait Writing program was reviewed and completed. A sample classroom graphic organizer is included in Appendix C. The student and SLP completed the graphic organizer with information from the brainstorming session. The student filled in ideas on the organizer while the SLP scaffolded ideas and information specific to the writing genre for the week.

The investigator watched the first session via webcam and reviewed the student's graphic organizer to develop individualized grids to be in place for the *Clicker5* program during the second session. The grids were structured with vocabulary word banks for the topic with text, speech synthesis, and pictures. Word banks were developed from the student's original words. Appendix D includes a sample *Clicker* word bank and grid developed for phase 2, week 17.

The second individual weekly session focused on the drafting process. The second day began with a brief general discussion of the topic and verbal review of the graphic organizer from day 1 between the SLP and student. If the student generated additional ideas, they were added to the organizer by the SLP. The student utilized *Clicker5* to develop a computer generated written response to the weekly prompt. The SLP used cues such as, "Did you include all the information from your graphic organizer?", "How can we make this a better or longer sentence?", "What other descriptive words can we use?" to elicit a complete production. Features of the *Clicker5* program utilized during the drafting process included picture symbols, word banks by topic, alphabetically organized word bank, on-screen mouse activated keyboard, highlighting, and speech synthesis read back.

The third session focused on the revising and editing process with the written draft produced on the *Clicker5* program during the second session. Content revision



and expansion were addressed by the SLP, as well as revising/editing for grammar, organization, and spelling accuracy. The third session began by using *Clicker5*'s speech synthesis feature to read aloud the entire composition. The student and SLP discussed ways to improve the production with cues such as, "How can we make it sound better?" or "Can we add or change any information?" to elicit planning, organizing and content revisions. Then student expanded the composition by adding more ideas or information relevant to the prompt. The SLP prompted the student to use highlighting. Read back features were used to review individual sentences for word choice, organization and sentence structure. *Clicker5* does not include a thesaurus tool, however words from The Creative Word Choice Journal were included in topic word banks, and the student could choose novel words from the alphabetically organized word bank to replace general overused words. *Clicker5*'s spelling and punctuation checker were used to identify errors during the editing process.

**Timeframe of individualized lessons.** All four students were oriented to *Clicker5* during the last week of October. The first student received individualized instruction for 4 weeks in Nov./Dec. The second student received individualized instruction for 4 weeks in Feb./March.

### **Dependent Variables**

The dependent variables were collected in two tasks. These tasks included the Friday morning handwritten response to the prompt in the classroom and a Friday afternoon individually generated written response using the *Clicker5* computer writing program. On Friday mornings, students in the regular classroom, along with the study participants, responded to the weekly written prompt from the Daily 6-Trait

Writing Program in the regular classroom. Copies of the hand-written productions from this classroom writing prompt were collected by the investigator.

In the afternoon, the participants each independently used the *Clicker5* program to provide a computer assisted written product. The primary investigator took information from the control subject's classroom graphic organizer to create a *Clicker5* grid to be used during the independent response condition. The intervention subject's original grid from the intervention sessions was also used for the independent prompt response. The weekly writing prompt was read to the subjects, and they were given their completed graphic organizer. The participants were instructed that they could refer to their classroom graphic organizer, and then generate a written response using *Clicker5*. Prompts were given by an investigator during the independent writing task, such as "Write as much as you can," "Is that all?" and "Can you add any more information?" to elicit complete responses. The investigator also assisted for technology related difficulty, such as using a laptop touchpad.

The matched pairs responses were measured and compared based on analysis of sentence and text level form and content using measurements of percent of grammatically acceptable T-units, mean number of words per T-unit, total number of words, number of different words (NDW), local coherence and global coherence (McFadden & Gillam, 1996). Table 2 presents a description of each of the measures.

To ensure reliability, 37% of the weekly probe measurements were rescored by a second investigator. Three samples from the phase 1 intervention subject and three from the control subject were rescored. Pearson correlations were calculated to

determine the reliability between the two investigator's measures. Reliability for total number of words was 1.0, for NDW was .998, for MLU was 1.0, and for spelling accuracy was .999.

Table 2. Description of dependent variables.

Measure		Description
Percent Grammatically Correct T-Units	Grammar Accuracy	Number of syntactically correct minimal terminal units (i.e. main clause plus subordinate clauses attached to or embedded in it is a, T-Unit) divided by total number of T-Units.
Mean Length T-Unit	Sentence Length/Complexity	Total number of words divided by total number of T-Units.
Total Number of Words	Overall Length	Number of words in the discourse.
Number of Different Words	Vocabulary Diversity	Total number of unique words.
Local Coherence	Organization / Referents	5 Ideas follow logical progression 4 Each Communication Unit (i.e. each dependent clause with its modifiers, CU) is related to the preceding or following CU 3 One CU is not related to the preceding or following CU 2 Two CUs are not related to the preceding or following CU 1 More than two CUs are not related to the preceding or following CUs
Global Coherence	Organization / Topic Maintenance	5 Ideas for integrated story about topic 4 All CUs are on topic 3 One CU strays from topic 2 Two CUs stray from topic 1 Generally off topic

**Data Analyses.** Data was evaluated by visual inspection of matched pair's graphs for each of the dependent variables. Lines on the graph depict writing performance in the *Clicker5* and hand-written conditions. Performance of the subjects participating in classroom instruction only, compared to matched pair

performance of subjects participating in classroom instruction plus the individualized

*Clicker5* treatment, were evaluated.

## Chapter IV

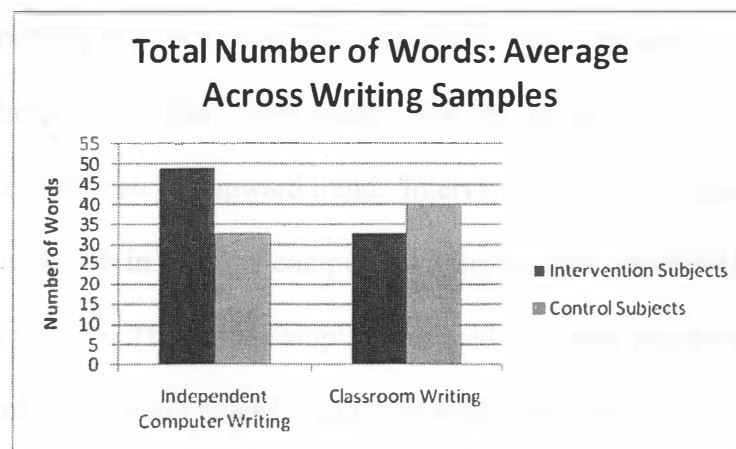
### Results

The dependent variables were measures of form and content including total number of words, number of different words, MLU, spelling and grammatical accuracy, and local and global coherence. The results are displayed in two graphs per measure; one for the independent computer writing sample and one for the classroom writing sample. The graphs depict the results demonstrated by each subject over the four weeks of intervention. Additionally, total number of words, number of different words, MLU and spelling accuracy are depicted utilizing a single bar graph for each measure. These graphs provide a summary of the average result for each measure based on the subject and writing sample. Tables with results appear in Appendix E.

#### Total Number of Words Across Writing Samples

The results for total number of words appear in the subsequent bar graph and line graphs. The bar graph in Figure 1 is an average of the total number of words used by the intervention subjects in the classroom and independent computer samples as compared to the control subjects in each of the samples.

