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Modeling Elementary Aged Students' Fluency Growth in Written Expression: Predicting Fluency Growth for Girls and Boys in General Education

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Abstract

Research on evidence-based writing intervention practices as well as reliable and valid assessments of elementary-aged students' writing fluency has been lacking compared to other academic areas (i.e., reading). Brief behavioral interventions like performance feedback targeting writing fluency are gaining empirical support (Eckert et al., 2006); however, growth trajectories for elementary-aged students' writing fluency over a short period of time and contributing variables have not been explored. The purpose of this study was to model students' writing fluency growth as it relates to: (a) instructional practices, (b) sex differences, and (c) individual student's initial level of writing fluency. A total of 133 third-grade students in three urban elementary schools were randomly assigned to either an individualized performance feedback condition (n = 46), a practice-only condition (i.e., weekly writing practice) (n = 39), or an instructional control condition (n = 48) for eight weeks. Results indicated that students assigned to the performance feedback condition demonstrated statistically significantly greater growth in their writing fluency than students assigned to the other two conditions. Additionally, students assigned to the instructional control condition demonstrated statistically significantly greater growth in writing fluency than students assigned to the practice-only condition. Statistically significant sex differences were observed, with girls writing more total words and correct writing sequences than boys. However, in comparison to boys, girls did not differ in their rate of growth. Finally, students' initial level of writing fluency did not differentially predict their growth in writing fluency over the course of the study. Implications for measuring and increasing growth in elementary-aged students' writing fluency are discussed.

MODELING ELEMENTARY AGED STUDENTS' FLUENCY GROWTH IN WRITTEN EXPRESSION: PREDICTING FLUENCY GROWTH FOR GIRLS AND BOYS IN GENERAL EDUCATION

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Illustrative Materials

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There has been a rapidly growing body of fluency-based intervention research in the areas of reading and math (Martens & Eckert, 2007); however, in the area of writing, less is known regarding the effects of fluency-based interventions on elementary aged students' writing fluency growth. Furthermore, even less is known regarding the effects of fluency-based interventions on students' writing fluency growth over shorter periods of time (i.e., within a semester). From a pragmatic standpoint, educational decisions regarding the effectiveness of school-based interventions are generally made over short periods of time. For example, recent trends in school psychological service delivery (i.e., Response to Intervention) require that interventions be evaluated over a period of time as short as six weeks (Gresham, 2007). Therefore, it is important to explore and understand (1) the expected rate of elementary-aged students' writing fluency growth over short intervals, (2) the utility of evidence-based interventions for writing fluency, and (3) variables that affect writing fluency growth. The current study aims to address each of these areas in order to improve school-based practices by increasing the research base on writing practices and to inform data-based decision-making by school professionals. These aims are consistent with national demand for evidence-based practices/interventions and the practical considerations that arise in school settings (APA Task Force on Evidence-Based Practice, 2006; Kratochwill & Shernoff, 2003/2004; Stoiber & Kratochwill, 2000).Furthermore, this type of information regarding written expression will be of practical importance for school psychologists as concerns about written expression are second only to reading problems in number of referrals that school psychologists receive nationally (Bramlett, Murphy, Johnson, & Wallingsford, 2002).

A review of the overall literature in writing demonstrates a need for evidence for the important variables in decision-making regarding students' writing performance. The literature reviewed here begins with an overview of the complex skill of writing and briefly introduces the programmatic use (or lack thereof) of evidence-based principles in writing curricula. Next, the literature review provides a rationale for continued emphasis on fluency-building instructional practices, particularly in the area of writing, and discusses the importance of identifying evidence-based writing fluency interventions that can be easily implemented in general education classrooms. One fluency-based intervention, performance feedback, has been recently adapted for classwide implementation to improve elementary-aged children's reading, math, and writing fluency (Eckert et al., 2006). This body of research is reviewed, followed by a critical discussion of important variables possibly affecting elementary-aged children's fluency growth, leading to the investigation in the present study. These variables include factors related to the child (e.g., sex, initial level of fluency) and the classroom (e.g., amount of practice received or classroom instructional practices), as well as important methodological considerations (e.g., use of multi-level modeling) that are largely ignored in fluency-based intervention research.

Writing: Definition and Models

The construct of writing has been studied in a multitude of fields including linguistics, teacher education, special education, cognitive psychology, developmental psychology, neuropsychology, psychoeducational assessment, teaching of English, and medicine. For the purposes of this study, writing will be broadly conceptualized as encompassing a number of component skills, including handwriting, spelling, grammar,

punctuation, and creativity (Shapiro, 2004). Underlying these component skills are more complicated cognitive functioning capabilities such as translating ideas into written language as well as executive functioning skills that include conscious attention, planning, reviewing, revising, and strategies for self-regulation (Berninger & Amtmann, 2003; Berninger et al., 2006). The combination of component skills and cognitive functioning capabilities results in an outcome often measured in classroom settings: written expression. Therefore, for the purposes of this study, written expression will be defined as a handwritten composition (i.e., an essay or story product) containing at least two sentences that provides a sample of a student's written expressive language skills. In other words, the written product must be a spontaneous production that does not have a pre-specified correct answer, but is open to an infinite number of responses. Consequently, the production of short answers, for example, on a test or worksheet in science class will not be considered in this definition of written expression. Student responses in that case are constrained by the requirements of the task.

Translating thoughts and ideas into handwritten symbols, words, and sentences is a highly complex skill that is cultivated within the context of a developmental progression (Abbott & Berninger, 1993; Berninger et al., 2006). Abbott and Berninger (1993) demonstrated that this progression has two primary steps: transcription (i.e., retrieval from memory of orthographic symbols that could then be coordinated with motor output of those symbols) followed by text generation (i.e., generating ideas and placing the words into grammatically-correct expressions). Transcription skills need to develop first and generally constitutes the focus of writing instruction from kindergarten through second grade, in which spelling and handwriting/orthographic skills (i.e.,

transcribing sounds and language into symbols that comprise written language) are targeted. Therefore, proficiency (i.e., fluency) in handwriting and orthographic skills is required in order to facilitate children's success in the upper elementary grades, when writing instruction begins to emphasize the way in which words and sentences are ordered (Berninger et al., 2006). The second step of the developmental progression, text generation, generally begins in third grade and continues throughout formal schooling. This step involves the development and accommodation of writing skills in extended text composition for increasingly broader applications. Ultimately, mastery of transcription in the early grade levels is essential for future writing success in each successive grade level (Berninger et al., 2006).

As a result of these two developmental periods in writing, several recommendations were made regarding instruction and intervention at the elementary-school level. First, it was recommended that children receive explicit instruction in spelling and compositional strategies following second grade as well as continued monitoring of students' handwriting skills past second grade (Berninger & Amtmann, 2003). Second, Berninger and colleagues (2006) suggested that writing intervention efforts target students in the third and fourth grade as this is a transition period when writing requirements become more complex and challenging, as students move into the second stage of transcription development. Third, it was recommended that during transcription development, students receive practice with composing extended text and fluency-building exercises so that students build a solid foundation in their writing composition skills (Eckert, Codding, Truckenmiller, & Rheinheimer, 2009). Furthermore, Berninger's work demonstrated that precursor writing skills must be mastered in order for

children to become successful in learning the other components of writing. The ultimate implication is that transcription must be *fluent* before other writing skills can be taught in the classroom. Given the fundamental role of fluency in the writing process, the present paper will concentrate on writing fluency, which will be defined as a quantitative measure indicating the amount of text produced within time constraints (Deno, Marston, & Mirkin, 1982). This measurement results in an index of student performance that is sensitive to change/growth/learning over time (Marston, Deno, & Tindal, 1983).

Writing Instruction

Instructional programs that have gained empirical support as best practices in writing instruction include self-regulated strategy instruction (see Graham & Harris, 2002 for a review), the Early Literacy Project (Englert et al.,1995), explicit handwriting instruction (Berninger et al., 1997), and explicit spelling instruction (Graham, Harris, & Fink-Chorzempa, 2002). Most of these programs were developed, validated, and gained empirical support with populations of children receiving special education services. To date, no empirically-supported instructional programs have been validated among children receiving general education.

Although there is a general consensus about the broad topics to be covered in general education writing instruction, curricula across states, school districts, and even classrooms within the same school are highly varied (Berninger et al., 2006; Cutler & Graham, 2008; Graham, Harris, MacArthur, & Fink, 2002). It is difficult to determine the effectiveness of writing instruction in the United States because curricula are so widely varied. One recent national survey indicated that 65% of primary grade teachers do not use any commercial programs to teach writing, and the remaining 35% reported using

137 different programs (Cutler & Graham, 2008). The literature examining the current state of writing instruction has provided some descriptive insights regarding classroom instructional trends, however, are not conducive to recommendations for best practices in writing.

First, Abbott and Berninger (1993) reported that basic writing skills (e.g., handwriting, spelling, grammar) are taught in the elementary grade levels and little direct instruction is provided following elementary school. In a descriptive review of written language skills curricula, Smith (2004) concluded that writing mechanics, spelling, and handwriting are phased out of writing instruction following fourth grade and are entirely absent from middle and high school curricula. As a result, elementary-aged students who do not achieve a solid base in writing in the elementary grades will continue to have more difficulty as they progress through middle and high school.

Second, there is little evidence to suggest that students get sufficient writing repetition (i.e., practice) in order to become fluent in written expression skills (Abbott & Berninger, 1993; Graham & Harris, 1997; Graham & Harris, 2005).This is concerning considering that several studies, which included a practice control condition and an instructional condition, found that both conditions were highly effective in producing gains in students' writing fluency across time (Berninger & Amtmann, 2003; Eckert et al., 2006; Eckert, Truckenmiller, Rheinheimer, Perry, & Koehler, 2008; Truckenmiller, 2007). Several national surveys of primary grade teachers' writing instruction practices were conducted and provide some insight about the wide variability of writing instruction and the amount of time children spend writing. One survey of elementary teachers' instructional practices estimated that their students spent an average of three hours per

week writing with a wide standard deviation of 2.2 hours (Graham, Harris, & Fink-Chorzempa, 2003). However, these researchers found that students at all grade levels spent most of the documented 'writing' time producing short answers on worksheets in contrast to producing longer connected text. A more recent survey investigated the amount of time elementary aged students spend writing text that was a paragraph or longer and found similar varied results with a median of 105 minutes per week, standard deviation of 71 minutes and a range of 0 to 380 minutes per week (Cutler & Graham, 2008). These findings are particularly concerning given the general assumption that the amount of time engaged in an academic task directly corresponds with academic outcomes (Shapiro, 2004). These findings provide further support for writing programs that sustain continued practice in writing within the instructional setting.

Third, writing instruction has been demonstrated to be somewhat inflexible. Similar to descriptive findings by Smith (2004), survey results reported by Graham and colleagues (2003) indicated that more than 70% of teachers emphasized basic writing skills, strategies for spelling unknown words, capitalization and punctuation, grammar, planning and revising, retaught skills, and modeled writing processes at least once per week. Although teachers reported that they emphasized basic skills, 42% of the teachers in this study made few or no adaptations in their instruction for general education students experiencing writing difficulties. Considered together, these findings suggest that many elementary-aged students are lacking sufficient practice and adjustment in instruction to become proficient with the basic skills associated with producing a meaningful composition. Furthermore, it seems that teachers are ill-equipped to adapt instruction for students who are not responding to the general education curriculum in

writing. As a result, general education students may receive very little practice with written expression. Those students who experience writing difficulties may not receive differentiated instruction, reducing the likelihood of remediation through direct instruction after elementary school.

From the literature reviewed, there is considerable evidence that current instructional practices do not correspond with existing theoretical models related to the development of elementary-aged children's writing skills. In addition, there is evidence that current instructional practices do not align with recommended best practices for writing instruction. The educational implications of these discrepancies can be most directly observed by examining the recent reports of the National Assessment of Educational Progress. This ongoing educational assessment of a large, nationally representative sample of United States students indicates that a substantial percentage of school-aged students have not demonstrated mastery of writing skills considered fundamental for proficient work. Specifically, 72% of fourth- (Persky, Daane, & Jin, 2003), 66% of eighth-, and 75% of twelfth-grade students could not write at the Proficient Level for their grade level (Salahu-Din, Persky, & Miller, 2008). When broken down across a number of key demographic variables, the lack of proficiency in writing skills is even more concerning. Within the sample of elementary-aged children (i.e., fourth grade students assessed in the most recent sample; Persky et al., 2003), 86% of Black children, 83% of Hispanic children and 86% of American Indian/Alaska Native children were not performing at or above the proficient level. Considerably lower percentages were reported among White children (67%) and Asian/Pacific Islander children (59%). Among children eligible for free and/or reduced price lunch, 88% of the

elementary-aged children could not write at the Proficient Level. These findings further substantiate national policy reports on the condition of writing in U.S. public schools (National Commission on Writing, 2003), wherein writing has been characterized as the 'the neglected R.'

Writing Fluency

Because writing can be conceptualized as a highly complex skill that has been typically instructed in an unsystematic fashion with less than proficient outcomes for a majority of children, it becomes important to concentrate on those basic components of writing that provide the foundation for acquiring more advanced writing skills. Based on the empirical work of Berninger and Amtmann (2003), proficiency in transcription (i.e., writing fluency) is a fundamental skill that must be acquired by children at the elementary school level.

Many components of writing can be and are taught continuously across grade level (e.g., editing, grammar, mechanics, spelling). However, children must first become fluent with transcription in order to benefit from further writing instruction. A number of studies documented that increases in elementary-aged students' rate of writing (i.e., writing fluency) are associated with improvements in writing quality (Deno, 2003; Deno, Mirkin, & Marston, 1980; Van Houten, Morrison, Jarvis, & McDonald, 1988). Due to the importance of writing fluency, the major focus of this study will be on the measurement of written fluency among elementary-aged students.

Measuring Writing Fluency

A number of different assessment approaches are used to measure elementary students' writing fluency depending on the purpose for which a writing assessment is

needed. These assessment approaches include achievement test batteries, state-mandated testing, holistic teacher ratings of writing samples, and Curriculum-Based Measurement in written expression (CBM-WE). Despite the common focus on text production, each of the aforementioned assessment approaches vary in terms of the evaluation methods as well as the how the assessment results are used. For example, achievement test batteries are standardized, norm-referenced measures that describe the relative standing of an individual student's achievement against the normative sample. These results are commonly used to make entitlement, post-entitlement, and accountability decisions for children (Salvia, Ysseldyke, & Bolt, 2007).It is important to note two significant limitations associated with norm-referenced tests: (a) they cannot be re-administered following short time intervals; and (b) they cannot detect small changes within a person over time (Shinn, 1989).Norm-referenced tests are specifically created to produce stable responses. That is, standard scores include small changes (e.g., growth) as error. Therefore, if these tests are given more than once within a period of a few months, one should expect similar scores on these measures from one measurement point to the next, even if some improvement or decrement in skill has occurred. Furthermore, these tests are standardized on one set of items and more than two equivalent forms are not available. Finally, to maintain test validity (i.e., avoid practice effects), norm-referenced tests cannot be administered more than once in a period of six months anyway (Sattler, 2001).

Conversely, the purpose of state-mandated testing is to evaluate a school district's performance in adhering to state academic standards. The results of these assessments are predominately used to make accountability decisions (Salvia et al., 2007).Although state-

mandated testing does sample the students' curriculum and measures a skill as opposed to an aptitude, these measures cannot be used on a frequent basis to monitor students' writing growth over short periods of time for the following reasons. Measuring growth with a scoring system that has only four possible scores restricts the possibility for growth. Furthermore, the scoring of the writing section of the New York State English Language Arts Test (The University of the State of New York, 2005), for example, is highly subjective and results of the writing task are confounded by including a reading comprehension component.

Holistic teachers' ratings of individual students' writing performance are the most frequently used classroom-based assessment approach to measure students' achievement in writing (Calfee & Miller, 2007). For this type of assessment, teachers generally assign a single score to a student's written composition based on a rubric that evaluates the quality of the written product in comparison to prototypical responses (Calfee & Miller, 2007). Although the results of holistic teachers' ratings of writing samples can be used to make entitlement, post-entitlement, and accountability decisions for children, they are frequently used to make pre-referral classroom decisions, including the provision of special help or assistance, referral to an intervention assistance team, or the provision of intervention assistance (Salvia et al., 2007). Use of teacher ratings in criterion validity studies of writing fluency (e.g., McMaster & Espin, 2007) suggest that holistic teacher ratings are considered a commonly accepted measurement of writing quality and fluency. However, several limitations are associated with their use, including the lack of a standardized and objective rubric for rating written compositions and the inability to reliably and validly measure student progress in writing over time. Calfee and Miller

(2007) also point out that these ratings are ill-suited for classroom assessment as the results cannot inform future instruction.

One final assessment approach that most closely matches the assessment goal of this study, specifically designed to objectively evaluate elementary-aged students' writing fluency is CBM-WE (Deno et al., 1982). In general, Curriculum-Based Measurement (CBM) approaches are designed to evaluate basic academic skills, serve as dynamic indicators relative to a broader number of tasks in the same domain, and are sensitive to detecting change over time (Deno, 2003; Shinn, 1989). CBM-WE tasks require students to complete a story starter stimulus (e.g., "It was a dark and stormy night and ...") and students are given three minutes to write a narrative composition. For each writing composition, objectively countable indices (e.g., the number of words written, the number of letters written) of writing fluency are recorded. Early researchers of CBM tools identified four specific goals of any CBM system: (a) efficient use by teachers; (b) produce accurate, meaningful information with which to index student's academic skill level and growth; (c) evaluate the effectiveness of programs in producing that growth; and (d) provide information to help teachers plan better instructional programs (c.f. Deno, Fuchs, Marston, & Shin, 2001). As a result, CBM is frequently used to make pre-referral classroom decisions, including the provision of special help or assistance, referral to an intervention assistance team, or the provision of intervention assistance (Salvia et al., 2007). In addition, CBM is considered to be a reliable and valid measure that can be used in the formative evaluation of students' basic academic skills (Marston, Lowry, Deno & Mirkin, 1981). Specifically, formative evaluation allows educators to frequently examine

student progress and determine when and how to adjust instruction (Fuchs, Fuchs, & Hamlett, 1990).

Because of its sensitivity to measuring academic fluency growth as well as the effects of other variables (e.g., instruction, intervention, teacher characteristics, child characteristics) (Christ, 2006; Christ & Coolong-Chaffin, 2007), CBM is considered to be the most appropriate assessment approach for measuring the amount of fluency growth that occurs during a school year and identifying the extent to which other variables, particularly changes in instruction, affect a student's progress in basic academic skills such as writing fluency. This is an important consideration for teachers, school psychologists, and special education teachers who may be altering instruction or implementing fluency-based interventions to improve writing skills. A drawback that still remains is the lack of normative data or benchmarks for CBM-WE.

Currently, only one set of *non*commercial national normative data for writing fluency is available to categorize (i.e., frustrational, instructional, mastery) elementary-aged students' writing fluency. These standards are based on early work by Mirkin and colleagues (1981), who identified normative criteria for the total number of words written in three minutes in the elementary grades. Several limitations are associated with this set of normative data. First, the study is somewhat outdated and does not include normative data for other fluency metrics, such as correctly spelled words and correct writing sequences. Also, these findings are based on a limited number of assessment points (i.e., one per grade level); and these data do not take into account developmental trends, as students' writing fluency was not examined longitudinally. Finally, these data do not provide information regarding writing fluency growth estimates. Given recent changes in

making pre-referral and entitlement decisions based on the extent to which children respond to interventions over short time periods (Gresham, 2007), it has become increasingly more important to explore and understand the expected rate of elementary-aged students' writing fluency growth over short periods of time.

One commercial assessment program, AIMSweb© (Pearson Education Inc., 2009), provides national normative and benchmarking data each year for students enrolled in grades one through eight. This program provides benchmark assessment data at three points during the school year (fall, winter, and spring), and descriptions of rates of improvement. However, more information is needed regarding the amount of growth to expect during a short-term intervention targeting writing fluency. The focus of the paper will now shift to a review of empirical work that has focused on improving elementary-aged students' writing fluency and short-term growth. The predominate focus will be on evidence-based writing fluency interventions for elementary-aged children due to the increasing emphasis that has been placed on this type of research in the field (APA Task Force on Evidence-Based Practice, 2006).