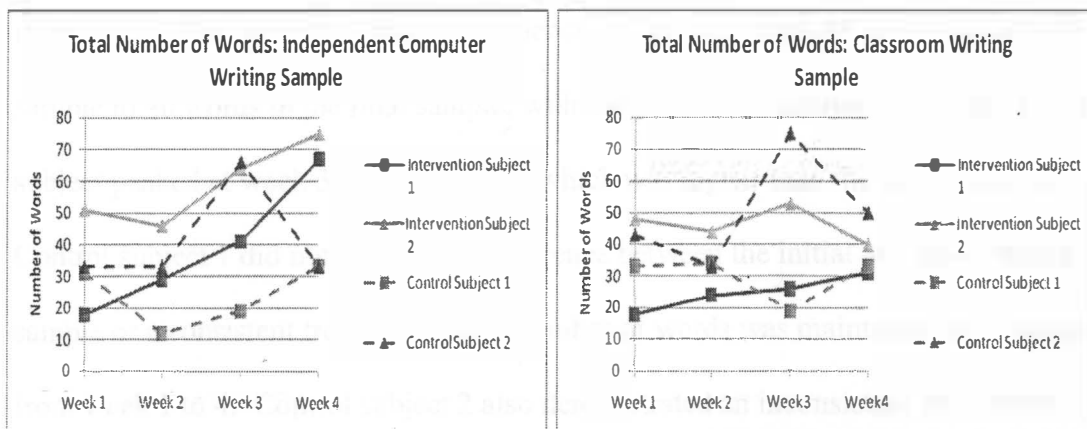
*Figure 1.* Average number of words per week across writing samples.



The total number of words in the intervention subjects' independent computer writing samples on average was 16.1 words higher than the classroom writing samples. The control subjects evidenced 7.5 more total words in the classroom writing sample. Overall, the intervention subjects scored higher in the independent computer samples than the controls in either the classroom or computer writing.

The line graphs in Figure 2 provide individual data points of the written productions at each week of the intervention period for all subjects and both samples. These graphs also provide information about trends across the 4 weeks of intervention.

Figure 2. Total Number of Words.



In the Independent Computer Writing Sample (Figure 2), intervention subject 1 evidenced an increase in total number of words in the final computer writing sample as compared to the initial sample. From week 1 to 4, the subject increased from 18 words to 67 words with a steady upward trend. Intervention subject 2 also demonstrated more words in the final computer writing sample compared to the initial computer writing sample. The initial sample evidenced 51 words and the final evidenced 75 words. The trend dipped slightly in week 2 by 5 words, but was a consistent upward trend from that point forward. The final computer writing sample

for control subject 1 included two more words than the initial sample. The trend dipped in week 2, then steadily increased. Control subject 2 did not evidence a difference between the initial and final computer writing sample. The trend demonstrated a large spike in week 3 similar to intervention subject 2's increase from week 2 to week 3. The intervention subjects scored higher than the control subjects on this measure 3 out of 4 weeks. For intervention subject 1, scores were higher in the final 3 weeks of the intervention period.

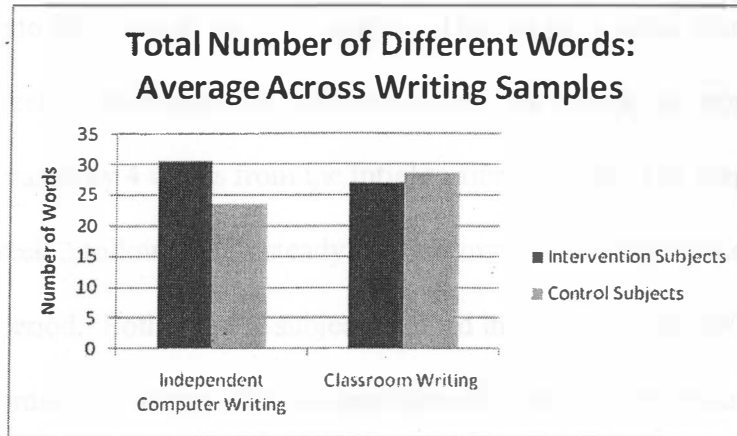
In the Classroom Writing Sample (Figure 3), intervention subject 1's initial classroom writing sample included 18 total words which increased to 31 words in the final sample. The subject also demonstrated a steady upward trend for the entirety of intervention. Intervention subject 2 evidenced a decrease from 48 words in the initial sample to 40 words in the final sample, with variability throughout intervention. The subject peaked at week 3 with 53 words, which was higher than the initial sample. Control subject 1 did not evidence a difference between the initial and final writing sample or a consistent trend. The total number of words was maintained at 33 words from week 1 to 4. Control subject 2 also demonstrated an inconsistent trend from weeks 1 to 4 with a decrease at week 2 and 4. Overall, the subject increased from 43 in the initial sample to 50 total words in the final sample. The intervention subjects scored higher than the controls on this measure 2 out of 4 weeks. For intervention subject 2, scores were higher in the last 2 weeks of the intervention period.

### **Total Number of Different Words Across Writing Samples**

The results for number of different words appear in the subsequent bar graph and line graphs. The bar graph in Figure 3 is an average of the total number of

different words used by the intervention subjects in the classroom and independent computer samples as compared to the control subjects in each of the samples.

*Figure 3.* Average number of different words per week across writing samples.



The intervention subjects scored higher in the independent computer writing samples than the classroom sample by 3.4 different words. However, the independent computer samples had fewer different words than the classroom samples for the control subjects. Overall, the intervention subjects scored higher in the independent computer writing samples than in the classroom writing samples, and higher than the controls in either sample.

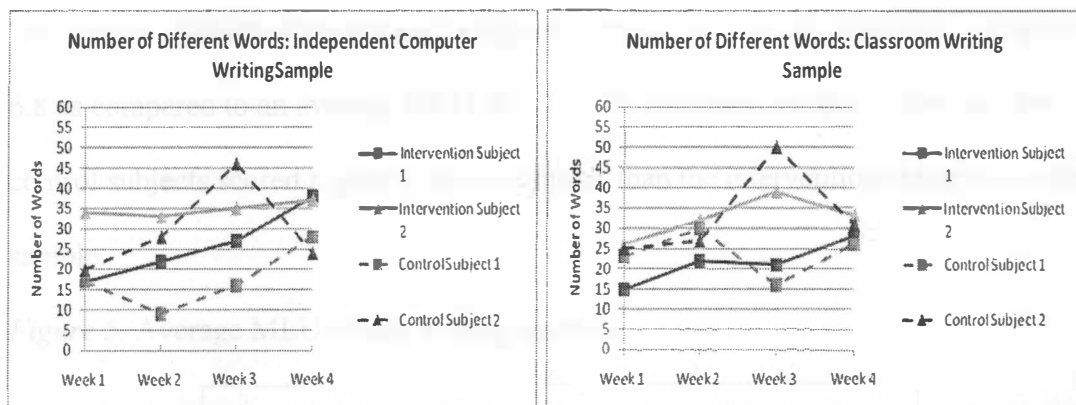
The line graphs in Figure 4 provide individual data points for the written productions at each week of the intervention period for all subjects and both samples. These graphs also provide information about trends across the 4 weeks of intervention.

In the independent computer writing sample (Figure 4), intervention subject 1's final computer writing sample was higher in NDW than the initial sample, more than doubling from 17 to 38. The subject demonstrated a steadily increasing trend from week 1 to 4. Intervention subject 2 evidenced an increase of 3 words from the



initial to final computer writing sample. The trend was similar in NDW to that of the total number of words. The sample evidenced a dip in week 2, and a consistent upward trend thereafter. Control subject 1 increased from 17 different words in the initial sample to 28 words in the final sample. The sample's trend demonstrated a decrease in week 2 which was also reflected in the total number of words. Control subject 2 increased by 4 words from the initial to final sample. The trend displayed a decrease at week 2 followed by a steady upward trend for the remainder of the intervention period. Both phase 2 subjects dipped in week 2 for NDW and total number of words. The intervention subjects scored higher on this measure 3 out of 4 weeks. For intervention subject 1, scores were higher in the final 3 weeks of the intervention period.

Figure 4. Number of Different Words.



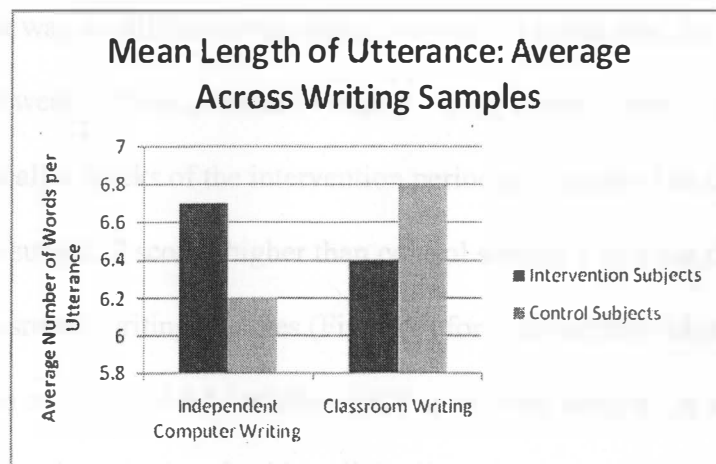
The number of different words in the classroom writing samples (Figure 4) for intervention subject 1 increased from 15 to 28 NDW. The trend displayed a nearly consistent upward trend with a dip at week 3 of 1 word. Intervention subject 2's sample increased from 26 words initially to 33 words in the final sample. The trend decreased at week 4 which corresponds to the decrease in total number of words at week 4. Control subject increased by 3 words from the initial to final sample with a

highly variable trend. Control subject 2 increased overall from 25 different words in the initial sample to 31 in the final sample. The trend was characterized by inconsistency with a spike at week 3 followed by a dip at week 4. Intervention subject 1 scored higher than control subject 2 in the last 2 weeks of the 4 week intervention period. Intervention subject 2 scored higher on this measure for 3 out of 4 weeks as compared to control subject 2.

### MLU Across Writing Samples

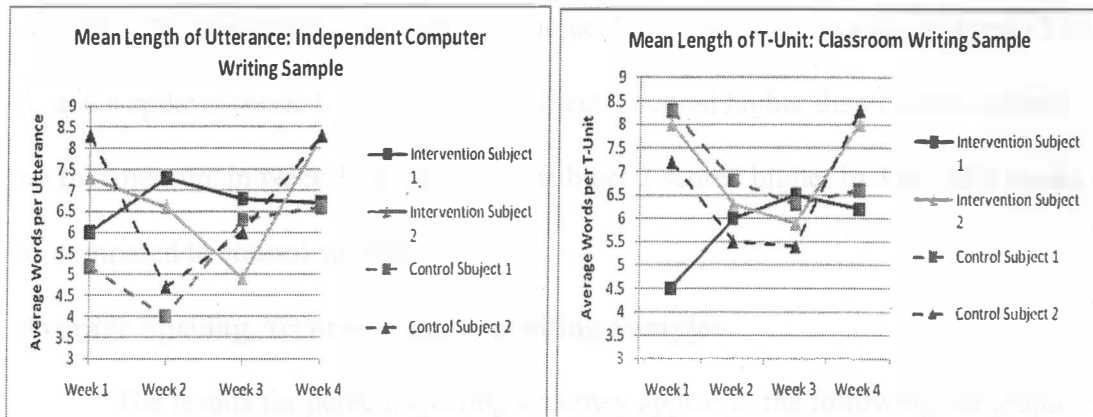
The results for MLU measures appear in the following bar graph and line graphs. The bar graph in Figure 5 is the average MLU in the intervention subjects' classroom and independent computer samples as compared to the control subjects in each of the samples. The intervention subjects evidenced a higher MLU of 6.7 in the independent computer writing samples than the average MLU of 6.4 in the classroom. The control subjects demonstrated a higher average MLU in the classroom samples of 6.8 as compared to an average MLU of 6.2 in the computer samples. Overall, the control subjects scored higher in the classroom than the intervention subjects in either sample.

Figure 5. Average MLU across writing samples.



The line graphs in Figure 6 provide individual data points for the written productions at each week of the intervention period for all subjects and both samples. These graphs also provide information about trends across the 4 weeks of intervention.

Figure 6. Mean Length of Utterance.



In the independent computer writing sample (Figure 6), intervention subject 1 increased overall from an MLU of 6 in the initial computer writing sample to 6.7 in the final sample. The trend evidenced a spike at week 2 with an MLU of 7.3. Intervention subject 2's final sample was also higher than the initial sample increasing from 7.3 to 8.3. The MLU decreased at weeks 2 and 3 with a large spike at week 4. Control subject 1 increased from 5.2 in the initial writing sample to 6.6 in the final. There was no difference in control subject 2's initial and final samples, and MLU dipped at week 2, then increased steadily. Intervention subject 1 scored higher on this measure all 4 weeks of the intervention period as compared to control subject 1. Intervention subject 2 scored higher than control subject 2 in 2 out of 4 weeks.

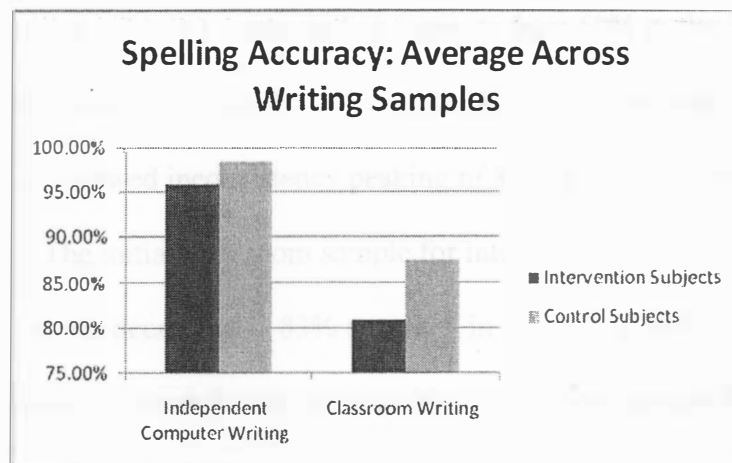
The classroom writing samples (Figure 6) for intervention subject 1 evidenced an increase from an MLU of 4.5 initially to 6.2 in the final sample. A steady upward trend was evidenced weeks 1 to 3 with a slight dip at week 4. There was no

difference in MLU for intervention subject 2's classroom samples. The subject's trend dipped at weeks 2 and 3, and spiked from 5.9 to 8 at week 4. Control subject 1 decreased overall from 8.3 in the initial sample to 6.6 in the final sample. The subject demonstrated a steadily decreasing trend in weeks 1 to 3 with a slight increase at week 4. Control subject 2's samples increased from 7.2 initially to 8.3 in the final sample. The variability of the phase 2 subjects correlated due to a dip at weeks 2 and 3, and a spike at week 4. Intervention subject 1 scored higher than control subject 1 on this measure in week 3. Intervention subject 2 scored higher in 3 out of 4 weeks as compared to control subject 2.

### Average Spelling Accuracy Across Writing Samples

The results for percent spelling accuracy appear in the following bar graph and line graphs. The bar graph in Figure 7 is the average spelling accuracy in the intervention subjects' classroom and independent computer samples, as compared to the control subjects in each of the samples.