Evidence-Based Interventions in Writing Fluency

Due to the multiple component skills involved in writing, there are a number of writing intervention programs that *indirectly* target improving the writing fluency skills of elementary-aged students. In a comprehensive review, Graham, Harris, MacArthur, and Schwartz (1991) evaluated the empirical support of four writing intervention procedures: (a) Process Approach to Writing (e.g., Writer's Workshop and computer-assisted instruction), (b) Procedural Facilitation (e.g., cues given to prompt the next step of the writing process), (c) Basic Skills Instruction (e.g., spelling and handwriting), and

(d) Strategy Instruction (e.g., planning text, content generation, editing, and revising). Their review suggested that Strategy Instruction (especially for students with learning disabilities) and Process Approaches to Writing were the most efficacious whereas the other two procedures produced equivocal results. Each of these interventions have empirical support for instructing the specific writing skill that is targeted, however, none directly target fluency.

More recent empirical work has demonstrated the efficacy of a comprehensive Strategy Instruction intervention program called Self-Regulated Strategy Development (see Graham & Harris, 2003 for a review). This intervention indirectly addresses writing fluency by teaching students the cognitive aspect of writing, which includes teaching children: (a) how to retrieve ideas, (b) the conventions of writing, (c) how to plan written work; and (d) how to revise written work (Graham, Harris, & Mason2005). This program represents an optimal writing curricula as it is closely tied to Hayes and Flowers' theoretical model of writing (Graham & Harris, 2005) and has considerable empirical support (Graham et al., 2005). Instruction consists of small group instruction for twenty minutes, three times per week, for five months. Although labor intensive, this program has demonstrated large, positive effects on the quality, structure, and length of various genres of written products (i.e., personal narrative, persuasive, story, and informative writing) among students with and without learning disabilities. Specifically, the effect sizes reported were large (range, 1.46 to 2.34) and were maintained over time (range, 0.82 to 1.60; Graham et al., 2005). Although extensive empirical support exists for the use of Self-Regulated Strategy Development as evidence-based practice, there are some limitations in using this intervention to target and improve writing fluency. First, the

program has a wide focus and does not directly target fluency. Relatedly, no formative evaluation system is linked to Self-Regulated Strategy Development, so its effectiveness can only be evaluated at the completion of the five-month program. Finally, Self-Regulated Strategy Development also has some practical implementation limitations, such as the need for intensive training of teachers and adjusting the existing writing curriculum at the level of the school and classroom.

A considerable number of writing intervention studies was conducted using single-subject research designs. A recent meta-analysis (Rogers & Graham, 2008) of single-subject studies of writing interventions among school-age children revealed several categories of treatment that were demonstrated to be efficacious: (a) strategy instruction for planning/drafting; (b) strategy instruction for paragraph writing; (c) strategy instruction for editing; (d) direct and sequenced instruction in grammar/usage; (e) word processing; (f) sentence construction; (g) prewriting activities; (h) self-monitoring; (i) goal setting for productivity; and (j) reinforcement for improvements in writing. The results of this literature synthesis indicated that four categories of treatments (i.e., strategy instruction, goal setting for productivity, reinforcement, word processing) were shown to significantly improve the production of text (i.e., writing fluency) among elementary-aged students experiencing difficulties in writing as well as typically-developing students. The four categories of treatment studies classified as efficacious demonstrated mean percentages of non-overlapping data points that ranged between 79% and 96%.

Similar to goal-setting and reinforcement, other brief behavioral interventions have been found to be effective as supplements to already existing instructional practices

(Griffiths, VanDerHeyden, Parson, & Burns, 2006). One type of brief behavioral intervention, fluency-building interventions, has received increasing empirical attention to improve children's basic academic skills (Eckert et al., 2009). In contrast to the previously reviewed interventions, fluency-building interventions are conceptualized as time-efficient practices that can supplement instruction or intervention already occurring in the classroom (Martens, Daly, Begeny, & VanDerHeyden, in press). Empirical support for these interventions suggests moderate to strong effects (Eckert et al., 2009; Morgan & Sideridis, 2006), although most fluency-building interventions focused on reading and mathematics (Codding et al., 2007; Morgan & Sideridis, 2006). The existing literature base demonstrating the efficacy of fluency-based writing interventions in general education classrooms is small and focuses predominately on one type of fluency-building intervention, performance feedback (Eckert et al., 2009).

Performance Feedback Interventions

Performance feedback has been defined as a mechanism by which individuals receive information about the nature and/or the effects of their behavior as well as reinforcement for their responding (Solomon & Rosenberg, 1964). Writing fluency interventions incorporating performance feedback provide children with qualitative and quantitative information regarding the amount of text produced. E.L.Thorndike (1931) first described this process in his law of effect, which postulated that individual learning depends on the effect of the response. Singley and Anderson (1989) further extended Thorndike's conceptualization to include the cognitive components that are affected to produce individual learning. In their work, they described performance feedback as inducing active cognitive processing that causes qualitative differences in what is learned.

This means that students use feedback information to assist them with their subsequent performance (Eckert et al., 2006). It has also been suggested that feedback from teachers within the context of the classroom functions as reinforcement for either (a) the general approach the student is taking; (b) the manner of responding (i.e., succinct or discursive); or (c) the fact that the student is responding (Solomon & Rosenberg, 1964). Recently, there has been some evidence to suggest that including feedback and reinforcement components above and beyond typical instructional practices is necessary for increasing performance as it motivates students to demonstrate that they acquired a particular skill (McCurdy, Skinner, Watson, & Shriver, 2008).

In school settings, early performance feedback interventions used a performance feedback system to increase students' academic performance and decrease aberrant behavior (Drabman & Lahey, 1974; Van Houten et al., 1974; Van Houten, Hill, & Parsons, 1975). This system of feedback incorporated public posting of students' progress, explicit timing of educational activities, and self-scoring of academic work. The results of studies examining the effectiveness of this feedback system yielded positive improvements in students' academic responding and behavioral compliance as well as generalized effects in the classroom throughout the school day. In the area of writing fluency, Van Houten and colleagues conducted three studies (Van Houten, 1979; Van Houten et al., 1974; Van Houten et al., 1975) that included a performance feedback component (i.e., each student counted the number of words he/she produced and this figure was displayed on a chart in the classroom). All three studies demonstrated improvements in writing fluency (i.e., number of words written within time constraints).

Furthermore, Van Houten (1979) demonstrated the clinical utility of these procedures by documenting that teachers could easily implement the interventions on their own.

Although this system was found to be effective, two considerations arise. First, these studies did not examine the relative contributions of each component included in the intervention. As a result, it is unclear whether performance feedback, in isolation, was responsible for the changes in the students' behavior, as any number of components interacting in the system could be responsible for the positive effects. Among others, Kazdin (2008) has pointed out that very few intervention studies specifically focus on isolating the mechanisms of change, despite the importance of this information for improving intervention effectiveness. Second, the feedback system emphasized individualized student feedback that was publicly posted. Publicly displaying students' scores on academic assignments may be called into question as unethical and unprofessional educational conduct (Van Houten & Van Houten, 1977).

Recently, the effectiveness of using performance feedback, in isolation, as an intervention for writing fluency has been explored. This line of research has examined the effects of manipulating fundamental components of performance feedback, such as precision, immediacy, frequency, schedule, valence, and sources, on students' writing fluency rates (Eckert et al., 2006). In comparison to the feedback system evaluated by Van Houten and colleagues, there are several advantages to the performance feedback interventions evaluated in these studies. First, the intervention examines the presentation of performance feedback in isolation. Second, the intervention is simple to implement and can be used as a brief behavioral intervention to supplement core instructional programs used in the classroom. Third, the intervention can be readily administered with

an entire classroom of students (i.e., as a universal intervention) or with individual students. Finally, the intervention has been rated positively by students.

In their first study, Eckert and colleagues (2006) examined the effectiveness of individualized performance feedback on 50 third-grade students' writing fluency. Two classrooms of students were randomly assigned to a performance feedback group or a control group. Once each week, the control and feedback group participants were required to compose a story from a beginning sentence-stem (e.g., "I found a note under my pillow that said . . . ."). All students were given 1 minute to think about the story and 3 minutes to write the story, for a total of 4 minutes spent engaged in writing tasks. Prior to composing the story, the feedback group participants received feedback on the number of words they had written from the previous session. The performance feedback intervention included informing each student of the number of words he/she wrote on the previous story and if that number was higher or lower than the preceding story. This feedback was displayed in a visual format to each student and occurred once each week, adding approximately 0.5 minutes to the feedback condition in comparison to the control condition. The control group responded to the same story starters but did not receive feedback about the number of words written or the direction of change. These procedures occurred during 15-minute sessions conducted in the students' classrooms delivered by university researchers once each week for a total of 8 weeks. Stories were then evaluated objectively by trained scorers for writing fluency indicators, including the number of words written, the number of letters written, and the number of words spelled correctly. For each participant in the study, a calendar day slope estimate was calculated for each fluency indicator. The results of a one-way analysis of variance (ANOVA) revealed that

the feedback group participants demonstrated significantly greater growth across the three dependent measures than the control group.

In a second similar study, an examination was conducted of the effectiveness of the same individualized performance feedback intervention on the writing fluency of 38 third grade student in general education classrooms, half of which were considered to be at-risk students (Eckert et al., 2008). Based on norms for students in the winter of third grade (Shinn, 1989), a high frequency of students enrolled in one of the two classrooms scored below the 25th percentile on baseline measures of writing fluency and had more students receiving special education services. As a result, students enrolled in the first classroom were considered to constitute an at-risk group and were assigned to the feedback condition, whereas students enrolled in the second classroom were considered to constitute a typically-developing group and were assigned to the control condition. Procedures were identical to those previously described, except the study was conducted over 6 weekly sessions. The results of an analysis of covariance (ANCOVA), which controlled for baseline differences in fluency levels of the two groups, revealed that the at-risk students receiving performance feedback demonstrated significantly more growth across three dependent measures than the typically-developing students assigned to the control group. Not only was the amount of growth significantly higher for the feedback group, but the feedback group's fluency level (M = 41 words written) outstripped the control group (M = 31 words written) by the end of the study. Maintenance of these effects was not measured.

Three more studies varying the delivery of performance feedback (Rosenthal, 2005; Rheinheimer, 2008; Truckenmiller, 2007) were conducted to examine the effect on

elementary-aged students' writing growth. Further support for the use of individualized performance feedback to increase writing fluency growth was found (Rheinheimer, 2008). However, no statistically significant increases in the amount of students' writing growth were found by strengthening or altering the feedback intervention (i.e., adding a school-home note regarding the students' performance, and utilizing a group-oriented contingency). Further, one study conducted by Rosenthal (2005) tripled the amount of feedback provided to students over a period of 8 weeks and, in comparison to students receiving feedback once a week, found comparable growth rates between the two conditions. These results lend to the conclusion that individualized performance feedback on a brief CBM-WE probe delivered once per week has moderate to high effects (d = 0.76; Eckert et al., 2006) on children's writing fluency growth and that practice with CBM-WE may also have some effect on writing fluency.

Overall, this set of research studies demonstrated the benefits of: (a) increasing writing fluency growth rates for struggling writers in a short amount of time (i.e., 6 to 8 weeks) with brief sessions (i.e., 15 minutes), (b) easily incorporated into previously-existing instruction, and (c) well-received by students (Eckert et al., 2008). Although effectiveness and utility of this fluency-based intervention was demonstrated, a more in-depth exploration of factors affecting writing fluency growth may improve the use of performance feedback. To date, no study has compared rates of writing fluency change following performance feedback to a condition where students are provided with no regular writing practice beyond typical classroom instruction. Similarly, no study has examined the effect of writing practice alone (i.e., without intervention) on the trajectory of elementary-aged student's writing fluency. It is unclear whether students' writing

growth may benefit simply from practice with CBM-WE probes. Finally, use of performance feedback can be further expanded and more flexibly studied by using more sophisticated modeling techniques (i.e., multi-level modeling techniques) to quantitatively describe how certain variables affect children's growth in writing fluency in addition to level of writing fluency. The versatility of multilevel modeling techniques will be described in further detail following a discussion of some variables that may affect writing fluency. Although the focus thus far has been on the component processes of writing, writing instruction, and brief behavioral interventions for writing fluency, there are less conspicuous factors that affect writing fluency that now warrant closer inspection.

Variables Affecting Writing Fluency

There is some literature to suggest that certain learner characteristic variables, such as sex, ethnicity, socioeconomic status, special education status, and learning English as a second language affect children's academic outcomes in reading, mathematics, and writing (Lee, Grigg, & Dion, 2007; Lee, Grigg, & Donohue, 2007; Persky et al., 2003; Salahu-Din et al., 2008). Limited empirical attention has focused on the variables that affect children's writing fluency and particularly growth in writing fluency over time. However, there are some initial research findings to suggest that children's writing fluency and growth in writing fluency over time may vary across several student learner characteristics, including sex, initial level of writing fluency, and trajectory of writing fluency growth (Truckenmiller, 2007). Each of these areas will be reviewed below.

Sex differences. Overall, boys have more profound difficulties in general writing performance. National achievement data indicates that elementary-aged girls (Persky et al., 2003), intermediate-aged girls, and high school-aged girls (Salahu-Din et al., 2008) all significantly outperform boys on a test of general writing proficiency. Boys are also at higher risk of a learning disability in writing. Boys have a relative risk ranging from 2.0 to 2.9 of being diagnosed with a learning disability in writing for every one girl diagnosed (Berninger, Nielson, Abbott, Wijsman, & Raskind, 2008). Analyses of students' writing performance on norm-referenced measures such as the Iowa Test of Basic Skills (Hieronymus, Lindquist, & Hoover, 1982), indicates that elementary-aged girls outperformed boys on all relevant subtests, including spelling, capitalization, punctuation, and language usage (Martin & Hoover, 1987). In addition, this research demonstrated that girls outperformed boys in grades 3 through 6 by a significant margin (Martin & Hoover, 1987), suggesting significant differences in overall writing achievement between boys and girls. However, it is unclear how this difference translates to actual differences in writing skill and writing fluency as the test scores were subjective and the scoring was based on 4-point scale, which is limited in range.

A number of possible causes were identified to account for these sex differences, including differences in males and females brain functioning (Berninger et al., 2008; Shaywitz et al., 1995), executive functioning and processing speed (Camarata & Woodcock, 2006), as well as orthographic skills (Berninger & Fuller, 1992; Berninger et al., 2008). Camarata and Woodcock alternatively suggest that males' slower processing speed significantly affects their performance on any type of timed achievement test, including writing measures. For example, these researchers found no sex differences on

untimed achievement tests in reading and math; but on the corresponding timed fluency tests, female students outperformed male students. Interestingly, in the area of writing, female students significantly outperformed male students on a test of writing achievement (d = 0.33) and a timed test of writing fluency (d = 0.42; Camarata & Woodcock, 2006).

Although there is still some speculation regarding the specific causes of these sex differences, there appears to be compelling evidence that girls outperform boys and that outcome analyses must be separated by sex. To date, only two studies employing large samples of elementary-aged children reported writing fluency results that were reported separately based on the sex of the students. In the first study, students in grades one through three participated in several assessments of fluency including verbal fluency, orthographic fluency, and writing fluency (Berninger & Fuller, 1992). These researchers focused on examining differences in ability between boys and girls in elementary school on several determinants of writing fluency. Results indicated that boys outperformed girls in verbal fluency but girls outperformed boys in orthographic fluency and writing fluency. Berninger and Fuller reported that their sample of third grade girls wrote an average 51.5 words in five minutes and their sample of boys wrote an average 45.7 words. Because the measures of verbal and orthographic fluency focused on between-individual differences, a longitudinal design examining within-individual changes was not used. Although it is important to know the degree to which boys and girls differ in writing fluency abilities and skills, it is also important to examine if these differences also affect growth in writing fluency over time. That assumption cannot be inferred without being directly tested.

In the second study, Malecki and Jewell (2003) examined differences based on sex across children's development (i.e., elementary and middle school years) as measured by CBM-WE. The main purpose of this study was to describe the degree of sex differences at various grade levels as measured by various scoring metrics, utilizing a cross-sectional design. They did not focus on the growth trajectory of the same set of students; rather, they focused on describing the sex differences that might be observed in the elementary and middle school grades. For the purposes of this review, the results pertaining to children enrolled in grades three through five are discussed. Within their sample of 481 third, fourth, and fifth grade students assessed in the fall and the spring, Malecki and Jewell reported that girls outperformed boys, writing 44.7 total words written (TWW), 42.1 words spelled correctly (WSC), and 40.2 correct writing sequences (CWS) compared with38.6 TWW, 35.5 WSC, and 33.1 CWS. These differences represent a small to medium effect size with a partial $\eta^2$of 0.05. Sex differences accounted for about 5% of the total variance in TWW, WSC, and CWS. An interaction between sex and age (i.e., grade level) was also found. That is, the gap between females and males widened across the three developmental periods used by the researchers (early elementary, elementary, and middle school) when examining performance on production-dependent measures (i.e., TWW, WSC, and CWS). Alternately, the gap decreased with increasing age on production-independent measures (i.e., percentage of correctly spelled words and percentage of correct writing sequences).However, this interaction was not explicitly tested at the longitudinal level (i.e., from fall to spring of the school year).

Interestingly, in both studies, the standard deviations were similar for girls and boys, indicating no significant sex differences in writing variability. This reported finding

is consistent with sex differences in achievement testing (Martin & Hoover, 1987). However, it is unclear whether the reported fluency levels are representative of elementary-aged students as one study did not report student demographic information (Malecki& Jewell, 2003) and the other study only included a sample with restricted demographic characteristics (i.e., higher socioeconomic status) (Berninger & Fuller, 1992). Although it is highly likely that the demonstrated differences in growth over time generally occurs, this conclusion is limited by the sometimes false conclusions that occur from cross-sectional designs (Raudenbush, 2001). There are currently no empirical data available describing the effect of sex on elementary-aged students' writing fluency growth longitudinally. Based on the work by Berninger and Fuller (1992), Camarata and Woodcock (2006) and Malecki and Jewell (2003), it is reasonable to predict that there are significant sex differences in elementary-aged students' level of writing fluency, although it is unclear whether these sex differences in elementary-aged students' writing fluency growth (i.e., slope) exist.

Initial level of writing fluency. As previously reviewed, certain demographic factors such as sex, can affect students' level of writing fluency. Regardless of the factors that cause variability in initial level of writing fluency, it can be argued that it is just as important to identify how a student's initial level of fluency predicts growth over time. Evidence that initial level of writing fluency affects students' writing fluency growth is beginning to accumulate. In an early study of CBM-WE, developers examined the ways in which CBM-WE performance differed between low-achieving students and students with a diagnosed learning disability (Shinn, Ysseldyke, Deno, & Tindal, 1982). The two groups of students were compared in terms of initial level of writing fluency and weekly

growth across 5 weeks. The two groups did not differ significantly on a standardized measure of writing, however, the students with learning disabilities did produce lower writing fluency rates (*M* = 37.6 TWW) than the low-achieving students (*M* = 43.9 TWW). By the end of the 5-week period, statistically significant differences were observed in the students' writing fluency growth. The students who were classified with a learning disability had gained an average of 1.04 words per week, whereas the low-achieving students demonstrated *decreases* in their writing fluency growth (i.e., 0.53 words per week). Although it is possible that the reported findings were due to curricular differences or measurement issues associated with initial fluency levels (i.e., floor and ceiling effects), the results of this study suggest that students with lower initial levels of writing fluency exhibit a higher degree of growth over time. Conversely, students with somewhat higher initial rates of fluency may not experience significant growth over time. For example, a student writing ten words at baseline would be expected to demonstrate a steeper rate of fluency than a student writing sixty words at baseline. Ultimately, this has implications for the amount of growth that can be expected of students and highlights the need to differentiate each student's goal for improvement depending on a set of factors that includes initial level of fluency.

Two recent writing studies utilizing CBM-WE with a general education population, lends support to this hypothesis (Rheinheimer, 2008; Truckenmiller, 2007). These studies demonstrated that a statistically significant number of students initially writing at a frustrational level (i.e., below grade level fluency expectations; less than 37 TWW in three minutes) improved to an instructional or mastery level at the conclusion of the study (Rheinheimer, 2008; Truckenmiller, 2007). Interestingly, the students who

initially performed at a mastery level were not able to maintain a mastery level of fluency at the end of the studies. These results provide some support for the implications that students may need different growth expectations based on their initial fluency level. However, less than five students performed at a mastery level at the beginning of the studies; so the limited sample size restricts the interpretation of the effects of elevated levels (i.e., mastery level) of initial writing fluency on students' writing growth across time. Additionally, these studies merely compared fluency levels obtained at two measurement points and did not directly investigate the association of initial writing fluency level with an estimate of growth. Therefore, continued investigation of the potential interaction of initial level of writing fluency with writing fluency growth is warranted.