*Figure 7. Average spelling accuracy per week across writing samples.*

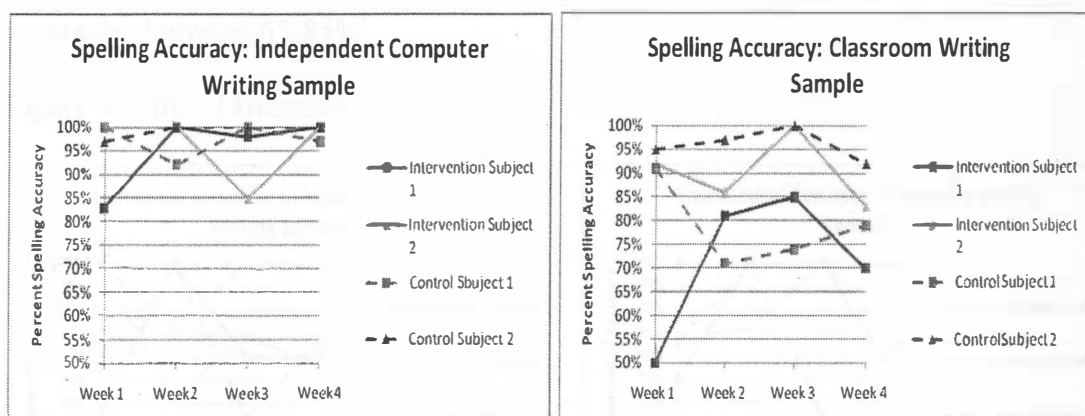


Spelling accuracy for all subjects was higher in the independent computer writing samples than the classroom writing samples. Overall, the intervention

subjects' accuracy was lower than the control subjects in both samples; however the gap decreased in the independent computer writing samples.

The line graphs in Figure 8 provide individual data points for the written productions at each week of the intervention period for all subjects and both samples. These graphs also provide information about trends across the 4 weeks of intervention. Spelling accuracy for all subjects in the independent computer writing sample (Figure 8) was disregarded due to near ceiling results from intervention outset.

Figure 8. Percent Spelling Accuracy.



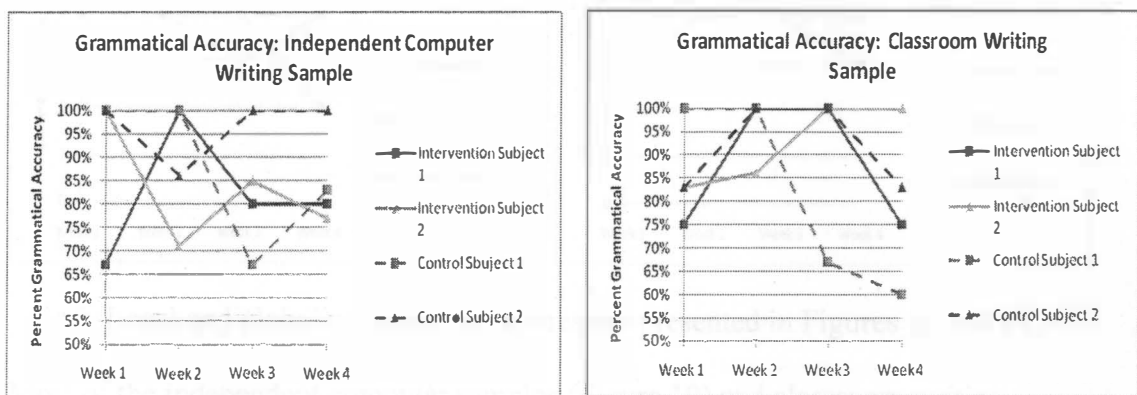
Intervention subject 1 evidenced an increase from 50% in the initial classroom writing sample (Figure 8) to 70% accuracy in the final sample. The spelling accuracy showed inconsistency peaking of 85% at week 3, and dipping to 70% at week 4. The initial classroom sample for intervention subject 2 demonstrated 92% accuracy, which decreased to 83% accuracy in the final sample. The trend was variable, and peaked at week 3 with 100% accuracy. Control subject 1 also decreased from the initial to final classroom sample, with 91% to 79% accuracies, respectively. The subject decreased at week 2, and demonstrated a consistent upward trend from weeks 2 to 4. Control subject 2 decreased slightly, with 95% accuracy in the initial

sample to 92% accuracy in the final sample. The subject's trend displayed a steady increase from weeks 1 to 3, but a dip at week 4.

### Percent Grammatial Accuracy

Measures for the percent of grammatical accuracy are presented in Figure 9. Three of the four subjects had 100% in the initial independent writing sample (Figure 9). Intervention subject 1 had 67% accuracy the first week. At week 2, intervention subject 1 and control subject 2 both had 100% accuracy, while intervention subject 2 had 70% accuracy and control subject 2 had 85% accuracy. At weeks 3 and 4, control subject 2 had 100% accuracy while the other three participants demonstrated accuracies between 65-85%.

Figure 9. Percent Grammatial Accuracy.



Similar variability and ceiling effects at times were demonstrated in the classroom writing sample (Figure 9). For example, control subject 1 had 100% accuracy in grammar the first two weeks, then declined to 60-65% accuracy during the last two weeks. Intervention subject 2 had steady gains in grammatical accuracy between weeks 1-3, with 100% accuracy in weeks 3 and 4.

## Coherence Measures

Figure 10. Local Coherence.

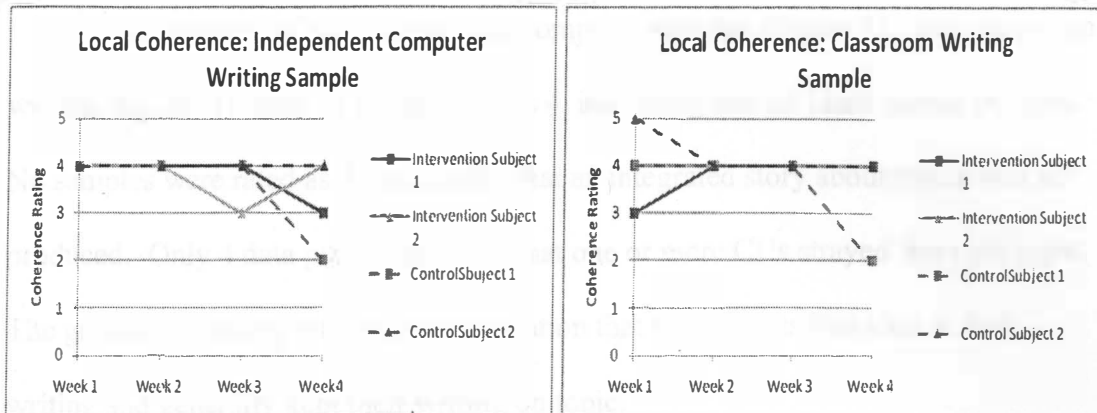
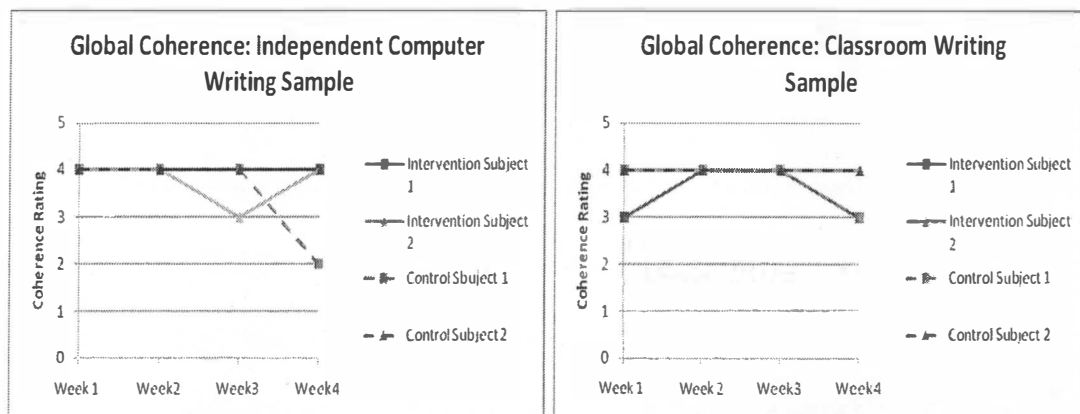


Figure 11. Global Coherence.