A similar study was conducted in the area of mathematics (Codding et al., 2007).This study was particularly illuminating as it utilized Hierarchical Linear Modeling to examine both group and individual responses over time as a function of two different math fluency interventions while also allowing for differential responses in math fluency growth due to variability in individual's initial level of math fluency. Examining a sample of 98 second- and third-grade students, Codding and colleagues found that the students' response to two different fluency-based interventions (i.e., cover-copy-compare and explicit timing) was dependent on the student's initial level of math fluency. Specifically, students performing above the 25th percentile for their grade level demonstrated growth in mathematics fluency only if they were assigned to the explicit timing condition; whereas students performing below the 25th percentile for their grade level demonstrated significant growth only if they were assigned to the cover-copy-compare condition or the

control condition. However, one limitation of this study is that weekly practice with the dependent measure (i.e., CBM in mathematics probes) was not able to be explicitly modeled and therefore it remained unclear how much variability could be accounted for by practice. Overall, this study provides a model research design for modeling students' academic fluency growth and considering salient student variables.

Growth trajectory. In writing fluency, there are several aspects that need to be considered when examining elementary-aged students' growth trajectories: (a) the amount of growth to expect, and (b) how often growth is measured. However, there is limited literature describing these considerations. In a hierarchical linear model of writing development across first through third grade (one measurement point at each grade level), Coker (2006) demonstrated a positive or increasing trajectory. Malecki and Jewell (2003) provide further evidence that growth slopes from fall to spring (two measurement points during an academic year) are significantly positive at a group level for the CBM-WE metrics: TWW, WSC, and CWS (*partial* η^2 = 0.13 to 0.015). Furthermore, AIMSweb© estimates indicate that third grade students' rate of improvement from fall to winter to spring is 0.4 units (i.e., TWW, WSC, and CWS) per instructional week.

Although this literature seems to suggest that the growth trajectories of elementary-aged children's writing fluency increases in a positive direction, there are several limitations worth noting. First, the amount of growth is relatively small across a large period of time; however, these findings indicate that significant growth is to be expected in writing fluency. When frequently measured across a time period shorter than a school year, it may be difficult to detect that small amount of growth. For example, Marston et al. (1981) reported that less than half of elementary-aged students evidenced

increased writing fluency performance from fall to spring. Second, very little is known about the expected growth trajectory of correct writing sequences for elementary-aged students.

Additionally, this literature has not mentioned the attributes of practice effects on students' outcomes. Skinner, Fletcher, and Henington (1996) demonstrated that learning rates increase when the quantity and quality of learning trials is increased. Therefore, regular practice with CBM-WE probes in addition to a teacher's standard writing curriculum may be more beneficial than the absence of that practice. For example, students may just need the opportunity to get enough repetition (i.e., practice) in writing to become fluent (Abbott & Berninger, 1993; Graham & Harris, 1997).

The limited evidence in the literature on CBM-WE suggests that more research needs to be conducted on the nature of writing fluency growth and particularly during a shorter period of time. Writing instruction selection and particularly decisions regarding writing fluency intervention should improve if practitioners are provided with empirical literature that accurately depicts the amount of growth to expect as well as the variables that may influence writing fluency growth (e.g., sex differences, initial level of fluency, and practice effects.

Estimating Growth Trajectories: Analytical Considerations

Although a few studies examined elementary-aged students' writing fluency growth trajectories (Eckert et al., 2006; Eckert et al., 2008), no study provided a robust estimate of growth that accounts for predictor variables. Multi-level modeling (also referred to as hierarchical linear modeling) has been identified as a robust technique for modeling group academic growth trajectories (Burchinal, Nelson, & Poe, 2006;

Raudenbush, 2001; Singer & Willett, 2003). Multi-level modeling is highly suited for and matches the goals of estimating student growth trajectories in four important ways when CBM-WE probes are used: (a) it retains individual differences by modeling each individual's intercept and slope estimates; (b) it is sensitive to detecting variables affecting incremental changes in outcome measures; (c) it easily accommodates missing data; and (d) it can detect predictor variables that may affect outcome measures. For example, multi-level modeling examines how experimentally-manipulated variables as well as characteristics of the person, affect growth over time.

Multi-level modeling allows individual growth curves to differ from the estimate of the group growth curve. This feature is important in measuring children's writing fluency as students may show a variety of growth patterns such as a positive linear slope, negative linear slope, flat slope or a non-linear function (Fuchs, Fuchs, Hamlett, Walz, & Germann, 1993). It is, therefore, important to allow each individual to retain their own intercepts and growth estimates to obtain a more realistic statistical model.

Additionally, multi-level modeling does not make the assumption that data are independent. Instead, the model depends on the use of parallel forms of a repeated measure, like CBM. Furthermore, multi-level modeling flexibly handles missing data and unequal numbers of measurement points. Given the likelihood of missing data (e.g., student absences, school cancellations), this is a significant benefit of multi-level modeling over more traditional analytic approaches. Although multi-level modeling has been used to estimate growth trajectories in reading (Blachman et al., 2004) and mathematics (Codding et al., 2007), only one study has used multi-level modeling to estimate elementary-aged students' writing fluency growth (Coker, 2006) and no

published studies used this technique to estimate students' writing fluency growth when classroom-based fluency interventions were implemented.

Purpose of the Current Study

Although the majority of academic fluency research has targeted basic skills in the areas of reading and mathematics, fluency in the area of writing is also an essential skill for elementary-aged students. As previously discussed, proficiency in writing has been demonstrated by only 28% of elementary-aged students in the United States (Persky et al., 2003), making writing an essential target for further research to yield empirically-based intervention, especially for particular groups of marginalized students. Consequently, this study intended to expand the base of research for writing fluency interventions. In particular, three areas were addressed: (a) writing fluency growth as it relates to the use of two brief behavioral supplements to classroom instruction; (b) writing fluency level and growth as it relates to sex; and (c) writing fluency growth as it relates to individual's initial level of fluency.

The primary aim of this study was to describe the pattern of writing fluency growth that emerges under typical instructional conditions in children's writing (i.e., instructional control condition) as well as following the use of two brief behavioral supplements to classroom instruction: weekly practice with written compositions in response to CBM-WE (i.e., practice-only condition) and weekly practice coupled with individualized performance feedback (i.e., feedback condition). Changes in students' writing fluency (i.e., growth trajectories) were compared across the three conditions. It was predicted that fluency growth would be greatest for students receiving performance feedback, followed by those students receiving weekly practice. Previous research

suggests that practice and performance feedback both positively affect students' writing fluency (Eckert et al., 2006; Eckert et al., 2008). However, there are no data to support or refute that growth in writing fluency will occur in the absence of practice or performance feedback. The primary aim of this study emphasized the extent to which students' writing fluency changes within a short-term progress monitoring period for the purpose of informing curricular decision-making, which parallels some schools pre-referral intervention practices. Therefore, an examination of the long-term effects or maintenance effects was outside the scope of this study.

A second primary aim focused on measuring writing fluency. Previous research (Eckert, et al., 2006; Eckert et al., 2008) and benchmark data (Mirkin et al., 1981) has utilized TWW as the primary metric for writing fluency, with less attention regarding the metric that provides more information about writing quality: CWS. However, the CWS metric has been shown to be a more valid and practically useful variable for elementary-aged children (Espin, Scierka, Skare, & Halverson, 1999; Gansle, Noell, VanDerHeyden, Naquin, & Slider, 2002; Hubbard, 1996; Truckenmiller et al., 2009; Weissenburger & Espin, 2005). The current study utilized two dependent variables, TWW and CWS, to expand the literature in a needed direction. Hypotheses listed above are regarding TWW, as this was the metric targeted by the performance feedback. However, it was also hypothesized that results with CWS would parallel TWW as the two metrics were shown to be significantly correlated in a similar study (Truckenmiller, 2007). However, it was unknown how much growth to expect with CWS. Describing the amount of growth in CWS, especially in the practice-only and control conditions was conceptualized as clinically relevant.

Studies in mathematics (Codding et al., 2007) and writing (Coker, 2006) implicate several variables outside of experimental control that contribute to students' fluency level and fluency growth, such as sex, socioeconomic status, initial level of fluency, special education designation, and teacher variables. The current study examined and described the variability in writing fluency associated with two of these variables, sex and initial level of writing fluency, as there is some evidence to suggest these are significant contributing variables. By using multi-level modeling techniques, I explored the contribution of sex and initial level of writing fluency to elementary-aged students' writing fluency level (i.e., intercept) and growth (i.e., slope).

Because research has demonstrated that girls generally outperform boys in assessments of writing fluency (Berninger & Fuller, 1992; Camarata & Woodcock, 2006; Malecki& Jewell, 2003; Martin & Hoover, 1987), it was hypothesized that girls would have a higher writing fluency level estimate than the boys. However, it was previously unknown whether there would be a difference in growth estimates between the girls and the boys. Preliminary research in the content area of writing suggests that students' writing fluency level and growth depends partly on the students' initial level of fluency (Rheinheimer, 2008; Truckenmiller, 2007). Therefore, students' initial level of fluency may significantly predict the magnitude of fluency growth over time. In this study, it was predicted that students with a lower level of initial writing fluency (i.e., frustrational level or below the 25th percentile) would have a greater slope than students initially writing at a higher level (i.e., mastery level or above 25th percentile).

Method

Participants and Setting

A total sample of 133 third-grade student participated in the study. Over half of the sample was female (54%) and averaged 8.85 years of age (range, 8.17 years to 10 years). The majority of participants self-identified their race/ethnicity as African American or Black (74%). A smaller percentage of participants self-identified their race/ethnicity as White (18%), Hispanic or Latino (5%), or American Indian or Alaskan Native (2%). Although 20 students (15%) were receiving special education services, none were classified as Learning Disabled in Writing or eligible for additional instructional modifications (i.e., Section 504 plan). None of the students received an instructional aide. Student demographic variables were examined for differences between the three conditions (performance feedback, practice-only, and instructional control). No significant differences were found for sex, X^2 (2, N = 133) = 1.71, p = .43, ethnicity, X^2 (6, N = 133) = 8.36, p = .21, age, F (2, 132) =1.71, p =.19, or special education status, X^2 (2, N = 133) = 2.43, p = .30. Individual student's socioeconomic status information was not available. Table 1 provides the demographic characteristics of the participating sample.

Two male teachers (22%) and seven female teachers (78%) participated (100% consent rate). The teachers had an average of 11 years teaching experience (range = 3 years to 31 years). Two teachers had a master's degree, 6 teachers had a bachelor's degree, and one teacher did not indicate her degree. All teachers held an elementary certification. Additionally, four teachers held a special education certification, one teacher was certified as a missionary teacher, and one teacher held a certification in literacy. Teacher demographics are summarized in Table 2.

The setting for the study was nine third-grade general education classrooms housed in three elementary schools in a mid-sized city in the northeast. Each school enrolled students in Kindergarten through fifth grade. These schools were considered to represent an underserved population as an average of 78% (range, 66% to 86%) of the students attending the three schools qualified for free or reduced-price lunches.

Research Assistants

A total of four doctoral students in school psychology, including the author, one university faculty member in school psychology, and four advanced undergraduate psychology majors administered the experimental conditions. In addition, six advanced undergraduate psychology majors served in several capacities as research assistants. These capacities consisted of conducting procedural integrity observations, scoring dependent measures, and completing data entry. Inter-rater reliability and data error-checking was conducted by the author, two other doctoral students in school psychology, and one advanced undergraduate psychology major. Research assistants received training on all of the aforementioned responsibilities. As part of their training, research assistants were provided with procedural scripts for administering dependent measures, a manual detailing the scoring procedures for the dependent measures (Rosenthal, 2005; Truckenmiller, 2007), and procedural scripts for conducting procedural integrity observations. They received training on scoring dependent measures, followed by opportunities to practice and receive feedback on scoring the probes. All research assistants were required to demonstrate 100% proficiency following procedural scripts, scoring dependent measures, and conducting procedural integrity observations. In addition, all research assistants completed and provided documentation regarding

successful completion of a formal training in research ethics, as required by Syracuse University Institutional Review Board. This training, the Collaborative Institute Training Initiative (CITI), provided online basic courses in the protection of human research subjects.

Materials

Informal writing screening measure. In order to determine whether the students' handwriting was legible, participants printed a set of 10 lowercase letters from the alphabet (i.e., f, c, r, m, v, y, i, h, e, o). These 10 letters were randomly chosen utilizing a random numbers generator after excluding the commonly reversed letters 'b' and 'd.' This measure was an informal measure developed by the author and no psychometric evidence is currently available.

Paragraph Copying Task. The paragraph copying task from the Monroe-Sherman Group Diagnostic Reading Aptitude and Achievement Test (Monroe & Sherman, 1966) was administered as a baseline indicator of orthographic skill (see Appendix A). Participants were given 90 seconds to copy a short paragraph as quickly as possible without making mistakes. Normative data was based on the total number of words copied accurately. This particular task was chosen as it is the only paragraph copying task with published normative data for elementary-aged children; however, the psychometric properties and norming procedures associated with this measure are not available. In previous studies (Berninger, Hart, Abbott, & Karovsky, 1992; Graham, Berninger, Abbott, Abbott, & Whitaker, 1997; Jones & Christensen, 1990), this measure was shown to be a significant predictor of overall writing ability and writing fluency.

Test of Written Language-Third Edition. The Test of Written Language-Third Edition (Hammill & Larsen, 1996) is a standardized, norm-referenced assessment designed to evaluate students' written expression skills. The measure was designed to assess the written language expression skills for children, aged 6 through 16. In this study, the Spontaneous Writing subtest (Appendix B) was administered for the purpose of quantifying each student's general writing abilities. The Spontaneous Writing subtest requires students to look at a picture, plan a story, and write a story for fifteen minutes. The story is evaluated in three areas: (a) Contextual Conventions (e.g., punctuation, capitalization, and spelling), (b) Contextual Language (e.g., vocabulary and sophistication of sentence construction), and (c) Story Construction (e.g., plot, character development, and style).

The technical adequacy of the Test of Written Language-Third Edition has been primarily evaluated by the test developers and the psychometric properties were reported in the test manual. The internal consistency of the Spontaneous Writing Quotient for 8- and 9-year-old children is high (r = .90). In addition, interscorer and alternate-form reliability is high (i.e., coefficients are greater than .80). In terms of criterion-related validity, the Spontaneous Writing Composite demonstrated a moderate association with the writing component of another standardized measure, the Comprehensive Scales of Student Abilities (Hammill & Hresko, 1994) (r = .50).

Curriculum-Based Measurement probes in written expression. CBM-WE probes were administered over the course of the study. Each probe contained a different story starter that was previously evaluated for appropriateness for elementary-aged students of varied backgrounds (McMaster & Campbell, 2006). The story starters contain

short sentence fragments that provide an idea to the students for writing a narrative story (e.g., “I was talking to my friends when all of a sudden ...”) (see Table 3 for a complete listing). During each session, a different CBM-WE probe was presented to each student within the context of a writing packet. Although the story starters chosen for this study were identified as appropriate for use with diverse populations (McMaster & Campbell, 2006), they were not thoroughly evaluated for use as parallel forms. Previous use of these story starters indicated high correlations between the story starters (r =.52 to .83) (Truckenmiller, 2007).

The first page of the writing packets (Appendix C) contained the student’s identifying information. To reduce student previewing of the story starter, the second page of the packet contained a picture of a stop sign in the middle of the page (Appendix D). For participants assigned to the practice-only condition, the remaining pages of the packet contained the probe materials. For participants assigned to the performance feedback condition, the third page of the packet contained an individualized performance feedback sheet (described below). Following the performance feedback sheet, the remaining pages of the packet contained the CBM-WE probe materials. The probe materials included: (a) one page containing a story starter written across the top of the page and a stop sign at the bottom (Appendix E), (b) one page containing the story starter with compositional lines (Appendix F), and (c) one page containing compositional lines (Appendix F). Additional sheets of compositional paper were available on an individual basis when needed. In this study, each written response to the CBM-WE probe was evaluated for two metrics: TWW and CWS.

The literature base exploring the use of CBM-WE in schools has examined several metrics for measuring writing fluency in addition to TWW, WSC, and CWS. These measures include: (a) total number of letters written, (b) percentage of words spelled correctly, (c) percentage of correct writing sequences, (d) correct writing sequences minus incorrect writing sequences, (e) number of complete sentences, (f) number of words in complete sentences, (g) number of verbs, and (h) number of correct punctuation marks. However, TWW, WSC, and CWS are the most commonly used to assess elementary-aged children's written fluency skills (Espin et al., 2000).

The technical adequacy of these three metrics of CBM-WE has been explored in 15 studies of elementary-aged children with comprehensive reviews provided in the AIMSweb manual (Powell-Smith & Shinn, 2004) as well as a meta-analysis (McMaster & Espin, 2007). Based on these two syntheses, the resulting reliability and validity coefficients are summarized in Table 4. Overall, the reported parallel form reliability coefficients for TWW are high (range, r = .51 to .99), as well as interscorer agreement (range, 91% to 99%). In the few studies that examined the psychometric properties of CWS, parallel form reliability (r = .46) and interscorer agreement (range, 86% to 98%) was lower than the estimates for TWW or correctly spelled words. However, studies examining the validity of the three metrics indicate that the CWS metric was more highly correlated (range, r = .31 to .85) with the criterion measures than either TWW (range, r = .08 to .82) or WSC (range, r = .21 to .88). Furthermore, the face validity of CWS has been shown to be higher among teachers than the other two scoring metrics (McMaster & Espin, 2007). Finally, there is evidence that CWS was the most accurate and precise measure, as compared to TWW and WSC, when monitoring student growth over time. In

summary, these findings suggest that CWS is the most valid indicator of writing fluency and overall writing quality among elementary-aged students, but should continue to be examined for interscorer agreement.

Rating of story starters. In order to capture possible differences associated with students' preferences for specific story starters contained in the CBM-WE probes, students responded to four 5-point Likert items. Responses ranged from "*not at all*" to "*very, very much*." These items were inserted at the end of each writing probe (Appendix G) with the corresponding story starter. The third item was reverse scored to account for potential response bias. Use of this measure has not been evaluated previously and the results are being used only for descriptive purposes.

Procedural acceptability assessment packet. A brief survey was administered to all students to assess their perceptions of the writing procedures used in the study. This assessment included a series of questions using a 5-point Likert-type response system. Responses ranged from "*not at all*" to "*very, very much*." For those students assigned to the practice-only condition and the instructional control condition, a 3-page packet was administered that contained six questions regarding the students' attitudes towards the procedures used as well as their own writing skills (Appendix H; questions numbered 1 through 4 and 7 through 8). For those students assigned to the performance feedback condition, a 4-page packet (Appendix H) was administered and contained the same six questions contained in the practice-only condition as well as two questions (questions numbered 5 and 6) regarding the students' perceptions toward receiving feedback. The questions contained the packet were developed by the author in order to obtain a short

descriptive evaluation of the students' perceptions on the specific procedures used during this study.

Teacher questionnaire. As indicated earlier, writing instruction across classrooms is highly variable, and therefore, a description of the writing instruction provided in the classrooms should be measured and reported. In order to describe the instructional environment, teachers completed a questionnaire that contained the Writing Orientation Scale (Graham, Harris, MacArthur et al., 2002) and questions regarding the classroom writing curricula. The Writing Orientation Scale (Graham, Harris, MacArthur et al., 2002) was designed to measure teachers' beliefs about writing instruction. There is some evidence that teachers' beliefs greatly influence teachers' instructional practice and student outcomes (c.f. Graham, Harris, MacArthur et al., 2002). The items on the Writing Orientation Scale load onto three factors: (a) correct writing, (b) explicit instruction, and (c) natural learning. These factors respectively account for 15%, 12%, and 10% of the variance in the scale (Graham, Harris, MacArthur et al., 2002). Average scores for each factor are obtained, with higher scores indicating that the teacher placed more emphasis on the construct measured by that factor. Each of the factors correlate with associated writing practices (range, r = .17 to .31) and the internal consistency of the measure is moderate (r = .70).

In addition to administering the Writing Orientation Scale, all teachers were asked to list their writing curricula and to quantify the amount of instructional time devoted to handwriting, spelling, and written composition in the classroom (e.g., Please estimate how many minutes per week your students are engaged in composition writing). These

questions (Appendix I) simply provide a description of the classroom writing curricula and instructional practices and were not technically evaluated previously.

Curriculum-Based Measurement in mathematics. Curriculum-Based Measurement probes in mathematics (CBM-M) were administered over the course of the study to participants assigned to the instructional control condition. Each probe contained 60 mixed basic addition and subtraction facts, using numerals no higher than 12. Mixed addition and subtraction was targeted as third grade students are expected to be proficient (fluent) with the addition and subtraction of whole numbers by the end of third grade (National Mathematics Advisory Panel, 2008). During each session, two CBM-M probes were presented to each student within the context of a mathematics packet. The first page of the packet contained the student's identifying information. To reduce student previewing of the feedback page, the second page of the packet contained a picture of a stop sign in the middle of the page. The third page of the packet contained an individualized performance feedback sheet. The performance feedback sheet was similar to the feedback sheet in the writing performance feedback condition, except that number of correctly computed digits was inserted as the feedback. Following the individualized performance feedback sheet, the remaining pages of the packet contained the CBM-M probe materials: four pages (two pages per 2-minute probe) of mixed addition and subtraction computation problems (see Appendix J).