Local and global coherence measures are presented in Figures 10 and 11.

Most of the independent computer samples (Figure 10) and classroom writing samples (Figure 10) were rated as 4 for local coherence, meaning that each communication unit (i.e. each dependent clause with its modifiers, CU) were related to the preceding or following CU. Only one sample from control subject 2's first week classroom sample was rated as 5, in which all ideas followed a logical progression. The poorest cohesion in the independent and classroom conditions occurred during week 4, when several ratings of 2 or 3 were given, indicating one or more CUs were not related to the preceding or following CU. The measures of

coherence were problematic in that the structure of each week's graphic organizer had a large influence in the organization of the writing samples.

The majority of the independent computer samples (Figure 11) and classroom writing samples (Figure 11) were rated as 4, indicating that all ideas stayed on topic. No samples were rated as 5, indicating that an integrated story about topics was not produced. Only 4 data points indicated that one or more CUs strayed from the topic. The graphic organizer influenced information that the subjects included in their writing and generally kept their writing on topic.



## Chapter V

### Discussion

#### Summary of Results

The goal of this study was to investigate the difference between classroom written products and independent computer generated written products during periods of individual instruction utilizing the *Clicker5* writing program and elements from the Writing Lab Approach (Nelson et al., 2004). The writing samples were scored on measures of form and content, including total number of words, NDW, MLU, spelling and grammatical accuracy, and local and global coherence. Grammatical accuracy and the coherence measures were disregarded due to insufficient sensitivity and ceiling effects. Also, spelling accuracy in the independent computer writing samples demonstrated near ceiling measures from intervention outset. Therefore, measures to be discussed include total number of words, NDW, MLU and spelling accuracy for the classroom writing sample.

The intervention subject from phase 1 of the study evidenced the strongest effects from intervention. On each of the measures this subject evidenced an increase between independent computer and classroom writing samples from the initial to final product. The subject increased with relatively steady trends from the first to final week of the intervention period, whereas the control subject demonstrated inconsistent results. The intervention subject also scored higher than the control subject on total number of words and NDW in the later stages of intervention as compared to the initial intervention week. These results indicate a positive impact from the intervention because the control subject did not demonstrate equitable

progress. The control subject also evidenced more variability in trends, whereas the intervention subject made more consistent gains from week to week.

Phase 2 was impacted by a week without intervention following week 2 due to snow days at Main Street School. The classroom samples demonstrate more variability, which may be attributed to a break in intervention, especially within a relatively short treatment period. On measures of total number of words, NDW and MLU, the intervention subject increased from the initial to final independent computer writing sample. The subject made gains only on NDW used in the classroom samples. There was no difference in the initial and final classroom sample in MLU, and the total number of words decreased. However, the subject's total number of words peaked at week 3 above the initial sample score. The dip in the final week may be attributed to the nature of the writing prompt or classroom instruction, because it correlates with a dip in the control subject's total number of words in the same week. Furthermore, the trends in MLU for both subjects are highly similar; therefore results may also be attributed to the writing prompt or classroom instruction. These factors add strength to the use of the *Clicker5* program due to the intervention subject's consistent increases evidenced in the independent writing samples. The scores in these samples were not impacted by the nature of the writing prompt. The intervention subject also scored higher than the control subject for 3 of the 4 weeks on measures of total number of words in the independent sample, NDW in both samples, and MLU in the classroom sample. For 2 out of the 4 weeks, the subject scored higher on measures of total number of words in the classroom sample and MLU in the independent sample, as compared to the control subject. These results indicate more variability than the phase 1 subject, but also positive effects of

intervention. The variability is likely to be a result of the nature of the writing prompts due to the similarity in trends across the phase 2 subjects.

Across measures, the independent computer writing samples evidenced higher scores than the classroom writing samples for the intervention subjects. These scores were also higher than the control subjects in either writing sample. Additionally, spelling accuracy in the independent samples was higher for all subjects as compared to the classroom samples. These results indicate positive effects for intervention utilizing the *Clicker5* program because the intervention subjects demonstrated the highest scores across measures and samples when utilizing *Clicker5* to respond to the writing prompt. Further implications include the necessity for instruction on the *Clicker5* program to elicit higher outcomes based on the lower scores across measures for the control subjects in the independent samples as compared to the classroom samples. Overall, the results of the study evidenced good growth on measures of form and content for a relatively short intervention period.

### **Relationship to Past Literature**

The results of the current study supported gains in written language when utilizing the components of the Writing Lab Approach reported by Nelson et al. (2004). The current study and Nelson et al. (2004) reported gains in NDW, structure, length and number of words spelled correctly as a result of an integrated approach to intervention. The Writing Lab Approach (Nelson et al., 2004) utilized spoken and written language interactions to address the needs of students with or without speech-language deficits. The intervention in the current study also included a spoken and written language focus via the verbal brainstorm, filling in the graphic organizer, and

verbal read-back of the written product. Gillam et. al (1995) also demonstrated gains in written products as a result of an integrated approach to intervention.

Research has indicated positive effects when utilizing assistive technology features, such as pictures, speech synthesis, spell checkers and word processors, to generate written production. Word processors facilitate increased revision and quality of writing as demonstrated in the current and past studies (Lewis et al., 1999; MacArthur et al., 1996; Raskind & Higgins, 1995). Additionally, research has reported that technology that includes a variety of media (e.g., sound and pictures) may support the writing process. The demands for planning, organization, vocabulary and syntax are reduced due to the incorporation of picture, text, speech synthesis and spelling checkers (Parette et al., 2009). The current study adds support to the efficacy of utilizing these features to produce written compositions. The intervention subjects evidenced increases in form and content as a result of utilizing the *Clicker5* program to respond to the writing prompts. Features such as speech synthesis, pictures, text and spelling checker facilitated improvements in written language. Parette et. al (2009) found gains in literacy processes when utilizing ORT on *Clicker5* as compared to traditional ORT printed texts. However, no research existed that investigated the impact of *Clicker5* on written productions.

### **Clinical Implications**

The participants enjoyed using the program and demonstrated more enthusiasm and motivation as compared to classroom writing. They frequently requested repeated “read backs” of their stories, enjoyed the pictures and always requested a printed copy of their productions to show parents or teachers. The intervention subjects easily became proficient in using *Clicker5* and its features. For

example, they spontaneously used features such as the spell checker, word bank and speech synthesis.

### **Limitations**

One limitation of the study included that the dependent variable was conducted in the presence of the primary investigator. Another limitation was the variability in the type of graphic organizer and writing prompt from week to week within the classroom 6 Trait Writing Program that was also used as the prompt for the dependent variable writing conditions.

The investigator chose matched pairs from the same classroom to control for teacher instruction. Pairs were not “perfect” matches however, and factors such as language skills, personality and attitude toward writing may have influenced results. Both intervention subjects had a history of language deficits and language treatment, whereas the control subjects had a history of articulation-only or no past speech-language deficits. In the second phase of the study, the intervention subject required more cueing than the phase 1 subject throughout the intervention sessions. The subject demonstrated a personality that was slower to excite and engage in the writing process, and often stopped writing and revising his productions before the time limit was up. Conversely, the phase 2 control subject was very excited to write, especially when using the *Clicker5* program. The control participant utilized the pictures, spell checker and read back features more readily than the intervention subject, and rarely stopped writing before the 20 minute sessions were over. Furthermore, the low number of participants makes generalization of results difficult, and the short duration of the treatment period reduces its sensitivity to effects.