The psychometric properties of CBM-M were examined in a number of studies. Interscorer agreement for the number of digits correctly computed is high (range, 83% to 93%; Shinn, 2004). All conventional reliability estimates (i.e., internal consistency, test-retest, parallel forms, and alternated forms) were higher than .70, with stronger reliability

for single-skill CBM-M probes than mixed-skill CBM-M probes (Foegen, Jiben, & Deno, 2007; Shinn, 2004). Validity coefficients in a review of 17 studies were reported to be modest, ranging from .50 to .70, but similar to other tests of mathematics achievement (Foegen et al., 2007).

Procedures

Institutional Review Board approval from Syracuse University was obtained (IRB# 08-363) as well as approval from the participating school district's research office (dated 1/21/2009). Teachers and students attending three elementary schools in a mid-sized city in the northeast were invited to participate in the study (see Appendix K). Once teacher consent was obtained (9/9, 100% consent rate), parental consent (Appendix L) was obtained for 147 of the 199 students (74%). Of the students whose parents consented, 100% provided student assent to participate in the study (Appendix M). Students were then screened for eligibility. The eligibility criteria included: (a) not experiencing severe motor deficits that preclude students from composing written stories; (b) not experiencing significant cognitive deficits (i.e., classified as Mentally Retarded or Autistic); (c) English was the primary language spoken by the child; (d) not classified as Learning Disabled in Writing; (e) did not have a one-to-one instructional aide or a Section 504 plan indicating additional instructional modification; (f) demonstrated minimum proficiency by writing at least seven words on the baseline CBM-WE probe; and (g) legibly scribed 90% of 10 alphabetic letters dictated to them. A total of eight students (5%) were excluded from the study because they did not meet the inclusionary criterion of writing 7 or more words on baseline CBM-WE probe.

Following the eligibility screening, 139 participating students were randomly assigned to one of three conditions: (a) performance feedback condition; (b) practice-only condition; or (c) instructional control condition. Two students were unable to participate in the conditions due to schedule conflicts, and four students were excluded from the analyses due to limited data (i.e., missing baseline assessment). This resulted in a final sample of 133 third-grade student participants participating one of three conditions: (a) performance feedback condition (n = 46); (b) practice-only condition (n = 39); or (c) instructional control condition (n = 48). Detailed information regarding the recruitment, enrollment, and condition allocation are reported according to the Consolidated Standards of Reporting Trials Guidelines in Figure 1 (Moher, Schulz, & Altman, 2001).

The study was conducted in two phases: (1) eligibility and baseline assessment phase spanning 2 weeks; and (2) the intervention phase spanning 7 weeks. Following the eligibility and baseline assessment phase, the intervention phase was conducted in 15-minute sessions once per week during regularly scheduled class time for 7 weeks. Across all phases of the study, sessions were conducted in a group format in the students' regular classrooms, wherein all eligible students participated at the same time. Individual students were given packets with a colored cover sheet and were directed to a classroom designated by the group's color (i.e., green, gold, or blue). Research assistants (one or two assistants per condition) were responsible for conducting the sessions (described below) in the designated classrooms. Because these conditions represented classroom-wide general education instruction, those students who were ineligible participated in a manner identified by the classroom teacher. The teachers chose to have the students respond to the materials used in the study in order for the students to get extra practice

with writing. Following completion of the study, a debriefing session was held with teacher to provide an overview of the results. Teachers were provided with the option of having the researchers conduct the performance feedback intervention with those students assigned to the practice-only and instructional control conditions. The teachers declined this offer; however, the researcher provided with the script for the feedback condition, CBM-WE materials, and performance feedback template for their own use with the students.

Eligibility and baseline assessment phase. To determine students' eligibility to participate in the study, the experimenter read to the participants a set of 10 lowercase letters from the alphabet and asked the participants to print the letters on a lined and numbered piece of paper. Administration of this task took approximately five minutes. All students who completed this measure were considered eligible to participate in the study when 90% of the printed letters were deemed recognizable. Following eligibility determination and as part of the baseline assessment, Form A of the Spontaneous Writing subtest of the Test of Written Language-Third Edition (Hammill & Larsen, 1996) was administered in a group format to the participants. In accordance with the administration manual for the Test of Written Language-Third Edition, students were given 15 minutes to respond to the picture prompt. The alphabet writing task and Form A of the Spontaneous Writing subtest of the Test of Written Language-Third Edition were administered during the first session that took approximately 25 minutes.

During the second session, the paragraph copying task (approximately 90 seconds), two CBM-M probes (combined addition and subtraction probes; approximately 4 minutes), and one CBM-WE probe (approximately 5 minutes) were administered to all

eligible students. The total administration time for these four tasks was approximately 25 minutes. The results from the CBM-WE probe were used at the next session (i.e., first session of the intervention phase) to provide feedback to the students assigned to the performance feedback condition. The results from the two CBM-M probes were averaged and used to provide feedback to the students assigned to the instructional control condition.

Individualized performance feedback condition. For students assigned to the performance feedback condition, a packet containing a CBM-WE probe was distributed to each student and the research assistant provided instructions following a procedural script (Appendix N). Performance feedback was provided to each student and was presented in both visual and oral formats weekly. The visual presentation was in the form of a feedback page (Appendix O) that had been inserted into the writing packet. On the first session of feedback, the feedback page included a box containing the total number of words the student wrote. For each of the subsequent six sessions, the feedback page also displayed an arrow either pointing upward or downward to indicate an increase or decrease, respectively, of the total number of words the student wrote. During feedback sessions, the research assistant explained that the total number of words written was computed by counting all words that each student wrote. The remainder of the session focused on completing the writing probe. The research assistant introduced the writing task, provided 1 minute of quiet story planning, and then directed students to engage in 3 minutes of continuous writing. Following the completion of the story, each student was asked to rate the story starter. In total, students were engaged in the writing task for

approximately 4.5 minutes each session, which included approximately 0.5 minutes receiving feedback.

Practice-only condition. Students assigned to the practice-only condition were given packets identical to those described for the performance feedback condition; however, no performance feedback was provided. Procedures identical to those described for the performance feedback condition were followed concurrently, excluding the oral and visual individualized feedback. Identical story starters were used during the same sessions. During each session, research assistants provided instructions following a procedural script (Appendix P). Following the completion of the story, each student was asked to rate the story starter. In total, students were engaged in the writing task for approximately 4 minutes each session.

Instructional control condition. The instructional control condition was designed to provide a similar instructional experience as the performance feedback in writing condition, but focused on an unrelated academic skill, mathematics computation. Although this condition was considered to be a control condition, students may have benefited from the feedback in basic mathematics computation. During the intervention phase sessions, the students were given a packet containing two CBM-M probes (spanning two minutes each). Prior to working on the CBM-M probes, individualized performance feedback on digits correct was provided to each student similar to the performance feedback condition. During the first session of feedback, the feedback page included a box containing the average number of digits correctly computed (from the two probes administered during baseline). For each of the subsequent sessions, the feedback page also displayed an arrow either pointing upward or downward to indicate the increase

or decrease, respectively, of the student's average number of digits computed. During intervention phase sessions, the research assistant explained that the total number of correct digits was computed by counting all of the correct answers the students provided. The remainder of the session focused on completing the two mathematics probes. Research assistants provided instructions following a procedural script (Appendix Q). In total, students were engaged in the math task for approximately 4.5 minutes each session, which included approximately 0.5 minutes devoted to the performance feedback in mathematics.

On three occasions, students assigned to the instructional control condition were administered a writing packet identical to that previously described for the practice-only condition. The first packet was distributed during the baseline phase, the second packet was distributed during intervention phase session 3, and the third packet was distributed during intervention phase session 7. Similar to the practice-only condition, students were engaged in the writing task for 4 minutes during each of the three sessions.

Procedural acceptability assessment packet. At the conclusion of the last intervention-phase session (i.e., writing the final story at intervention session seven), all participants were asked to complete the procedural acceptability assessment. The research assistant conducting this session guided the students through each question by reading the directions and questions aloud. As previously discussed, the students in the practice-only condition and instructional control condition were asked questions regarding the acceptability of the story-writing procedures (six questions) and the students in the performance feedback condition were asked questions regarding the procedures and the feedback they received (eight questions).

Dependent Measures

Primary measures. The primary aim of this study was to model elementary-aged students' writing fluency progress over time, which was assessed by calculating the total number of words written and the number of correct writing sequences for each writing probe. As previously discussed, TWW provides a highly reliable measure of fluency that can be compared to national norms (Mirkin et al., 1981; Pearson Education Inc., 2009); and that CWS provides a more precise measure of fluency as well as quality of written work. For the purposes of this study, TWW was calculated by counting every grouping of letters separated by a space. Words were counted regardless of spelling or accuracy; however, numerals were not counted. Based on scoring procedures outlined by Shapiro (2004), CWS were computed by analyzing each adjacent word for correct punctuation, capitalization, spelling, and syntax. Within each story, the number of adjacent CWS was computed.

Predictor variables such as sex and initial level of fluency were coded as categorical variables and entered into the model. Information on sex was obtained from class rosters and then coded as a dichotomous variable (i.e., male or female). Initial level of fluency for each student was categorized into one of two levels (i.e., frustrational or instructional) based on the total number of words written in response to the first CBM-WE probe. Based on data from Mirkin and colleagues (1981), students writing less than 29 words in 3 minutes were classified as frustrational and students writing more than 29 words written were classified as instructional. Instructional level for the variable correct writing sequences was not available. Following the AIMSweb© guidelines (Pearson Education, Inc., 2009), students' initial level of fluency in the current study was also

categorized as Below Average (below the 25th percentile or 23 TWW or less) or Average/Above Average (above the 25th percentile or 24 TWW or greater). For the statistical model predicting CWS, students were categorized as Below Average (below the 25th percentile or 14 CWS or less) or Average/Above Average (above the 25th percentile or 15 TWW or greater).

Secondary measures. Standardized results from the Test of Written Language – Third Edition (Hammill & Larsen, 1996) are being reported as a description of the students' initial abilities in written expression in comparison to national normative data. To further describe these students' experience with writing, a summary of the responses to the Writing Orientation Scale (Graham, Harris, MacArthur et al., 2002) and writing instruction is also provided. Responses to the procedural acceptability questionnaires are serving as an indicator of intervention acceptability in this study and measure participants' perceptions of session procedures.

Experimental Design

A longitudinal repeated measures design was used in the current study. Growth in writing fluency was the primary variable of interest. Accordingly, a repeated measures design was used to monitor growth over a period of nine weeks. Students in third grade classrooms in three schools were randomly assigned to the performance feedback condition, practice-only condition, or the instructional control condition. All eligible participants were randomly assigned, stratified by school, to one of the three conditions by use of a random number generator. That is, within each school, all eligible third grade students were randomly assigned to a condition, so that each condition had a similar

number of participants within one school. All analyses were run separately for the two dependent variables: TWW and CWS.

An a priori power analysis for detecting differences in slope (i.e., growth) was conducted based on multilevel modeling simulation procedures outlined by Hox (2002). The simulation was run using a variance matrix from a previous study of performance feedback (Eckert et al., 2006) and designed to detect minimum difference in slopes of 0.75 words per week. The simulation indicated that 40 participants per condition measured in 8 waves of data collection would result in an appropriate power estimate of .80. It is important to note that although the primary focus of this study was on slope effects, and the study was sufficiently powered to detect slope effects, the power estimate for detecting intervention effects on level of writing fluency was .05. This suggests that the study was not sufficiently powered to detect intervention effects on level of writing fluency.

Procedural Integrity

Procedural integrity was assessed in two ways. First, for all sessions in each of the three conditions, a permanent product measure aligned with the procedural script was obtained by the primary research assistant responsible for conducting the session. Second, a secondary research assistant observed the primary research assistant conduct an average of 73% of the sessions. The secondary research assistant observed to verify the procedures implemented by the primary research assistant. Overall, procedural integrity for each condition was high. In the performance feedback condition, the primary research assistant administered an average of 99% of the steps (range, 96% to 100%). Observations by the secondary research assistant occurred during 67% of the sessions

confirmed that an average of 99% of steps were administered as scripted (range, 96% to 100%). In the practice-only condition, the primary research assistant administered an average of 99% of the steps (range, 89% to 100%). Observations by the secondary research assistant occurred during 81% of the sessions confirmed that an average of 99% of steps were administered as scripted (range, from 89% to 100%). In the instructional control condition, the primary research assistant administered an average of 99.8% of the steps (range, 95% to 100%). Observations by the secondary research assistant during 70% of the sessions confirmed that an average of 99.8% of steps was administered as scripted (range, 95% to 100%).

Interscorer and Interobserver Agreement

A total of 40% of the CBM-WE probes were randomly selected and re-scored for TWW and CWS. On average, interscorer agreement for TWW was high and similar to previously published results. The average interscorer agreement for TWW was 99% (range, 71% to 100%) and was calculated by dividing the lower total count with the higher total count and multiplying by 100%. The average interscorer agreement for CWS was 95% (range, 75% to 100%) and was calculated as number of agreements divided by agreements plus disagreements.

Data Preparation

Data input and consistency checks. Data were inputted by the primary researcher and trained research assistants into a Microsoft Excel file. Experimental condition was coded as 0 for the instructional control condition, 1 for the feedback condition, and 2 for the practice-only condition. Student's sex was coded as 0 for boys and 1 for girls. School assignment was coded as 0 for School A, 1 for School B, and 2 for

School C. Initial level of fluency was coded as 0 if the student performed at the frustrational level (i.e., 29 TWW or less) and 1 if the student was performing at the instructional level at baseline. In the CWS analyses, initial level of fluency for students writing in the below average range (i.e., 14 CWS or less) was coded as 0 and all other students were coded as 1. All data entries were checked by another trained research assistant. Excel was utilized for its versatility in editing data and graphs of model estimates. The data were transferred and analyzed using SPSS 11.5 (SPSS, 2002) and SAS 9.1 (SAS Institute, 2004). SPSS was used to generate descriptive statistics and SAS 9.1 was used for multilevel modeling of the primary dependent measure.

Data inspection. Data were inspected for violations of normality (skew) by reviewing: (a) a histogram distribution of residual error values, (b) a quantile-quantile plot, (c) a percentile plot, and (d) tests of normality. No significant deviations from normality were found. Multilevel modeling was chosen for its amenability to evaluate growth over time with missing data points. All students included in the analyses participated in at least 50% of the sessions. There was a total of 95 missing data points out of 824 possible data points (12%), with the instructional control condition, the practice-only condition, and the performance feedback condition missing 8%, 16%, and 9% of data points, respectively.

Analysis of the unconditional means model (i.e., model examining variability in the dependent variable without predictor variables) revealed an intraclass correlation (ICC) of .63 and a design effect of 42. These two indicators revealed that there was significant dependence in the data and a multilevel model was appropriate for analysis of the results (Peugh, 2010). The intraclass correlation also indicates that more than half of

the total variation in writing fluency was due to "between-person" variance. Therefore, entering predictor variables at a second level (level 2) of analysis is appropriate in order to differentiate it from the within-person variance that is modeled at level 1 (Singer & Willett, 2003).

Results

Descriptive Analyses

Baseline writing skills. In order to further describe the sample of participants, performance on baseline measures of the participating students' writing abilities are reported in Table 5. Baseline differences between the three conditions were not found on the primary dependent variables (i.e., TWW & CWS). Although, the results of the Paragraph Copying Task (Monroe & Sherman, 1966) indicated that students in the control condition copied significantly less words correctly in 90 seconds than the other two conditions, F (2,129) = 3.46, $p < .05$. However, the mean performance in all three conditions fell within the average range with percentile ranks for students in all three schools falling between 47 and 61. Participating students' performance on the spontaneous writing section of the TOWL-3 (Hammill & Larsen, 1996) was significantly different across the three schools, F (2,105) = 6.02, $p < .01$. Scores on the TOWL-3 indicated that the students enrolled in School A were performing within the Average range; students enrolled in School B were performing in the Low Average range; and students enrolled in School C were performing in the Borderline Low range. The mean results on a CBM-WE probe indicated that students wrote 31.50 TWW in 3 minutes (SD = 12.44) and 26.86 CWS in 3 minutes (SD = 12.22), corresponding to the 50th percentile for third-grade students (Pearson Education Inc., 2009). One significant difference in

performance on CBM-WE was found between boys and girls with the girls significantly outperforming the boys in TWW, F (1,131) = 5.15, $p < .04$ and CWS, F (1,131) = 5.85, $p < .05$. In an unrelated academic skill, basic mathematics fact fluency, the mean performance of all students (M = 28.91, SD = 13.09) fell between the 50th and 75th percentile for third grade students (Pearson Education Inc., 2009). Students' performance on each of these baseline measures (TOWL-3 quotient, CBM-WE, CBM-M, and Paragraph Copying Task) were significantly correlated with one another (see Table 6).

Instructional environment. Similar to previous studies (Cutler & Graham, 2008; Graham et al., 2003), the teachers participating in the current study utilized highly varied writing instruction. The instructional environment for the subject of writing is summarized in Table 7and described here in three ways: (a) listing of writing curricula utilized; (b) amount of instructional time devoted to writing practices each week; and (c) results from the Writing Orientation Scale (Graham, Harris, MacArthur et al., 2002). The differences between schools and classrooms regarding writing curricula, instructional practices, and writing orientations were not systematically examined due to the limited sample size and high standard deviation of writing practices within each school. Rather, the results were descriptively summarized to characterize these factors.

When asked to enumerate the writing curricula used in their classrooms, all three teachers in School A reported using the 6+1 Traits model (Culham, 2003) along with at least one of the following: school district guidelines, writing process, New York State standards (The University of the State of New York: The State Education Department, 2005), Erik Cork, and Lucy Calkins (Calkins et al., 2006). In School B, teachers reported using writing rubrics and the 6+1 Traits model (Culham, 2003). Teachers at School C

reported using the Four-Square technique (Gould & Gould, 1999), D'Nealian handwriting (Thurber, 2008), and the Venn diagram technique. It is evident from the list of differing curricula, that writing instruction in the school district and within the schools is heterogeneous. The one somewhat consistently used mode of writing instruction was the 6+1 Traits model. Based seminal work in the theory of components of writing, this model of writing instruction was designed to train teachers to teach and assess writing according to seven traits: Ideas, Organization, Voice, Word Choice, Sentence Fluency, Conventions, and Presentation. In this model, lessons are structured around the seven traits and feedback is given based on a rubric that provides scores ranging from a poor score of 1 to a high score of 5 for each trait for a possible total perfect score of 35. Only one experimental study produced by the publisher was available and found that students taught by teachers trained in the 6 + 1 traits model did not have significantly greater writing achievement than students in a control condition (Kozlow & Bellamy, 2004).

An assessment of the teachers' orientations to writing instruction (Graham, Harris, MacArthur et al., 2002) indicated that the teachers reported emphasizing the role of explicit instruction (*M* factor score = 4.85; *SD* = 0.50) with less emphasis on correctness in writing (*M* factor score = 3.35; *SD* =0.54) and natural or incidental learning methods (*M* factor score = 3.69; *SD* = 0.37). These results indicate that teachers participating in this study believed that students need explicit skill instruction in composition and revision but placed less emphasis on correct spelling and grammar (correctness in writing) and student-directed writing (natural learning).

The mean number of minutes per week devoted to writing instruction varied widely across the three schools for handwriting practice (range, 0 minutes to 93 minutes)

and spelling practice (range, 49 minutes to 80 minutes); whereas practice with written composition consistently encompassed a larger amount of time at each school (range, 103 minutes to 160 minutes). Amount of time spent on basic skill instruction (i.e., handwriting and spelling) has been identified as important in the elementary years (Berninger, et al., 1997). The amount of time spent in basic skill instruction ranged widely between the three schools with School C spending the most amount of time (173 minutes), School A spending 77 minutes, and School B spending only 40 minutes per week.

Major Analyses

Multilevel modeling (PROC MIXED in SAS V9.1) with full maximum likelihood (FML) estimation procedures was used to assess the statistical significance of the differences in the slope (i.e., growth) of students' writing fluency across the three instructional practices as well as other variables outside of the experimenter's control (i.e., sex, level of initial writing fluency, and other possible demographic variables). FML estimation procedures were used so that hypothesis testing for fixed effects could be conducted. The alternative procedure, restricted maximum likelihood estimation, only allows for hypothesis testing regarding the stochastic (i.e., random) portion of the multilevel model. Given the relatively small distinction between the two estimation procedures (Singer & Willett, 2003) and that the current data set fulfilled the statistical assumption of normal distribution of residuals, FML estimation was deemed most appropriate for these analyses. The time variable (i.e., weekly session) was centered on the final observation in order to test for potential, but underpowered, differences in students' writing fluency level. An unconditional model (without any second-level

predictor variables added) indicated that there was significant growth over time for both TWW, t (595) = 4.13, $p < .001$, and CWS, t (595) = 3.75, $p < .001$. Students participating in the study gained an average of 0.56 TWW and 0.46 CWS each week and reached an average total of 34.82 TWW and 29.58 CWS. Therefore, group level variables were systematically added to the model to explore significant contributing variables to final level of and growth in (i.e., slope) writing fluency. Successive conditional models were fit and predictors were retained in the model based on parameter tests, which resemble *t*-test statistics. It is important to note that intermediate models for both TWW and CWS encountered boundary constraints, indicating that the stochastic portion of the slope variance was over-specified. In other words, the complexity of the estimation procedure combined with the unbalanced data and iterative nature of the computational algorithms produced a covariance parameter exceeding plausible limits (i.e., greater than 1; Singer & Willet, 2003). It is possible that the intentional imbalance of the data collection schedule (i.e., 8 data points for the performance feedback condition and practice- only condition, and 3 data points for the instructional control condition) contributed to the over-specification of the stochastic portion of slope variance. This encounter with boundary constraints has been reported in other research studies investigating writing outcomes (Coker, 2006). Therefore, the final model reported here follows Singer and Willet's (2003) suggestion to simplify the model through "fixing" (p. 153) the slopes by removing the random effects of time (i.e., slope) from the model.

The unconditional and final models are summarized in Table 8 for TWW and in Table 9 for CWS. The final model included the significant main effects listed below and resulted in the best (i.e., lowest) goodness of fit statistics (see Tables 8 and 9). The final

model for TWW and CWS allowed for random variation of intercepts and fixed slopes and included predictor and control variables for students' growth (i.e., slope) in writing fluency (TWW and CWS). Although it was not an identified focus of the current study, significant predictors of final level (i.e., intercept) of writing fluency (TWW and CWS) were included and are reported here. Fixed main effects of predictor variables (i.e., assignment to condition, sex, and initial level of fluency) and a control variable (i.e., school assignment) on both growth and final level of writing fluency that were retained in the final model are described here. Simple effects (i.e., group comparisons) are described in later sections. By adding the predictor variables retained in the final model, goodness of fit statistics were improved from the unconditional growth model. The final model explained 10% of variance in TWW and 12% of variance in CWS based on pseudo R^2 statistics.

The final model for the dependent variable, TWW, included condition assignment and school assignment as predictors of growth in TWW, and sex and school assignment as predictors of final level of TWW. Statistically significant main effects for growth in TWW were found for condition assignment, t (593) = -2.51, $p < .05$, and school assignment, t (593) = -2.99, $p < .01$. Statistically significant main effects for final level of TWW were found for sex, t (593) = 2.88, $p < .001$, and school assignment, t (593) = -2.79, $p < .01$. Students' school assignment was explored and retained in level 2 of the final model as a control variable according to recommendations by Singer and Willett (2003) to enter control variables in the model after hypothesized variables. The random assignment of students to condition allowed the school assignment variable to be included as a level 2 control variable instead of adding a third level to the model for

school. As expected (due to a power estimate of .05), Assignment to experimental condition did not significantly predict a difference in the final level of TWW, t (593) = -1.31, p = .19. Predictor variables sex, t (592) = 1.48, p = .14, and initial level of fluency, t (592) = -0.04, p = .97, were not found to predict significant variation in growth in TWW.

The final model for the dependent variable CWS, included condition assignment as a predictor and school assignment a control variable for growth in CWS, and sex as a predictor and school assignment as a control variable for final level of CWS. A significant main effect for growth in CWS was found for condition assignment, t (593) = -2.28, $p < .05$, and approached significance for school assignment, t (593) = -1.83, p = .07. A significant main effect for final level of CWS was found for sex, t (593) = 3.04, $p < .01$, and approached statistical significance for school assignment, t (593) = -1.71, p = .09. Although there were statistically significant differences in growth between the conditions, these differences did not produce statistically significant differences in students' final level of CWS, t (593) = -1.24, p = .22. Other hypothesized predictor variables did not contribute significant variation to growth in CWS: sex, t (592) = 1.07, p = .28, and initial level of fluency, t (592) = -0.81, p = .42. Description of the simple effects associated with these main effects for TWW and CWS are now described for each of the hypothesized variables (i.e., condition assignment and sex) and the control variable (i.e., school assignment).

Writing Fluency Growth Related to Instructional Conditions

Students in the three conditions wrote a similar number of TWW at baseline. However, over the course of the study, the performance feedback condition gained an average of 1.25 TWW per week, the practice-only condition lost an average of 0.40

TWW per week, and the instructional control condition gained an average of 0.35 TWW per week (see Figure 3). Congruent with the first hypothesis, growth in TWW was positively affected by performance feedback as the students in the performance feedback condition gained more TWW per week than the instructional control condition, t (591) = 5.38, $p < .001$. Contrary to the primary hypothesis, students in the practice-only condition did not gain more TWW each week than the instructional control condition, and, in fact, lost significantly more TWW per week than the instructional control condition. The estimated means for final level of writing fluency were 38.29 TWW for the feedback group, 29.20 TWW for the control group, and 25.91 TWW for the practice-only group.

Hypothesis tests for CWS indicated similar positive results for students in the performance feedback condition. Congruent with the first hypothesis, students in the performance feedback condition gained more CWS per week than the instructional control condition, t (591) = 4.22, $p < .001$. Contrary to the primary hypothesis, students in the practice-only condition did not gain more CWS than students in the instructional control group, t (591) = -1.99, $p = .05$. On average, students in the performance feedback condition gained an estimated 0.96 CWS each week, students in the practice-only condition lost an estimated mean of 0.24 CWS per week, and students in the instructional control condition gained an estimated mean of 0.40 CWS each week (see Figure 3). The estimated means for final level of writing fluency were 30.47 CWS for the feedback group, 25.60 CWS for the control group, and 22.73 CWS for the practice-only group.

Writing Fluency Level and Growth Related to Sex

Consistent with the second hypothesis, female students performed significantly higher than male students by reaching a final level to 5.85 more TWW by the end of the

study, t (593) = 2.88, $p < .01$. Similarly, female students wrote an estimated mean of 5.6 more CWS than male students, t (593) = 3.15, $p < .01$. Exploratory analyses of the differences between boys and girls rate of growth in writing fluency across a short period of time indicated no statistically significant differences in growth for TWW or CWS. This finding is preliminary evidence suggesting that girls do not demonstrate a significantly greater amount of growth in writing fluency over a period of eight weeks. The level differences between girls and boys and parallel growth rates are illustrated in Figure 4 for TWW and Figure 5 for CWS.

Writing Fluency Growth Related to Initial Level of Fluency

The third research question in this study explored the effects of baseline variables on students' writing fluency growth. Exploration of initial writing fluency level categorized as frustrational or instructional (based on benchmark data for third grade provided by Mirkin, et. al., 1981) indicated no significant relation between this categorization of learning level and growth in TWW, t (592) = -0.04, $p = .97$. Categorization as 'Below Average' versus 'Average' (including Above Average) according to recent national normative data for third grade students in writing (Pearson Education Inc., 2009) was also explored due to common use of these norms to identify students in need of intervention. This categorization also did not contribute additional significant prediction for growth in TWW, t (592) = -1.16, $p = .24$. These findings suggest that participants demonstrated the same rate of growth over the course of the study, regardless of identified baseline levels within two common classification systems used to identify students for intervention.

Writing Fluency Growth Related to School Assignment

Although the students from the three schools were randomly assigned to conditions and no differences in performance on the baseline measure of writing fluency (i.e., TWW and CWS) between the three schools were found, school assignment was added as a level-2 control variable to the model due to (a) its statistically significant effect on growth and final level of TWW and (b) significant differences in writing achievement at baseline. The results of the analysis indicated that students in School A gained the most TWW per week (1.01), trailed by students in School C (0.14) and School B (0.04). By the end of the study, these differences were more evident as students in School A had reached an estimated level 36.34 TWW, students in School C reached 30.07 TWW, and students in School B reached 26.98 TWW. Estimates for each school are depicted in Figure 6. A similar pattern was found for CWS, although differences between the three schools were not as large. The results of the analysis indicated that students in School A gained the most CWS per week (0.75), followed by students in School C (0.29) and School B (0.07). By the end of the study, these differences were more evident as students in School A had reached an estimated level of 29.44 CWS, students in School C reached 26.12 CWS, and students in school B reached 23.23 CWS. Estimates for each school are depicted in Figure 7 for CWS.

Rating of Story Starters

A previous research study demonstrated that the story starters used for the purposes of the present study were appropriate for diverse populations (McMaster & Campbell, 2006) and were highly correlated ($r > .52$; Truckenmiller, 2007). The current study confirmed previous results, indicating that this set of story starters is significantly and highly correlated (see Table 3). In the current study, participants were asked to rate

their acceptability of each story starter in order to further examine the equivalence of the story starters. Acceptability items were rated on a 5-point Likert-type scale with 5 representing highly favorable perceptions and 1 representing less favorable perceptions of the story starters. Ratings of acceptability of the story starters were generally high (range, 3.85 to 4.16) (see Table 10).

Procedural Acceptability

Table 11 provides the mean rating (on Likert-type scale of 1 to 5 with 5 indicating high acceptability) of each item of the procedural acceptability assessment as rated by the student participants at the end of the study (i.e., the last session of the study). Students in all conditions were asked four questions regarding their acceptance of the story-writing procedures and two questions regarding their perception of improvement in their writing. The six items contained on the scale demonstrated moderate levels of internal consistency ($\alpha = .70$). A statistically significant difference in acceptability of the story-writing procedures was found between the three conditions, F (2,104) = 3.36, $p < .05$. On average, students in the practice-only condition rated the story-writing procedures the highest (M = 3.94; SD = 0.88), followed by students in the performance feedback condition (M = 3.71; SD =0.95), followed by the instructional control condition (M = 3.38; SD = 0.83). Acceptance of the procedures used in this study by students who responded to CBM-WE probes each week was generally moderate. Specifically, the students reported that they enjoyed writing stories in response to the probes “a lot” and that their writing improved “a lot”. However, acceptance of the timed component of the CBM-WE procedures was noticeably lower. Students indicated they only liked to be timed while writing “a little bit”.

Additionally, students in the performance feedback condition were asked to respond to two questions assessing their acceptability of the feedback procedures. Students assigned to this group found the performance feedback procedures to be highly acceptable, with mean ratings greater than 4.25 on a 5-point Likert-type scale.

Discussion

Despite repeated calls regarding the importance of educators focusing on elementary-aged students' writing skills (National Commission on Writing, 2003) and the large percentage of children experiencing difficulties with written expression (Persky et al., 2003; Salahu-Din et al., 2008), limited research is available regarding writing fluency measurement and intervention practices. One brief behavioral fluency-building intervention that has demonstrated positive effects on elementary-aged children's growth in writing fluency is individualized performance feedback (Eckert et al., 2006; Eckert et al., 2008). The purpose of this study was to describe the pattern of writing growth that emerged following implementation of this intervention and explore the effects of variables that may influence students' growth in writing fluency.

One of the aims of this study was to provide more information about the nature of writing fluency growth, as measured by the metric, number of correct writing sequences (CWS), in addition to the intervention target: total number of words written (TWW). For each of the hypotheses explored in this study, both metrics of writing fluency resulted in an identical pattern of findings. The parallel findings for the two metrics in the current study is important due to a majority of psychometric studies indicating that CWS demonstrates the greatest criterion validity for third-grade students (Hubbard, 1996; Jewell & Malecki, 2005; McMaster & Campbell, 2008; McMaster &Espin, 2007). As a

result, the current study supports previous findings that TWW and CWS are highly correlated and tend to have a similar growth trajectory among elementary-aged students (Malecki & Jewell, 2003; McMaster & Campbell, 2008; Truckenmiller, 2007). Due to the parallel results found in this study, the results discussed in the remaining sections will be conceptualized broadly as writing fluency, which includes both TWW and CWS.

Overall, the results of this study suggest five significant or noteworthy findings regarding children's writing fluency. First, students receiving weekly performance feedback increased their writing fluency at a rate significantly higher than students who did not receive feedback. Second, weekly practice with writing (i.e., practice-only condition) was not effective in increasing the rate of growth with writing fluency more than typical instructional practices over a short period of time. Third, girls maintained a significantly higher level of writing fluency than boys for the duration of the study. Fourth, instructional level categorizations did not differentially predict growth in students' writing fluency. Lastly, school-level variables differentially predicted growth in students' writing fluency. Each of these findings will be explored in the context of previous findings, and then integrated with respect to their implications for school-based practice. Finally, the limitations of this study and subsequent directions for future study will be described.

Writing Fluency Growth by Instructional Conditions

It was predicted that fluency growth would be greatest for students receiving performance feedback. This hypothesis was supported as students assigned to the performance feedback condition demonstrated greater growth (1.25 TWW per week, 0.96 CWS per week) than students assigned to the practice-only condition (-0.40 TWW per

week, -0.24 CWS per week) and the instructional control condition (0.35 TWW per week, 0.40 CWS per week). These findings for the performance feedback condition are consistent with previous research studies (Eckert et al., 2006; Eckert et al., 2008) examining the effects of performance feedback on children's writing fluency growth over a short period of time. In both of the previous studies, students gained more than 2.50 TWW per week. Differences in growth estimates between the previous studies and the current study may be due to the inclusion of school assignment as a control variable in the present model or due to the significantly smaller sample size used in the previous studies.

Also similar to previous studies (Eckert et al., 2006; Eckert et al., 2008; Rheinheimer, 2008, Truckenmiller, 2007), the students assigned to the feedback condition in the current study reached a level of writing fluency higher than the designation for instructional level for third grade (i.e., 37 TWW in 3 minutes; Mirkin et al., 1981). The estimated average performance of students in the feedback condition following seven weekly session of feedback was 38 TWW. Although the current study was underpowered (.05) to detect differences in final level of fluency between the three conditions, the estimated final level in the feedback condition was the only mean performance to exceed the instructional level for third grade. This finding demonstrates clinical significance as none of the group means (e.g., girls and School A) were at the instructional level at baseline (see Table 5).

The current findings contribute to a growing body of evidence supporting the effectiveness of individualized performance feedback as a supplemental classwide intervention for increasing the rate of elementary-aged children's writing fluency growth

(Eckert, Truckenmiller, Rymanowski, & McCurdy, 2010). Although there are still several limitations associated with this research line (described in the limitations section), this study further suggests the effectiveness of performance feedback by including experimental design factors (e.g., true control condition; random assignment of students to condition) that were not previously examined. In addition, the comparison of growth in students' writing fluency across the three conditions allowed for further examination of the effects of practicing with CBM-WE. Contrary to the primary hypothesis, no statistically significant practice effects were observed for those students assigned to the practice-only condition. The students in this study who simply wrote in response to CBM-WE once per week for 8 weeks did not have a statistically significantly higher rate of growth than students who did not practice weekly. In fact, the rate of growth for those students practicing writing was not significantly greater than zero. Furthermore, the mean rate of growth for students in the practice-only group was lower than students' rate of growth in the instructional control condition.

This finding contributes to mixed evidence regarding the amount of growth that occurs over a short period of time in response to practice with CBM-WE probes. The practice-only groups in previous studies demonstrated noticeable growth over time, about 1 TWW per week (Eckert et al., 2006; Eckert et al., 2008). Again, it is most likely that the differences from previous studies is due to the inclusion of significant control variables (e.g., instructional control condition and school-level variables) in the current study. The comparison of the three conditions in the current study suggests that feedback should be coupled with practice with CBM-WE in order to produce significant growth in writing fluency. Replication will be essential to support this conclusion; however,

practitioners should be aware that effects may not be obtained by simply using repeated practice for groups of student. For example, in the area of reading, repeated practice with a passage produces significant effects on reading fluency growth (Daly et al., 1999). The current study suggests that the same may not be true for writing fluency. Although, the effects of more intensive repeated practice with CBM-WE has not been explored.

One critical consideration and one of the identified barriers to intervening with elementary-aged students' writing fluency is the dearth of knowledge about the expected amount of growth in response to CBM-WE without practice over a short period of time (Eckert et al., 2009). Most examinations of writing fluency growth describe developmental growth over the period of one school year or more (Malecki& Jewell, 2003; Marston et al., 1981; McMaster & Campbell, 2006). In general, reports indicate that elementary-aged children experience very limited writing fluency growth within the period of a school year (i.e., 8 TWW or less; Marston et al., 1981; McMaster & Campbell, 2006). AIMSweb© (Pearson Education, Inc., 2009), the only source of current national norms for CBM-WE metrics, reports that third, fourth, and fifth-grade students typically gain about 0.4 TWW and CWS per week. However, these reported estimates are based on changes in the mean performance of a large sample from fall to winter to spring. This type of calculation fails to represent true growth because it examines mean differences as opposed to growth patterns within individual students (Cronbach, 1976). Given the general consensus that small amounts of growth is made over a whole school year, it was expected that growth rates for students assigned to the instructional control condition in this study would be small. Indeed, the results of this study indicated that the rate of growth for third-grade students over the course of the

study was not significantly greater than zero. Although estimates of growth provided by the current study are limited by a relatively small sample size containing only third-grade students, I found similar results to those reported by AIMSweb © (Pearson Education, Inc., 2009). Specifically, students assigned to the instructional control condition gained approximately 0.30 TWW and 0.40 CWS per week. These results provide support for the estimates of growth rates reported by AIMSweb© by directly examining true growth rates within individual students.

Some caution is warranted when interpreting the growth estimates for the instructional control group in this study. Given these students unexpected rate of growth in writing fluency, it is possible that other variables within the study affected their growth in writing fluency. The students in the instructional control group were given performance feedback on their mathematical calculation fluency during three sessions between the baseline and midpoint CBM-WE measurement and during two sessions between the midpoint and last CBM-WE measurement. It is highly possible that the students in the instructional control condition generalized their performance from the CBM-M probes on which they were receiving performance feedback to the CBM-WE probes. It is hypothesized that the similarity of instructions for the CBM-WE and CBM-M tasks and the presence of a stopwatch cued the students in the instructional control condition to perform more quickly on the CBM-WE probes based on their previous experience of feedback on the CBM-M probes. In fact, students in the instructional control condition reported similar acceptability of being timed while writing as the students in the feedback group, which was considerably less than the acceptability reported by the students in the practice-only group. Therefore, it is likely that the students

in the control condition generalized their perception of the performance expectations to the writing task.

Variables Affecting Students' Writing Fluency: Sex

Similar to findings reported in other studies of writing fluency, several variables outside of the experimenter's control contributed to students' fluency level and fluency growth (Coker, 2006; Malecki& Jewell, 2003; Marston et al., 1981). One variable that contributed to students' fluency level and fluency growth was the sex of the participant. Specifically, results of the current study provide more evidence that elementary-aged girls significantly outperform their male peers in writing fluency. These findings corroborate previous research studies demonstrating gender differences in writing performance across the lifespan (Berninger & Fuller, 1992; Berninger, Nielson et al., 2008; Malecki& Jewell, 2003; Marston et al., 1981; Persky, et al., 2003).

This significant gap may indicate an area for future research and additional instruction and intervention for boys in the elementary grades. This gap between boys and girls is evident across the grades as it widens during the middle school years (Malecki & Jewell, 2003) and nationally, girls' writing achievement is significantly greater than boys in the twelfth grade (Salahu-Din et al., 2007). Furthermore, it has been demonstrated that the gap between girls' and boys' performance is even greater when students are given a longer amount of time to write (i.e., 5 minutes; Berninger et al., 2008). The current study suggests that boys' growth in writing fluency is neither greater nor smaller than girls' growth in writing fluency over an eight week period, but represents an area for further research in attempting to accelerate the rate of boys' growth in writing fluency.

Variables Affecting Students' Writing Fluency: Instructional Level

A second variable that was hypothesized to contribute to students' fluency growth was the initial fluency level of the student. It was predicted that students performing at a lower initial level of fluency would demonstrate a higher rate of growth (i.e., slope) over the course of the study. In contrast to prior research demonstrating differential effects in fluency growth based on initial level of writing fluency (Rheinheimer, 2008; Truckenmiller, 2007), students in the current study did not perform differentially depending on their initial level of fluency or by categorization according to more recent national norms. The main factor that accounts for these differences is how the analyses were conducted. Previous studies (Rheinheimer, 2008; Truckenmiller, 2007) compared changes in students' instructional level from the beginning of the study to the end of the study, and found that a majority of the students performing at a frustrational level improved to an instructional level by the end of the study.