**Future Research**

The implications of the current study may be enhanced by utilizing a multiple baseline across subjects research design or a larger group design, which could provide information on maintenance effects, and add strength to resulting outcomes. Also, increasing the number of participants and including participants with various weaknesses in spoken and written language, such as language processing, dyslexia and syntax, will contribute to the study's generalizability. This information will also add support to the use of spoken and written language interactions to address the needs of students with various deficits. Furthermore, increasing the length of the treatment period may increase its efficacy with more precise trends and comparisons across samples and subjects.

Another area of investigation may involve measuring oral and written language outcomes as a result of this integrated approach to intervention. This will increase the evidence base concerning the reciprocal relationship between spoken and written language, as well as document the effects of integrated intervention on oral language.

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Appendix A

IRB Approval and Informed Consent Documents

Dear Parent or Guardian,

Hello, I am an undergraduate speech pathology major at Eastern Illinois University. As a part of the undergraduate honors thesis, I am conducting a study in conjunction with a certified speech language pathologist on the benefits of implementing a computer software literacy program called *Clicker5* that was purchased by the Main St. School. The school is planning on using *Clicker5* for literacy instruction with at risk children. I am investigating benefits in the participants' oral and written narratives as a result of instruction using the *Clicker5* program so that the school may use the program based on sound evidence. The school speech-language pathologist will be providing the *Clicker5* instruction for two 30 minute sessions each week for about 4 weeks.

With your permission, we would like to evaluate your child's narrative ability before and after the *Clicker5* instruction, as well as measure weekly progress using a story retelling and written summary from the classroom reading series. The research will only involve extra testing time during which your child may miss an hour of class time during pre- and post- *Clicker5* instruction testing, and 15 minutes during the weekly measurements. The investigator will work with the classroom teacher so that minimal class time is missed.

Benefits of this study include the opportunity for your child to receive writing instruction using a novel technology program purchased by the school to increase their written and oral narrative abilities. Parents and school staff will obtain more information about oral and written narrative skills. The school will also gain evidence regarding the effectiveness of the program to help make decisions about its use in the future.

Thank you,

Caroline Larson  
309-530-5932  
[calarson@eiu.edu](mailto:calarson@eiu.edu)

Rebecca Throneburg Ph.D. CCC-SLP  
217-581-2712  
[rmthroneburg@eiu.edu](mailto:rmthroneburg@eiu.edu)

## Consent to Participate in Research

You are invited to participate in a research study conducted by Caroline Larson and Dr. Rebecca Throneburg from the Department of Communication Disorders and Sciences at Eastern Illinois University. Your participation is completely voluntary. Please ask questions about anything you do not understand before deciding whether or not to participate.

- **Purpose of the Study**

The purpose of this research is to evaluate the effectiveness of the *Clicker5* literacy software program on measures of oral and written narratives with students identified at risk for literacy deficits by the classroom teacher.

- **Procedures**

If you volunteer your child to participate in this study, he or she will:

Be tested with The Test of Narrative Language as a pre- and post-test measure which takes approximately one hour to complete. Receive instruction with the school speech-language pathologist using the *Clicker5* program for one hour each week for approximately four weeks due to identification as at risk for literacy deficits by the classroom teacher. A weekly probe will be gathered by the investigator each Friday and will consist of an oral retelling and written summary of the narrative from their reading series, requiring approximately 15 minutes to complete.

- **Potential Risks and Discomforts**

Overall, risks are considered minimal. Children will participate in the assessments in a 1 to 1 setting with the researcher. At the Main St. School the teachers will introduce the student researcher and make sure the children feel comfortable talking with her prior to testing. This study will not pose any safety or health concerns. The participants have been identified as at risk for literacy deficits by the classroom teacher, and will be receive *Clicker5* instruction as designated by the school. The participants may miss an hour of instructional time during the pre- and post- testing and 15 minutes during the weekly probe, but the investigator will work with the classroom teacher so that minimal instructional time is missed from the classroom.

- **Potential Benefits to Subjects and/or Society**

Participants will have the opportunity to receive writing instruction using a novel technology program to increase their written and oral narrative abilities. The parents and school staff will obtain information from the measures taken about the student's oral and written narrative skills. The school will also gain data about the effectiveness of the program and make decisions about its degree of use in future years based on the outcomes of this study. Professionals in the field will have the opportunity to incorporate the software program into therapy and/or education based on scientific evidence.

- **Confidentiality**

Any information that is obtained from this study that can be identified with your child remains confidential and will be disclosed only with your permission or as required by law. Confidentiality will be maintained by means of storing observation data in a locked file cabinet at the EIU Speech-Language-Hearing Clinic. When presenting results of the study, pseudonyms will be used to protect the identity of the participants. Only the investigators will have access to the information.

- **Participation and Withdrawal**

Participation in this research study is completely voluntary. If you give permission for your child to participate in this study, you may withdraw your child at any time without consequences. There is no penalty if you withdraw from the study.

- **Identification of Investigators**

If you have any questions or concerns about this research, please contact Caroline Larson, or Dr. Rebecca Throneburg at 217-581-2712 or EIU Speech-Language-Hearing Clinic, 600 N. Lincoln Ave, Charleston, IL 61920.

- **Rights of Research Subjects**

If you have any questions or concerns about the treatment of human participants in the study, you may call or write:

Institutional Review Board  
 Eastern Illinois University  
 600 Lincoln Ave.  
 Charleston, IL 61920  
 Telephone: (217)581-8576  
 E-mail: [eiuirb@www.eiu.edu](mailto:eiuirb@www.eiu.edu)

You will be given the opportunity to discuss any questions about your rights as a research subject with a member of the IRB. The IRB is an independent committee composed of members of the University community, as well as lay members of the community not connected with EIU. The IRB has reviewed and approved this study.

I hereby consent to the participation of \_\_\_\_\_  
 \_\_\_\_\_, a minor/subject in the investigation herein described. I understand that I am free to withdraw my consent and discontinue my child's participation at any time.

\_\_\_\_\_  
 Signature of Minor's Parent or Guardian Date

I, the undersigned, have defined and fully explained the investigation to the above subject.

\_\_\_\_\_  
 Signature of Investigator Date

### Assent to Participate in Research

Hi, my name is Carrie Larson, and I am from Eastern Illinois University. We are asking you to be a part of a research study because we want to learn more about the *Clicker5* computer program, and how much it helps you with your speaking and writing. If you agree to be in our study, we will take a test to see how well you are able to tell a story and write a story. Then we will use *Clicker5* to practice our storytelling during the week, and at the end of the week we will tell and write a story about what we have been working on. After we are finished, we will take another test to see how much your stories have improved since we started using *Clicker5*.

There are no real risks in our study, but you may have to miss a little bit of classroom time when we take or tests and tell our stories. Once we are done with the study, its going to show the teachers, speech language pathologist, principle and the students at Eastern how to use the program with other kids.

Please talk this over with you parents before you tell us if you want to or don't want to do the study. Your parents have given their permission for you to take part in our study, and even though your parents said 'yes,' you can still decide not to do the study.

If you don't want to be in the study, you do not have to be. If you have a question later that you didn't think of now, you can call me at (309)530-5932 or ask me next time I see you. You may call me at any time to ask questions about the study or the *Clicker5* program.

Signing your name at the bottom means that you want to be in the study and you and your parents will be given a copy of this form after you have signed it.

---

Signature of Subject

---

Printed Name of Subject

---

Date



### Appendix B

Description of the trait and convention targets, topics/activities, graphic organizers, and weekly writing prompts associated with the *Daily 6-Trait Writing* classroom program across 25 weeks.