The current study explored the predictive power of categorization of student's initial level of fluency on growth estimates. Results failed to find that categorization of elementary-aged students' level of fluency differentially predicted students' growth trajectory in writing fluency. Although a statistically significant number of students performing at a frustrational level in the previous studies improved to an instructional level (Rheinheimer, 2008; Truckenmiller, 2007), the current study did not find that classification of instructional level was a significant predictor of writing growth. One complication to the interpretation of this finding is the uniqueness of the categorization of instructional levels for writing. Unlike CBM in reading, math, and spelling, the difficulty level/grade level of CBM-WE story starters cannot be controlled. Students' responses

(i.e., paragraphs) are not bound to any particular stimulus, unlike responses to a mathematics fact, for example. A further complication with identifying grade level performance in writing is that most writing curricula do not have a specified scope and sequence of skills that are to be mastered at each grade level (Cutler & Graham, 2008). Rather, the CBM-WE instructional level categorization appears to provide an indicator of the amount of discrepancy between students' current writing fluency and an estimate of grade level writing fluency.

In summary, these results suggest that further research needs to be conducted on predicting students' writing growth rates and that other variables, such as student's sex, have more predictive power regarding who will respond (i.e., have greater growth) to a brief behavioral writing intervention than initial level of writing fluency. Coker (2007) found that school level variables (i.e., first grade teacher, classroom literacy environment) differentially predicted writing growth across a three-year period. It is possible that school level variables outside of the control of this study are contributing to variation in writing fluency growth.

Variables Affecting Students' Writing Fluency: School Setting

A third variable that contributed to statistically significant differences in growth was school-level variables. Specifically, students in School A, regardless of condition assignment, had a mean growth rate that was significantly greater than zero. The mean growth rate for students in the other two schools differed, but neither school demonstrated growth rates that were statistically significantly different from zero. By the end of the study, students in School A were writing an average of 6 words more than students in the other two schools. This result is perplexing due to the baseline

equivalence of writing fluency scores across the three schools. It is possible that differences between the three schools are evident in other baseline skills, classroom instructional practices, or the demographic characteristics associated with the school population.

One statistically significant difference in students' writing performance across the three schools at baseline may provide some indication of school differences that differentially affected students' growth across the schools. Specifically, the mean scores on a measure of general written composition quality (i.e., TOWL-3) for School A was highest (standard score = 97), followed by School B (standard score = 83), and then School C (standard score = 71). These findings suggest that students across the three schools had differing abilities in general written composition at baseline, and these differences may have affected their writing fluency performance over the course of the study.

Given the high degree of variability of writing instruction and the subsequent inability to accurately classify teachers' classroom writing instructional practices, it is nearly impossible to determine the interaction of the procedures used in this study with classroom instructional practices. In the current study, the Writing Orientation Scale (Graham, Harris, MacArthur et al., 2002) and a brief description of instructional time were used to assess teachers' writing instruction practices across the nine classrooms. At the school level, teachers across the three schools reported a similar writing orientation (i.e., explicit instruction approach) and de-emphasized natural learning and correctness in writing. Despite this similarity, the teachers in this study reported using a variety of curricula in their classrooms and the chosen curricula was not consistent between

teachers within the same school building, which is similar to findings reported by Cutler and Graham (2008). Some patterns in the amount of time spent on writing instruction were evident. School C demonstrated the most overall time spent on writing instruction and writing practice, with a large majority of the time spent in basic skill instruction (i.e., handwriting & spelling). By comparison, School B spent the least amount of time in writing instruction with very little time devoted to basic skill instruction. It has been demonstrated that explicit instruction in basic skills of writing improves writing fluency (Berninger et al., 1997). Therefore, it is possible that the balanced amount of time the teachers in School A devoted to basic skill instruction and composition was beneficial and related to the students increased growth in writing fluency.

Although the participating schools in this study were contained in the same school district, school demographic data revealed differences in the populations of students enrolled across the three schools. Socioeconomic status data at the level of the school indicated that School A had a lower percentage of students qualifying for free- and reduced- price lunch than the other two schools. Unfortunately, socioeconomic status for individual students was not obtainable and could not be included in the model as a predictor of individual student's growth. However, in a previous longitudinal study of elementary-aged students' writing growth, Coker (2007) included socioeconomic status at the individual level and predicted that students qualifying for free- and reduced-price lunch would have significantly lower rates of growth in writing. Interestingly, he did not find support for his hypothesis. Therefore, further research is needed to draw conclusions about the nature of the relationship between socioeconomic status and writing growth. Although it is possible that the differences between the schools in the current study may

be due to the higher general writing abilities of School A or the lower percentage of students qualifying for free and reduced price lunch, differences may also be due to other unmeasured variables or the interaction of school level variables that was not explored explicitly. In general, the measurement and exploration of school level variables has been a difficult area of study and not as productive for informing academic intervention practice in school settings (Daly, Hintze, & Hamler, 2000).

Implications for Practice

The results of this study provide some considerations for addressing elementary-aged children's written expression regarding two areas: use of instructional practices and variables affecting growth in writing fluency. Researchers suggest that academic skill "proficiency is developed through practice over time with effective instruction, feedback, and reinforcement" (Martens & Eckert, 2007, p. 90). Because it has been demonstrated that some children have difficulty with writing due to inadequate instruction (Berninger et al., 2006), the first step in reducing the number of elementary-aged students who are not performing proficiently in writing is to increase the use of effective instructional techniques.

The school level effects on writing fluency growth found in this study suggest that core instructional practices, and demographics of the school to a certain degree, have the greatest impact on students' writing fluency growth and overall level of writing fluency. Generally, when presented with groups of students or individual students who are performing below expected levels, school-based practitioners first assess the general instructional environment (Shapiro, 2004). Although there are currently no consistently-used set of criteria for writing instruction, it was evident from the mean baseline levels of

performance of students at these three schools, that the instructional environment has not brought mean performance to instructional levels of writing fluency (i.e., 37 TWW in 3 minutes; Mirkin et al., 1981). In order to address the mean performance of these classrooms of students, a practitioner has many choices of interventions. Certainly in School B, a recommendation may have been made to increase the amount of instruction time in basic writing skills. Two behavioral fluency-building techniques that might be recommended and were explored in the current study are more practice opportunities and performance feedback.

Current national trends indicate that most practice with writing connected text occurs in the context of composing short, written answers in the context of other content areas (e.g., social studies, reading), limiting the opportunity for students to practice generating extended text (Cutler & Graham, 2008). Some have suggested that elementary-aged students may need additional practice to become fluent in writing (Abbott & Berninger, 1993; Graham & Harris, 1997) and some research has demonstrated that practice with CBM-WE positively affects students' writing fluency (Eckert et al., 2008; McCurdy et al., 2008). However, the results of this study suggest that simple practice with CBM-WE will not be strong enough to produce significant growth in writing fluency. Prior to trying more intensive individualized interventions for a large number of children, it seems prudent to deliver individualized performance feedback to classrooms or groups of students. Given the relative ease of implementing performance feedback interventions in the classroom with large groups of students, it seems reasonable to consider implementing this type of intervention before implementing more time- and resource-intensive writing interventions, such as SRSD.

In several studies, Berninger and her colleagues (1992; 1997; 2006; 2008) suggested that continuous direct instruction combined with fluency-building in text generation, like performance feedback, is essential across the elementary years. In order to produce significant growth, this study and others (Eckert et al. 2006; Eckert et al., 2008) indicate that performance feedback is likely to be the primary change agent. Therefore, it is important that school-based practitioners incorporate feedback into their writing instruction, writing practice, and writing intervention.

Feedback alone, however, may not be the most effective method for improving writing fluency growth for all elementary-aged students identified as needing assistance with writing. Additional behavioral intervention components that may enhance the effectiveness of performance feedback and subsequently increase the rate of some students' writing fluency include goal-setting and reinforcement (McCurdy et al., 2008; Morgan & Sideridis, 2006) and interdependent group-oriented contingencies (Popkin & Skinner, 2003). In fact, for one group of lower-performing students (i.e., boys), it has been suggested that providing reinforcement as a fluency-building intervention is more beneficial for boys than girls (Morgan & Sideridis, 2006).

In general, it seems prudent for school-based practitioners to ensure that feedback in writing fluency is occurring for all students and that student who are at-risk for significant writing difficulties (i.e., boys and students with a lower level of writing fluency) receive a combination of fluency-building procedures in order to at least prevent the gap in writing fluency from widening.

Limitations

Several limitations to the internal and external validity of the study were noted earlier and are expanded in this section. The largest threat to internal validity is the possibility that the instructional control condition did not represent a true control group. Students in the instructional control condition received performance feedback on math probes in order to closely approximate the performance feedback in writing condition, but target an unrelated skill: mathematical calculation fluency. However, the performance feedback provided for mathematical calculation fluency in the instructional control condition may have unintentionally impacted the instructional control students' writing fluency. This possibility limits conclusions about the effect of practice with CBM-WE and the interpretation of writing fluency growth estimates in the absence of intervention.

Additionally, there were two notable limitations associated with the experimental design: experimenters were not blind to condition assignment and the use of three conditions created an unbalanced experimental design. Although the study hypotheses were not revealed to the experimenters, the experimenters were not blind to the participants' condition assignment for administration or for scoring of CBM-WE probes. Although procedural integrity and interscorer reliability were monitored in order to capture blatant instances of experimenter bias, it is plausible that some form of bias was introduced during administration of the writing sessions.

Another design limitation was the unequal number of data points across the three conditions. In order to have a true control group, measurement using CBM-WE could only occur on three occasions throughout the study, which resulted in an unbalanced number of data points across the three conditions (eight waves of data for the feedback and practice-only condition and three waves of data for the control condition). By having

only three data points, performance by the control group was constrained to a linear trajectory and growth between the three data points could only be modeled in a linear fashion. However, the likelihood that writing growth, particularly when examined over a short measurement period, occurs in a nonlinear fashion is unlikely. To date, a nonlinear model of writing growth for elementary-aged children's writing fluency has not been found (Coker, 2006; Eckert et al., 2008; Marston et al., 1981; Truckenmiller, 2007).

The use of multilevel modeling for longitudinal academic data has been quite promising as it most appropriately models true growth (Burchinal et al., 2006; Raudenbush, 2001; Singer & Willett, 2003). However, close adherence to the slope estimates documented in this study is cautioned for several reasons. Boundary constraints in the estimation of variance prevented the model from retaining slope estimates for individual students. Instead, each student's growth was fixed to the group average estimate of the slope value. Secondly, the standard error of the slope values needs to be considered. The standard error of the slope estimates for the practice-only condition (0.23) and the instructional control condition (0.26) were almost as large as the respective slope estimates. This suggests that other unaccounted for variables may be affecting children's rate of growth or that the amount of growth produced by these two practices is very small or negative. Although research has not examined the standard errors of the slope estimates for intervention studies in writing, it has been demonstrated that the standard errors of the slope estimates in reading tend to be large and less stable over short periods of time (i.e., less than 10 weeks) (Christ, 2006).

As with all studies of academic achievement outcomes, recommendations against making causal inferences due to uncontrolled variables abound (Raudenbush, 2004). Any

interpretation based on demographic variables including school assignment, socioeconomic status, and students' initial level of writing fluency should remain tentative. In the current study, each individual student's socioeconomic status could not be specified. Therefore, it remained a school-level variable in these analyses and cannot be assumed to directly impact *individual* student's writing growth trajectory. Although school assignment could be specified for each student, the differences inherent among the three schools, such as teacher experience, reading/language arts curriculum, school climate, and student ethnicity, were not modeled in this study. Given the multiple uncontrolled and interacting variables in school-based research, several researchers have emphasized simplifying explanations of academic intervention results based on known and measured variables (Daly et al., 2000; Singer & Willett, 2003). As a result, further exploration of alternative variables was not prioritized in the current study.

This study, as well as previous studies of performance feedback as an intervention for writing fluency, is limited in terms of external validity. The effects of performance feedback have only been examined with third-grade students. Given the developmental progression of learning to compose written paragraphs (Berninger et al., 2006), students' growth in writing and responsiveness to fluency-based interventions are likely to be different depending on the students' grade level. Therefore, the results of this study cannot be extrapolated to other grade levels.

A final consideration is that the performance feedback used in this study was implemented by university-based researchers. No studies have examined the feasibility of teachers implementing performance feedback for writing fluency in classrooms. As is the case with many empirically-based interventions, teachers and other school-based

practitioners may encounter additional barriers that negatively impact students receiving an intervention, including several issues surrounding intervention fidelity (Kratochwill & Shernoff, 2003/2004). In order to produce the desired outcomes on children's academic performance, it is important for researchers to explore the barriers of implementation by school-based personnel and identify the resources needed to overcome those barriers.

Directions for Future Research

The important findings associated with this study indicate that performance feedback and not practice is a primary change agent in fluency-based interventions for writing. Knowing that performance feedback is an important initial component to building a fluency-based intervention, future research can target school implementation issues associated with implementing fluency-based interventions as well as focus on techniques to strengthen these types of interventions.

In addition to demonstrating empirical support for intervention procedures, Kratochwill and Shernoff (2003/2004) point out that any intervention designated as evidence-based must also demonstrate efficacy for use in the identified context. Therefore, research studies examining teachers' use of performance feedback, acceptability of performance feedback and outcomes, and identification of barriers to teachers' implementation is greatly needed. Several important questions remain to be answered regarding use of this brief behavioral intervention. What is teachers' acceptability of individualized performance feedback delivered as a classwide intervention or instructional practice? Will teachers or other school-based staff implement performance feedback and use CBM-WE probes with integrity? What is teachers'

acceptability of the amount of the increased growth rate for students' receiving performance feedback?

Although performance feedback has been demonstrated to successfully increase the rate of writing fluency growth for groups of elementary-aged students, there is no evidence to support the use of performance feedback on its own as an intensive individualized instructional intervention. Previous studies have failed to find a significant increase in general writing achievement as a result of performance feedback alone, even when feedback was provided on a more frequent basis (Rosenthal, 2005). More intensive interventions will be needed to address students' level of writing fluency; however, other fluency-based interventions may be an area for further study. In the area of reading, a meta-analysis found that some types of fluency-building interventions (i.e., feedback combined with goal-setting and/or reinforcement) had a greater impact than other types of interventions (i.e., repeated practice and tutoring) for improving boys' reading fluency growth (Morgan & Sideridis, 2006). Future intervention studies with writing fluency could include a reinforcement component in addition to the performance feedback to examine the impact on boys' writing fluency growth. In the current study, students' initial fluency level did not differentially affect their growth rates. In the area of mathematics, a comparison of two fluency-building interventions indicated that the type of intervention interacted with initial level of fluency in producing different rates of growth for students performing above the 15th percentile for their grade than students performing below the 15th percentile (Codding et al., 2007). Future research in the area of writing should consider conducting comparative studies to examine whether other

fluency-building interventions differentially affect students' writing fluency as a function of initial level of fluency.

One unpredicted finding of the current study was the amount of writing fluency growth demonstrated by students assigned to the instructional control condition. A follow-up study measuring students' growth in other timed tasks during a fluency-building intervention would be helpful in determining if generalization of performance occurs. For example, a fluency-building intervention targeting writing fluency may be examined for its effect on other basic skills (e.g., basic mathematics calculation, spelling, paragraph copying). Results from a study like that would strengthen the literature on fluency-building interventions. It is also possible, although less likely, that the performance feedback intervention provided for mathematical calculation had a residual effect on general orthographic fluency, thereby affecting writing fluency growth. Given the complexity of the construct of writing, it is possible that precursor skills (e.g., automatic letter production, copying, spelling) may differentially affect writing fluency growth. It has already been recommended that students' precursor writings skills be monitored even after direct instruction in those skills discontinues (Berninger et al., 2006). Therefore, a future study examining the predictive power of these skills on students' writing fluency growth (as opposed to just level of writing fluency) may provide beneficial information.

Finally, future research could be expanded to other elementary grade levels (e.g., grades 2, 4, and 5). Differences in task length (e.g., 3, 5, or 7 minutes), type of prompt (e.g., picture or text story-starter), and task demand (e.g., narrative, expository) all produce differences in students' writing fluency growth as a function of developmental

and/or grade level (McMaster & Campbell, 2008). These aspects of writing tasks will need to be considered in future efforts to explore the effects of performance feedback with elementary-aged students in other grade levels. In addition, performance feedback in writing fluency has solely targeted TWW with demonstrated residual effects on CWS. In future studies of other grade levels, feedback on another metric may be more beneficial and demonstrate greater validity. For example, one study of students in ninth grade gave feedback on the number of adjectives used, the number of complete sentences, and the number of compound sentences (McCurdy et al., 2008). This study demonstrated increased growth in each of the targeted variables following feedback. It seems that the feedback metric may differ widely as a function of grade level or developmental level. In general, the lack of general knowledge and consensus regarding writing fluency skills suggests that researchers continue to explore the level of writing fluency and the amount of growth desired for students in general education and identifying what needs to occur for those at-risk students in general education.

Conclusions

Large strides have been made in identifying critical skills for improving written expression outcomes for elementary-aged students (Berninger & Fuller, 1992; Berninger et al., 1997) and formatively measuring writing fluency (Espin et al., 1999; Espin et al., 2000; Gansle et al., 2002; Malecki& Jewell, 2003; McMaster & Campbell, 2008; Weissenberger & Espin, 2005). This study expands the current literature in writing fluency intervention practices by establishing individualized performance feedback as an effective and acceptable supplemental intervention for third grade writing fluency growth. Furthermore, the results call into question the effectiveness of increasing

students' writing practice without adding a fluency-building component such as performance feedback. Areas of further research were highlighted by the large discrepancies in writing fluency level due to sex and school-level variables. Through continued research on evidenced-based interventions and the exploration of variables affecting students' writing fluency growth, students' written compositions can improve from their current, commonly-used summary statement: "the end."

List of Appendices

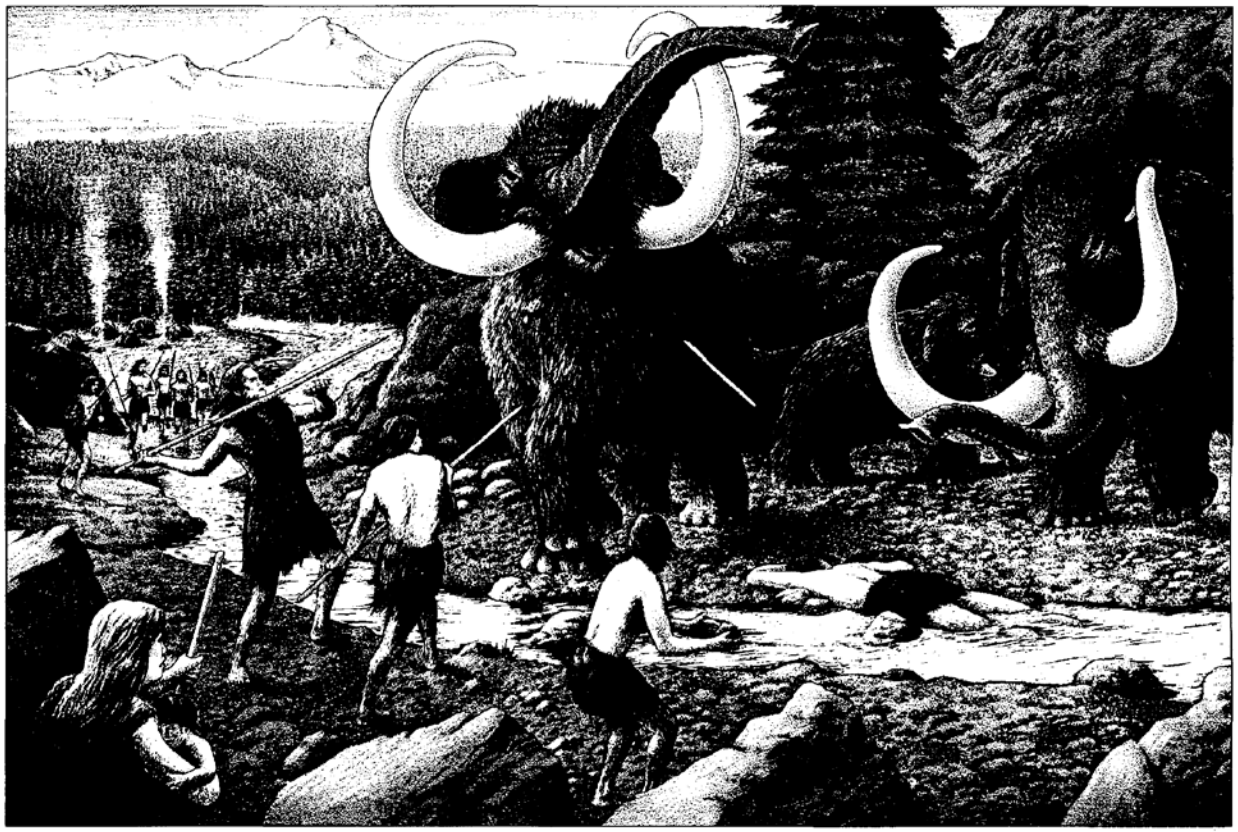
Appendix A

A little boy lived with his father in a large forest. Every day the father went out to cut wood. One day the boy was walking through the woods with a basket of lunch for his father. Suddenly he met a huge bear. The boy was frightened, but he threw a piece of bread and jelly to the bear.

Appendix B

Test of Written Language- Third Edition Spontaneous Writing Subtests, picture prompt

STORY



Appendix C

Identification Information

Syracuse University

2008 - 2009 Writing Project

_____Elementary School

3rd grade

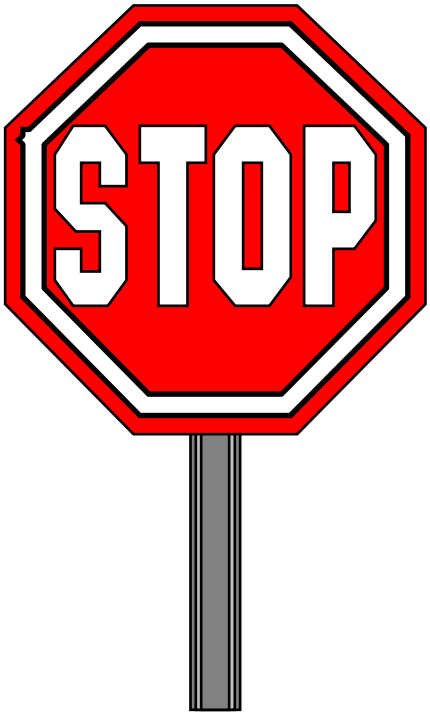
Name: _____

Classroom:

Probe # _____

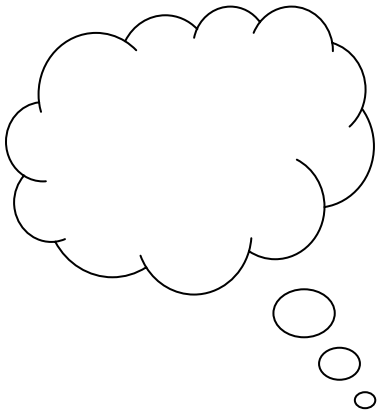
Appendix D

Second page of writing packet



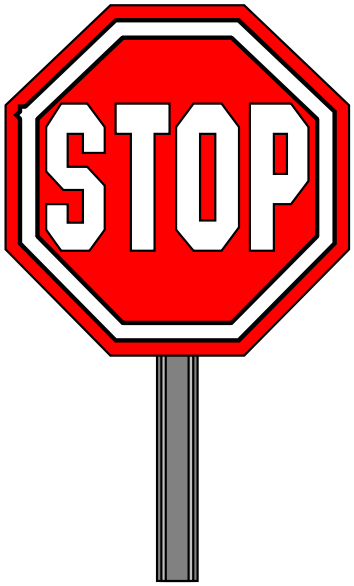
Appendix E

Story starter page



I was talking to my friends when all of a sudden **.**

. .



Appendix F

Compositional pages with story starter

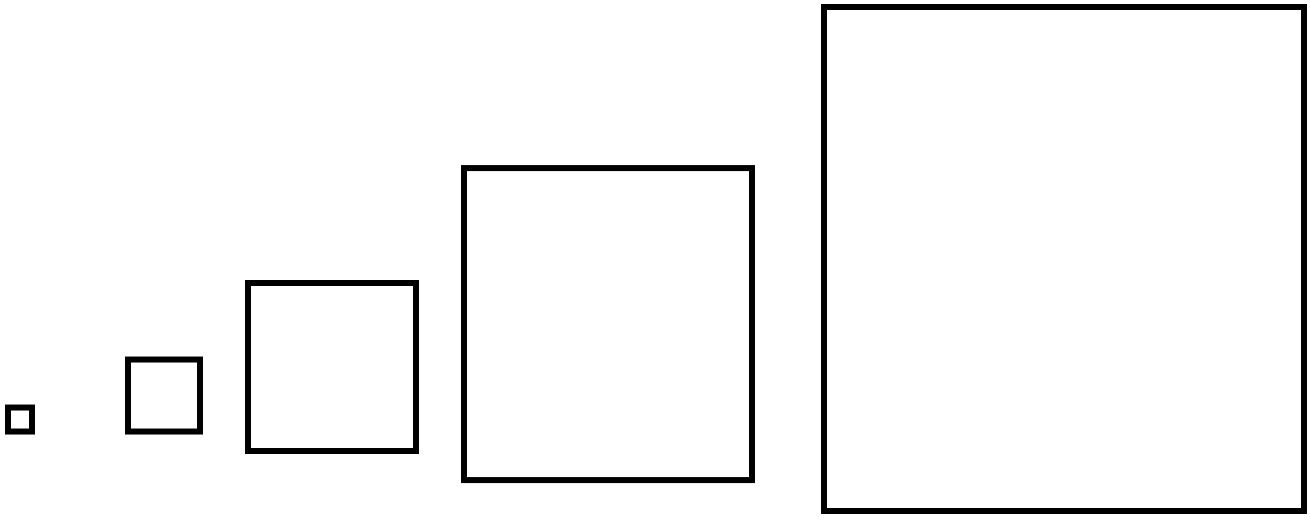
I was talking to my friends when all of a sudden

Keep going 

Appendix G

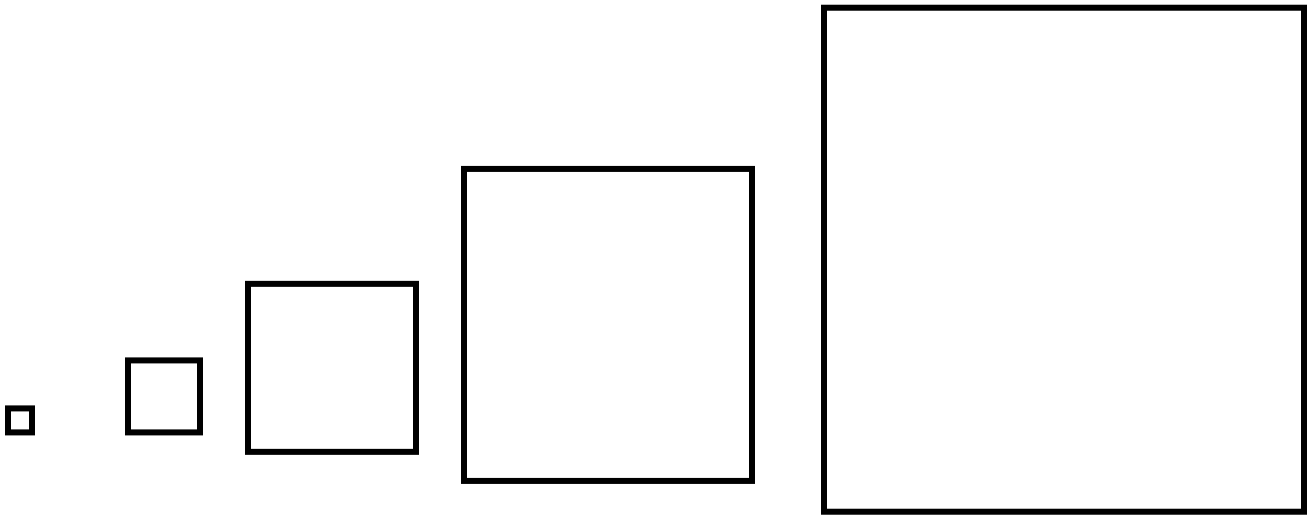
Story Starter Rating

How much did you like writing about *was talking to my friends when all of a sudden...* ?



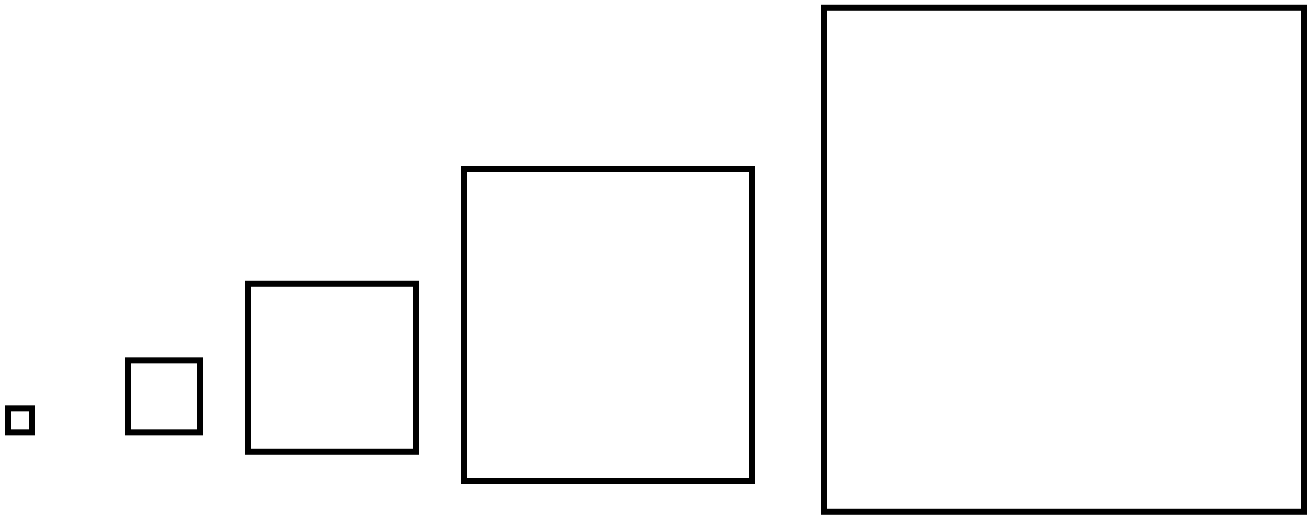
Not at all | A little bit | Some | A lot | Very, very much

Were you able to come up with ideas for writing about *I was talking to my friends when all of a sudden...*?



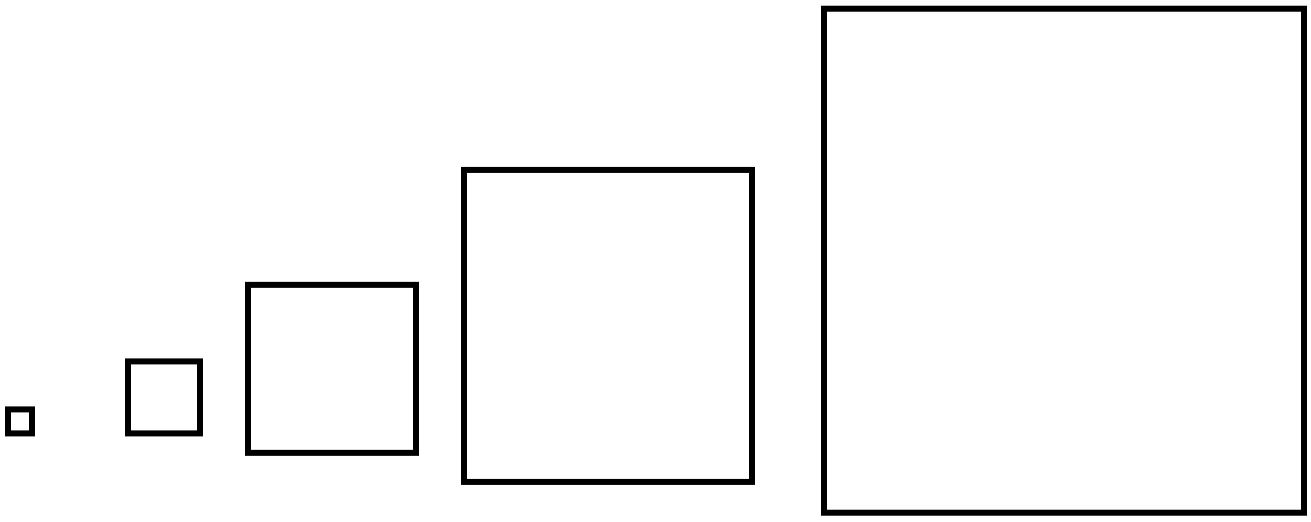
Not at all | A little bit | Some | A lot | Very, very much

Did you find it difficult to write about *I was talking to my friends when all of a sudden...*?



Not at all | A little bit | Some | A lot | Very, very much

Did you like to write about *I was talking to my friends when all of a sudden...*as much as other stories you wrote with me?



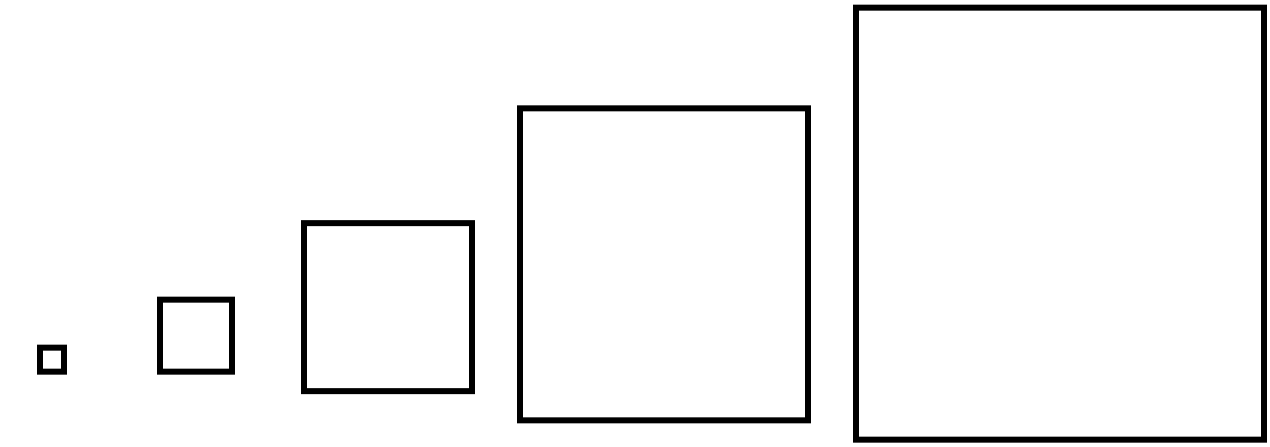
Not at all | A little bit | Some | A lot | Very, very much

Appendix H

Procedural Acceptability Questions

Question #1

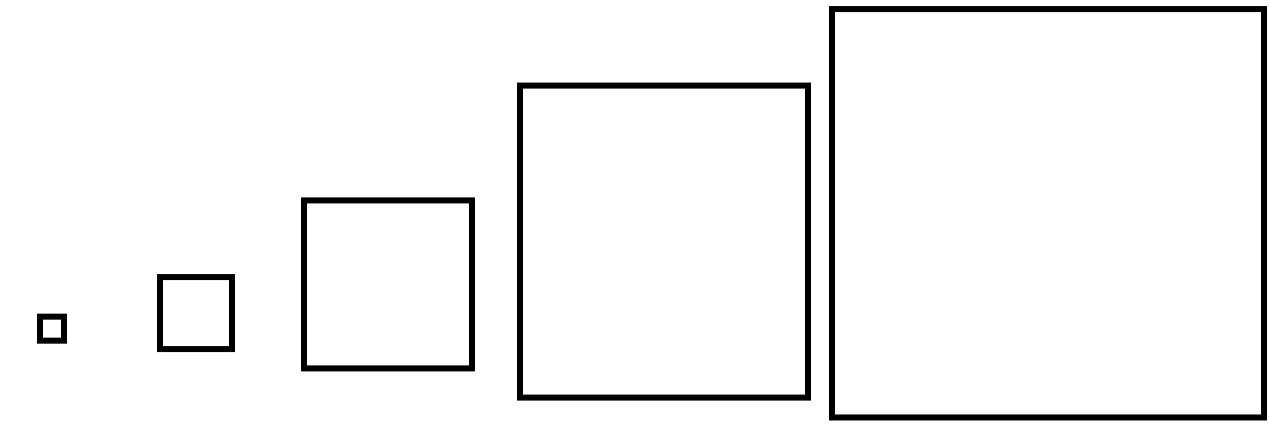
How much do you like writing stories each week with us?



Not at all | A little bit | Some | A lot | Very, very much

Question #2

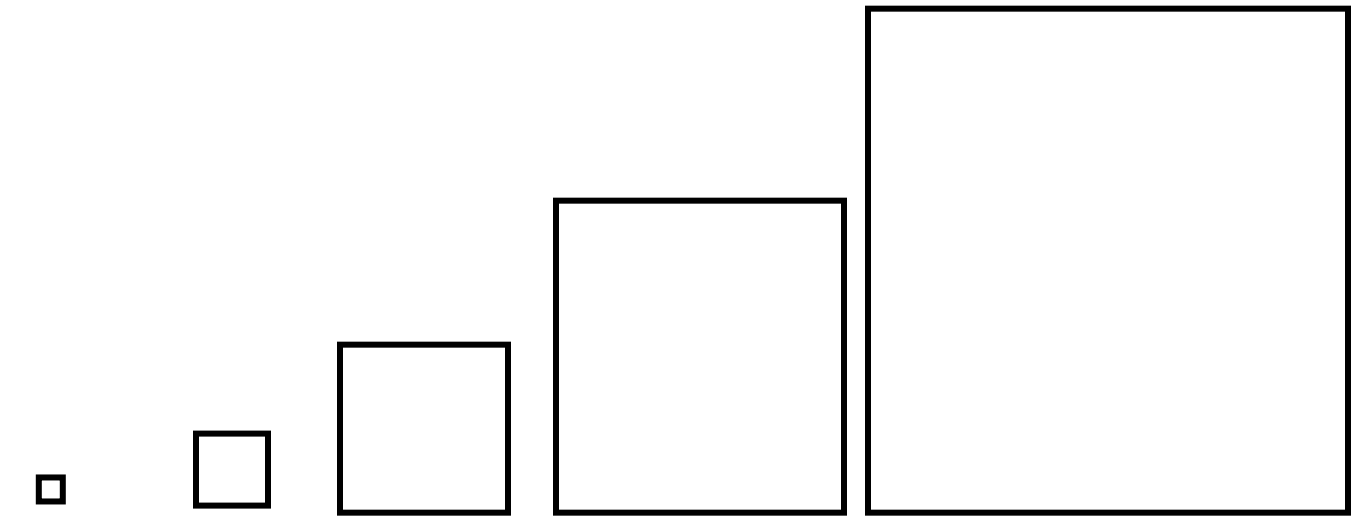
How much do you like being timed while you are writing your stories with us?



Not at all | A little bit | Some | A lot | Very, very much

Question #3

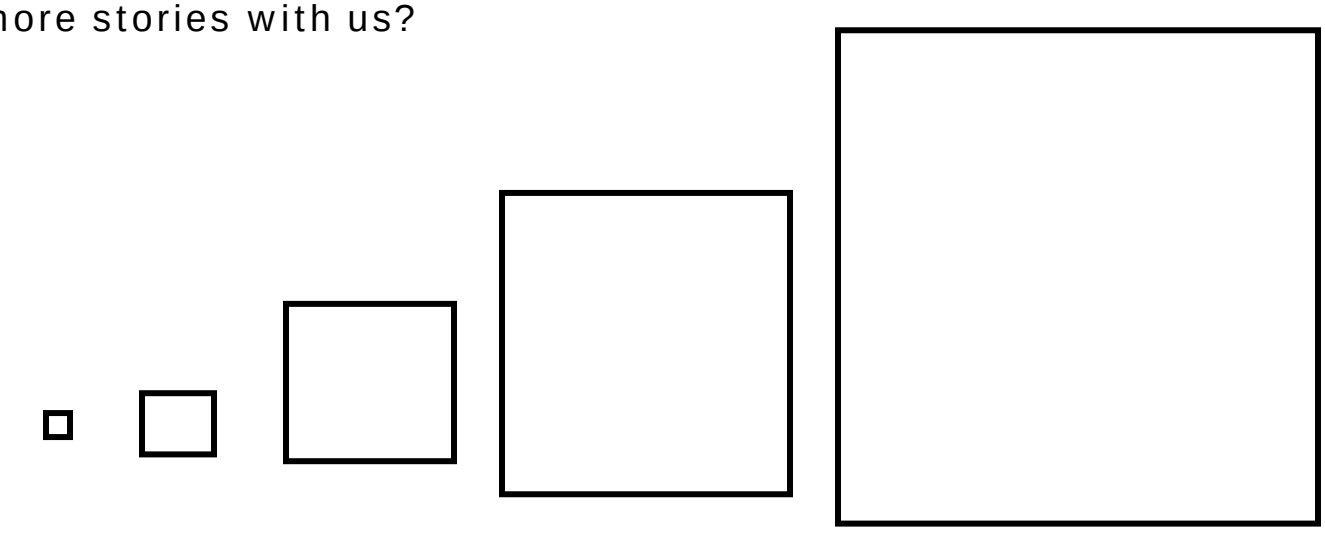
Were there any times when you didn't want to write a story with us?