Week	Trait	Writing Convention Skill	Topics/Activities	Day 4 Graphic Organizer	Day 5 Writing Prompt and Text Type (Nelson, 2004)
5	Ideas- Review	Capitalize titles	<p>Day 1: Musical performer pictures- underline best of three topics, write topic</p> <p>Day 2: Musician Book report- write details from the report, circle capital letters</p> <p>Day 3: Marching band- identify interesting details, mark capitals, make detail more interesting</p>	<p>Tell about musical experience you've had. Graphic organizer- topic line with four drums for four details</p>	<p>Write a journal entry telling about a musical experience you have had. Use the topic and interesting details you thought of on Day 4 (i.e. adding more details). Be sure to capitalize the titles of books and songs.</p> <p>Type – Personal Narrative/Journal entry</p>

6	<p>Organizat ion – Put things in the Right Order</p>	<p>Write complete sentences</p>	<p>Day 1: How to gather seeds- draw four sequential pictures  Day 2: Parts of a tree- finish sentences beginning with <i>First, Next, Then</i> in correct order  Day 3: How to make a bird feeder- use sentences given to complete a paragraph</p>	<p>Look at 4 pictures, write steps below each picture for how to make a leaf animal</p>	<p>Write complete sentences telling how to make a ‘leaf animal’. Use your ideas from Day 4.  Begin your sentences with the words <i>First, Next,</i> <i>Then</i> and <i>Last</i>.  Have a partner read your writing to check for complete sentences.  Type- Sequential/ Procedural Text</p>
7	<p>Organizat ion – Beginnin g, Middle End</p>	<p>Apostrophe s for possession</p>	<p>Day 1: Story beginnings- identify, write bold beginning  Day 2: Family stroll- underline</p>	<p>Think about a fun time you’ve had with your family.  Three boxes to draw pictures of what happened</p>	<p>Write about a fun time you have had with your family.  Be sure to write a bold beginning, a strong middle, and</p>

			<p>strong middle sentences, write strong middle</p> <p>Day 3: Birds- fix mistake, choose, write an ending</p>	<p>beginning, middle, end. Write important words to go with picture on lines next to picture</p>	<p>an excellent ending. Use the pictures and words from Day 4 to help you (i.e. child drawings and key words/phrases). Remember to add 's to words that show belonging. Type- Personal Narrative</p>
8	<p>Organizat ion- Group Together Ideas and Details</p>	<p>End punctuation</p>	<p>Day 1: Money- identify ideas and details about saving, spending, giving, draw a new detail</p> <p>Day 2: Farmers market, hardware store- pair picture with detail, add another detail</p>	<p>Design your own paper money. What would it look like? 3 lines to write words/numbers on bill 3 lines to write about pictures bill would have 3 lines to list color box to draw bill</p>	<p>Use your ideas and details from Day 4 (i.e. child creates their own money, adds details and draws a picture representation) to write a description of your paper money. Group together your ideas and details. Be sure</p>

			Day 3: Piggy bank- write given sentence in correct sequence, add end punctuation		to use correct end marks.  Type- Descriptive Text
12	Word Choice- Describe the Action	Capitalizing  days of the week	Day 1: Circle adverb that goes with picture, finish each sentence with appropriate adverb  Day 2: Snow day- write given words that go with picture, write the days of the week  Day 3: Summer day- write adverbs describing action	Graphic organizer- web descending with two adverb circles at the top, action, Day of the week, action, two adverb circles	Write a description of what you do on your favorite day of the week. Use your web from Day 4 (i.e. graphic organizer to describe an action).  Remember to use adverbs to describe action. Be sure to capitalize the day of the week you are writing about.  Type- Personal Narrative

			in pictures, identify capital letters		
13	Word Choice- Use Adjective s	Contraction s	Day 1: Dinosaur, bird- write given describing word under picture Day 2: Archeological scene- complete each sentence with correct adjective, identify contractions Day 3: Letter about science center- identify adjectives, write sentence with new adjective, write contractions	Graphic organizer- Dinosaur Munch in center with five surrounding boxes to describe feel, look, smell, taste, sound	Write a letter to a friend, telling him or her about your new favorite snack- Dinosaur Munch. Use your adjectives from Day 4 (i.e. graphic organizer of look, taste, feel) to describe the snack. Be sure to spell contractions correctly. Type- Descriptive text

14	Word Choice- Use Exact Nouns	Question marks	<p>Day 1: Poodle, shoes, palace, flowers, bug pictures with sentences- identify sentence using exact noun</p> <p>Day 2: Farm- write given exact noun naming each picture, cross out weak noun</p> <p>Day 3: Identify weak noun in sentence, replace with given exact noun</p>	<p>Write exact nouns to describe each room in the picture of a castle.</p> <p>Write one question about life in the castle.</p>	<p>Look at the picture from Day 4 (i.e. generating nouns in a graphic organizer).</p> <p>Write a description of the castle. Use some of the exact nouns you wrote.</p> <p>Write a question at the top of your page. Be sure to place a question mark at the end.</p> <p>Type- Descriptive text</p>
15	Word Choice- Review	Using <i>saw</i> and <i>seen</i>	<p>Day 1: Books covers with title, image- identify stronger verb, underline word</p>	<p>Chart- fill in chart with exact nouns</p>	<p>Write a description of your school.</p> <p>Include exact nouns, strong verbs, adjectives and</p>

			<p>preceding <i>seen</i></p> <p>in sentence</p> <p>Day 2: Write given adverb to describe action, write sentence using given adverb, complete rules for <i>saw</i>, <i>seen</i></p> <p>Day 3: School-identify adjectives, write two additional sentences with adjectives, fix mistakes in sentences</p>		<p>adverbs. Use your ideas from Day 4 (i.e. changing weak nouns to strong nouns such as fish to shark). Be sure to use <i>saw</i> and <i>seen</i> correctly.</p> <p>Type- Descriptive text</p>
16	<p>Sentence Fluency- Wrist a Sentence</p>	<p>Using <i>I</i> and <i>me</i></p>	<p>Day 1: Write naming (i.e. names noun), telling (i.e. tells what does, is)</p>	<p>Bake Sale Chart- complete chart with naming, telling parts, what to do, buy, who is</p>	<p>Describe a bake sale. Use the naming parts and telling parts you wrote on Day 4 (i.e. chart with what to</p>



			<p>parts of sentence, identify <i>I, me</i> in sentences</p> <p>Day 2: Identify given naming, telling parts of sentence, use naming, telling part to write a sentence, write <i>I</i> or <i>me</i> to complete sentence</p> <p>Day 3: Toy sale picture- write four sentences about the picture, identify naming, telling part, write <i>I</i> or <i>me</i> to complete sentence</p>	there	<p>do and buy, and who is there) to form sentences. Be sure to use the words <i>I</i> and <i>me</i> correctly.</p> <p>Type- Descriptive Text or Procedural/ Sequential Text</p>
17	Sentence	Commas in	Day 1: Bugs-	Graphic	Write a story entitled

	<p>Fluency- Write Longer Sentence s</p>	<p>a list</p>	<p>identify words added to second sentence, identify commas, list three details from sentences Day 2: Bees- identify, add words describing when, where, how Day 3: Beetle- add commas, write two sentences using commas</p>	<p>Organizer- Jane's bug picnic topic in center, four boxes containing three lines to describe where, how, when, what</p>	<p>'June Bug's Picnic'. Use the sentences and words you wrote in the web on Day 4 (i.e. ideas for story). Be sure to use commas to separate items in a list. Type- Fictional Narrative</p>
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Appendix C

Sample Graphic Organizer

Here are some sentences for a story. Write words and phrases that you might use to make the sentences longer.

June Bug had a picnic. (*where*)

1. by the lake
2. \_\_\_\_\_
3. \_\_\_\_\_

They sang. (*how*)

1. along with Cricket's fiddle
2. \_\_\_\_\_
3. \_\_\_\_\_



**June Bug's  
Picnic**

They danced. (*when*)

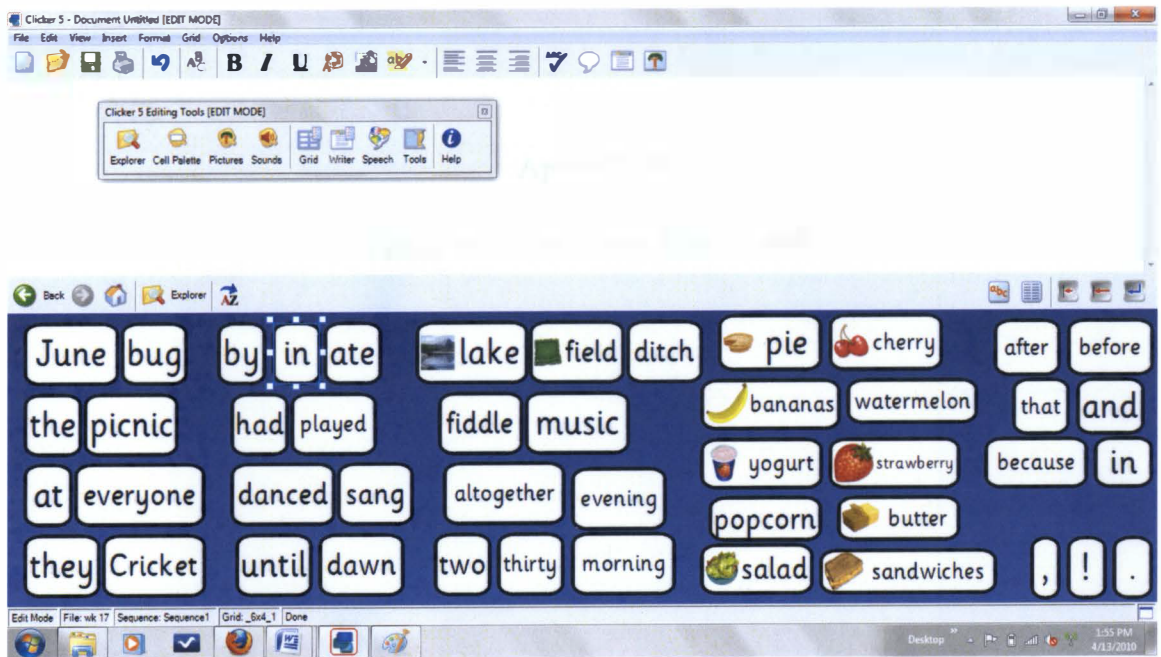
1. that evening
2. \_\_\_\_\_
3. \_\_\_\_\_

Everyone ate. (*what*)

1. pie, watermelon, and salad
2. \_\_\_\_\_
3. \_\_\_\_\_

Appendix D

Sample *Clicker5* Grid



Appendix E

Tables with Data from Phase 1 and 2

**Table 1a.** Independent Condition: Mean Length of Utterance

SUBJECT	WEEK 1	WEEK 2	WEEK 3	WEEK 4
Intervention Subject 1	6	7.3	6.8	6.7
Intervention Subject 2	7.3	6.6	4.9	8.3
Control Subject 1	5.2	4	6.3	6.6
Control Subject 2	8.3	4.7	6	8.3

**Table 1b.** Classroom Condition: Mean Length of Utterance

SUBJECT	WEEK 1	WEEK 2	WEEK 3	WEEK 4
Intervention Subject 1	4.5	6	6.5	6.2
Intervention Subject 2	8	6.3	5.9	8
Control Subject 1	8.3	6.8	6.3	6.6
Control Subject 2	7.2	5.5	5.4	8.3



**Table 2a.** Independent Condition: Total Number of Words

SUBJECT	WEEK 1	WEEK 2	WEEK 3	WEEK 4
Intervention Subject 1	18	29	41	67
Intervention Subject 2	51	46	64	75
Control Subject 1	31	12	19	33
Control Subject 2	33	33	66	33

**Table 2b.** Classroom Condition: Total Number of Words

SUBJECT	WEEK 1	WEEK 2	WEEK 3	WEEK 4
Intervention Subject 1	18	24	26	31
Intervention Subject 2	51	46	64	75
Control Subject 1	33	34	19	33
Control Subject 2	33	33	66	33

**Table 3a.** Independent Condition: Number of Different Words

SUBJECT	WEEK 1	WEEK 2	WEEK 3	WEEK 4
Intervention Subject 1	17	22	27	38
Intervention Subject 2	34	33	35	37
Control Subject 1	17	9	16	28
Control Subject 2	20	28	46	24

**Table 3b.** Classroom Condition: Number of Different Words

SUBJECT	WEEK 1	WEEK 2	WEEK 3	WEEK 4
Intervention Subject 1	15	22	21	28
Intervention Subject 2	26	32	39	33
Control Subject 1	23	30	16	26
Control Subject 2	25	27	50	31

**Table 4a.** Independent Condition: Percent Spelling Accuracy

SUBJECT	WEEK 1	WEEK 2	WEEK 3	WEEK 4
Intervention Subject 1	83%	100%	98%	100%
Intervention Subject 2	100%	100%	85%	100%
Control Subject 1	100%	92%	100%	97%
Control Subject 2	97%	100%	100%	100%

**Table 4b.** Classroom Condition: Percent Spelling Accuracy

SUBJECT	WEEK 1	WEEK 2	WEEK 3	WEEK 4
Intervention Subject 1	50%	81%	85%	70%
Intervention Subject 2	92%	86%	100%	83%
Control Subject 1	91%	71%	74%	79%
Control Subject 2	95%	97%	100%	92%

**Table 5a.** Independent Condition: Percent Grammatical Accuracy

SUBJECT	WEEK 1	WEEK 2	WEEK 3	WEEK 4
Intervention Subject 1	67%	100%	80%	80%
Intervention Subject 2	100%	71%	85%	77%
Control Subject 1	100%	100%	67%	83%
Control Subject 2	100%	86%	100%	100%

**Table 5b.** Classroom Condition: Percent Grammatical Accuracy

SUBJECT	WEEK 1	WEEK 2	WEEK 3	WEEK 4
Intervention Subject 1	75%	100%	100%	75%
Intervention Subject 2	83%	86%	100%	100%
Control Subject 1	100%	100%	67%	60%
Control Subject 2	83%	100%	100%	83%

**Table 6a.** Independent Condition: Local Coherence

SUBJECT	WEEK 1	WEEK 2	WEEK 3	WEEK 4
Intervention Subject 1	4	4	4	3
Intervention Subject 2	4	4	3	4
Control Subject 1	4	4	4	2
Control Subject 2	4	4	4	4

**Table 6b.** Classroom Condition: Local Coherence

SUBJECT	WEEK 1	WEEK 2	WEEK 3	WEEK 4
Intervention Subject 1	3	4	4	4
Intervention Subject 2	4	4	4	4
Control Subject 1	4	4	4	2
Control Subject 2	5	4	4	4

**Table 7a.** Independent Condition: Global Coherence

SUBJECT	WEEK 1	WEEK 2	WEEK 3	WEEK 4
Intervention Subject 1	3	4	4	3
Intervention Subject 2	4	4	4	4
Control Subject 1	4	4	4	3
Control Subject 2	4	4	4	4

**Table 7b.** Classroom Condition: Global Coherence

SUBJECT	WEEK 1	WEEK 2	WEEK 3	WEEK 4
Intervention Subject 1	3	4	4	3
Intervention Subject 2	4	4	4	4
Control Subject 1	4	4	4	3
Control Subject 2	4	4	4	4