Not at all | A little bit | Some | A lot | Very, very much

Question #4

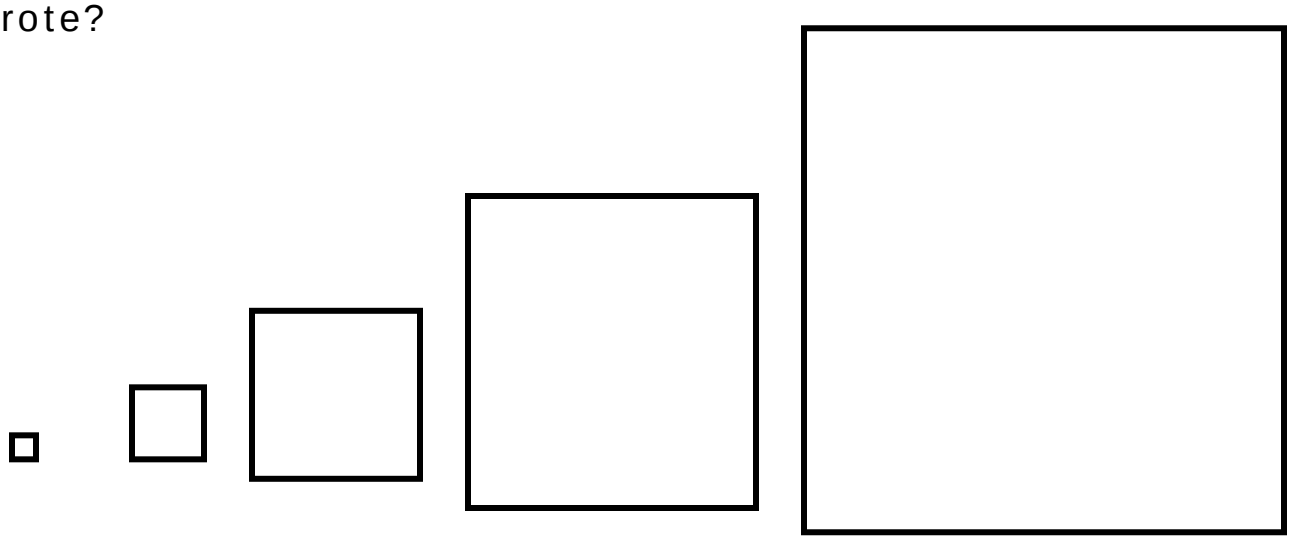
Were there any times when you wished you could write more stories with us?



Not at all | A little bit | Some | A lot | Very, very much

Question #5

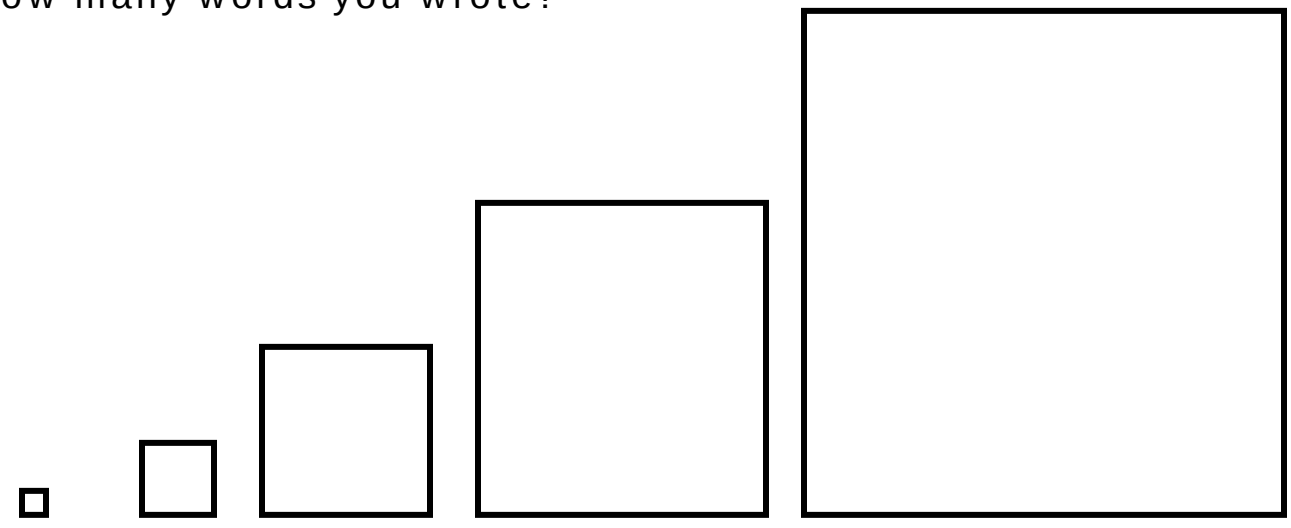
How much do you like being told how many words you wrote?



Not at all | A little bit | Some | A lot | Very, very much

Question #6

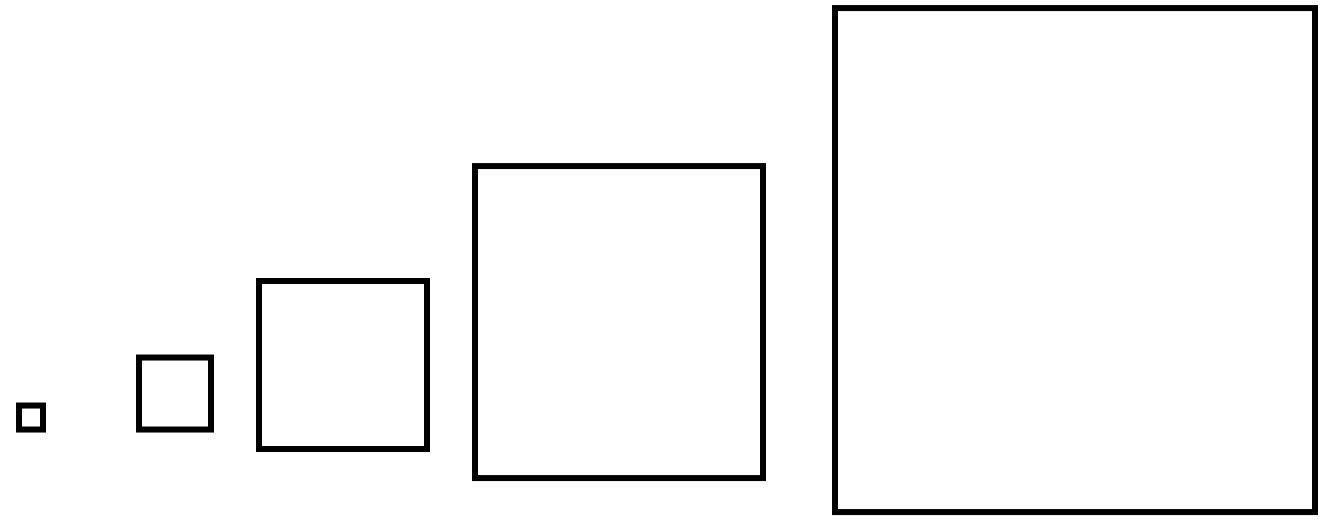
How much do you think it helps you when you were told how many words you wrote?



Not at all | A little bit | Some | A lot | Very, very much

Question #7

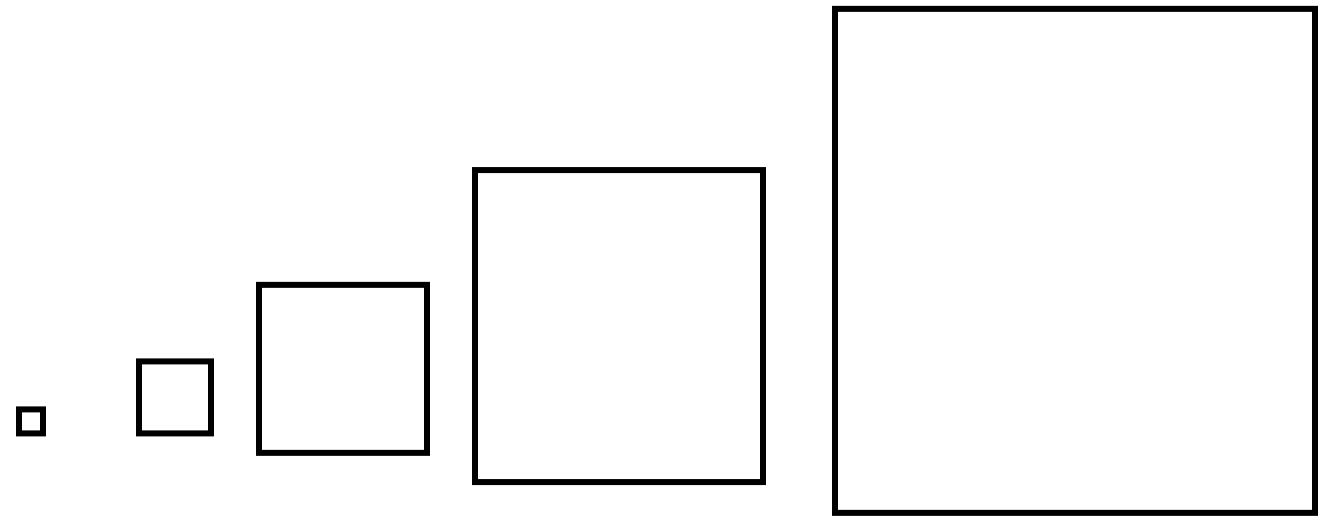
Do you think your writing has improved?



Not at all | A little bit | Some | A lot | Very, very much

Question #8

Do you think your writing has gotten worse?



Not at all | A little bit | Some | A lot | Very, very much

Appendix I

Teacher Questionnaire

Teacher's name: _____ Date: _____

Directions: Please answer the following questions so we may know more about your professional and educational experiences and credentials.

1) Total number of years of teaching: _____ years
2) Total number of years at current school: _____ years
3) Teaching degree(s): _____
4) Additional certification(s): _____

Writing Instruction

The purpose of our work is to examine effective writing strategies for students in elementary school. It would be helpful if you could identify any specific writing curricula or programs that you use to develop your writing lesson plans:

_____

_____

_____

Instructional Time in Writing

We are interested in learning how much instructional time is allocated for different writing activities. Please estimate **how many minutes per week** students in your classroom are engaged in:

(1) Handwriting practice: _____ minutes
(2) Spelling practice: _____ minutes
(3) Composition writing: _____ minutes

Teaching Philosophy in Writing

In addition, we are interested in learning more about your teaching philosophy regarding written. Please answer the following questions:

#	Item	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
1	A good way to begin writing instruction is to have children copy good models of each particular type of writing.	1	2	3	4	5	6
2	Instead of regular grammar lessons, it is best to teach grammar when a specific need for it emerges in a child's writing.	1	2	3	4	5	6
3	Students need to meet frequently in small groups to react and critique each other's writing.	1	2	3	4	5	6
4	The act of composing is more important than the written work children produce.	1	2	3	4	5	6
5	Before children begin a writing task, teachers should remind them to use correct spelling.	1	2	3	4	5	6
6	With practice writing and responding to written messages, children will gradually learn the conventions of adult writing.	1	2	3	4	5	6
7	Being able to label words according to grammatical function (e.g., nouns and verbs) is useful in proficient writing.	1	2	3	4	5	6
8	It is important for children to study words in order to learn their spelling.	1	2	3	4	5	6
9	Formal instruction in writing is necessary to insure adequate developmen all the skills used in writing.	1	2	3	4	5	6
10	Children need to practice writing letters to learn how to form them correctly.	1	2	3	4	5	6
11	Teachers should aim at producing writers who can write good compositio in one draft.	1	2	3	4	5	6
12	Before they begin a writing task, children who speak a non-standard dialect of English should be reminded to use correct English.	1	2	3	4	5	6
13	It is important to teach children strategies for planning and revising.	1	2	3	4	5	6

Appendix J

Curriculum-Based Measurement in mathematics probes

2 + 2	7 + 8	8 + 9	1 - 0	5 - 5	4 - 0
12 - 7	10 - 3	6 - 1	10 + 4	9 + 6	8 + 9
0 + 8	9 + 0	8 - 7	11 - 2	2 + 4	0 + 9
6 + 3	5 - 3	1 + 1	12 - 11	11 - 8	5 + 9
2 + 7	0 + 9	7 + 3	11 + 10	8 - 6	8 - 0

Keep going

7 - 5	6 + 5	7 - 0	8 - 5	3 + 2	0 + 1
12 + 2	2 - 0	7 + 1	0 + 4	2 + 0	5 - 1
12 - 1	9 + 11	12 + 8	9 - 7	9 - 2	5 - 4
5 + 1	9 - 7	1 + 9	6 + 2	11 + 8	6 + 12
11 - 10	9 - 8	9 + 5	9 - 3	11 - 8	9 - 2

STOP

4 + 5	0 + 3	7 + 3	3 - 0	8 - 3	8 - 1
7 - 7	11 - 8	3 - 3	9 + 7	2 + 9	4 + 7
1 + 3	2 + 3	12 - 10	9 - 0	1 + 9	4 + 4
3 + 2	5 - 1	0 + 0	4 - 0	8 - 6	2 + 3
5 + 0	6 + 5	1 + 6	8 + 9	8 - 1	9 - 5

Keep going

6 - 4	1 + 6	8 - 4	5 - 2	12 + 9	7 + 8
1 + 3	6 - 6	1 + 4	7 + 11	9 + 2	7 - 4
5 - 4	1 + 6	7 + 2	5 - 1	7 - 1	11 - 6
7 + 0	5 - 5	0 + 7	4 + 5	12 + 11	1 + 0
5 - 4	12 - 6	1 + 4	2 - 1	6 - 6	7 - 0

STOP

Appendix K

Teacher Consent Letter

SYRACUSEUNIVERSITY

DEPARTMENT OF PSYCHOLOGY

TEACHER CONSENT FORM

Treatment Research in Academic Competence
Examining Elementary-Aged Children's Written Expression and Mathematical Computation Skills

Principal Investigator: Ms. Adrea Truckenmiller
Dept. of Psychology, Syracuse University
Phone: (814) 880-2564
Co-Principal Investigator: Dr. Tanya Eckert
Dept. of Psychology, Syracuse University
Phone: (315) 443-3141

Dear Third Grade Teacher,

My name is Adrea Truckenmiller and I am a Ph.D. candidate in the department of Psychology at Syracuse University. I am conducting a research study with your students in an attempt to better understand and improve children's writing and math skills. I am trying to see how much children's writing skills and math computation skills improve over time. I am also looking for more information about typical writing curricula in your classroom.

Taking part in this study is completely voluntary, so you can choose to say 'yes' or 'no' to this invitation. This consent form will explain the project to you. Please feel free to call me (814-880-2564) or my faculty advisor, Dr. Tanya Eckert (315-443-3141) if you have any questions. We will be happy to answer any questions you might have.

Purpose of the Study

The purpose of this study is to determine how much children's academic skills change over time when given weekly practice with writing, weekly feedback with writing practice, and weekly feedback with practice in mathematical computation. The purpose

of the teacher survey is to get a description of writing curriculum and individual students' overall writing abilities.

Description of Procedures

First, if you agree to participate, we ask that you sign this form. Teacher's participation in this study includes 2 components: (1) completing a survey about the writing curriculum in your classroom; and (2) rating each of your students' writing abilities on 17 items. Upon completion of these materials, you will receive a $50 gift certificate for your participation. You may choose not to complete the survey at any time. Your decision will not affect your students' participation in the study. You should feel free to call me or email me to ask any questions you may have.

Risks of Participation

The risks of participating in this study are minimal. Completing the survey will take approximately two hours, depending on the number of students in your classroom. To compensate your time, we will provide you with a $50 gift certificate.

Number of Participants

All of the third grade teachers at three elementary schools (nine teachers) are being invited to participate in the project.

Confidentiality of Records

Any information obtained in this study will be kept confidential. That is, your completed survey will not be shared with anyone. The information will be kept in a locked office at Syracuse University and only our research team will have access to it.

At the completion of this study we will be writing a report about the results. This report will not include any identifiable information about you or your school. All information in this report and the summary that is presented will be in the form of group averages.

Voluntary Participation

Your participation in this study is voluntary. You are free to choose not to complete the survey with no penalty. You may also withdraw from the study at any time, for whatever reason. In the event that you do not give consent or withdraw consent, any information you have already provided will be kept in a confidential manner.

Cost and Payment

Participation in this study does not involve any cost to you. Upon completing the survey and returning it to us, you will receive a $50 gift certificate. If, after beginning to fill out the survey, you decide to discontinue, you will be compensated on a pro-rated schedule. For example, if you complete half the survey, you will receive a $25 gift certificate.

Contact Persons

If you have any questions, concerns, or complaints about the research, please contact the primary investigators: Adrea Truckenmiller or Dr. Tanya Eckert at Syracuse University,

430 Huntington Hall, Syracuse, NY 13244 by telephone: (315) 443-3141 or email: ajtrucke@syr.edu. If you have any questions about your rights as a research participant, if you have questions, concerns, or complaints that you wish to address to someone other than the investigator, or if you cannot reach the investigator, please contact the Syracuse University Institutional Review Board at 315-443-3013 or 121 Bowne Hall, Syracuse, NY 13244.

You are being provided with two copies of this letter. Please sign below indicating if you consent participate in our study or if you do not consent to participate.

Please return the signed copy to the investigators and keep the second copy of this letter for your records.

TEACHER CONSENT FORM
Treatment Research in Academic Competence
Examining Elementary-Aged Children's Written Expression and Mathematical Computation Skills

I, _____ give my consent to participate in Syracuse
(please print your name)

University's Treatment Research in Academic Competence project by completing the teacher survey.

_____ _____
Signature Date

OR

I, _____ **DO NOT** give my consent to participate in
(please print your name)

Syracuse University's Treatment Research in Academic Competence project by completing the teacher survey.

_____ _____
Signature Date

Appendix L

Parent Consent Form

SYRACUSEUNIVERSITY

DEPARTMENT OF PSYCHOLOGY

PARENT CONSENT FORM

Treatment Research in Academic Competence
Examining Elementary-Aged Children's Written Expression and Mathematical Computation Skills

Principal Investigator: Ms. Adrea Truckenmiller
Dept. of Psychology, Syracuse University
Phone: (814) 880-2564
Co-Principal Investigator: Dr. Tanya Eckert
Dept. of Psychology, Syracuse University
Phone: (315) 443-3141

Dear Parent or Guardian,

My name is Adrea Truckenmiller and I am a Ph.D. candidate in the department of Psychology at Syracuse University. I am working on a research study in your child's school in an attempt to better understand and improve children's writing and math skills. I am trying to see how much children's writing skills and math computation skills improve over time.

Taking part in this study is completely voluntary, so you can choose to say 'yes' or 'no' to this invitation. Your decision will **NOT** affect your child's grades or your child's educational program. This consent form will explain the project to you. Please feel free to call me (814-880-2564) or my faculty advisor, Dr. Tanya Eckert (315-443-3141) if you have any questions. We will be happy to answer any questions you might have.

Purpose of the Study

The purpose of this study is to determine how much children's academic skills change over time when given weekly practice with writing, weekly feedback with writing practice, and weekly feedback with practice in mathematical computation.

Description of Procedures

First, if you agree to allow your child to participate, we ask that you sign this form and return it to school with your child. If you choose not to have your child participate in the study, please indicate that on the form and return it to school with your child. You should feel free to call me to ask any questions you may have. Beginning in March, myself and other students from Syracuse University will be working with your child's classroom for 15 minutes per week. During those 15 minutes, some students will be practicing writing stories, some students will be told how they are doing in writing in addition to practicing writing, and some students will be told how they are doing in math in addition to practicing math problems.

Your child's teacher will also be asked to rate your child's basic skills in writing. These ratings are similar to the way your child's teacher evaluates your child's writing skills on a report card.

Benefits of Participation

There are several benefits of your child participating in this study. Your child will get extra practice with writing stories and/or math problems. As a result, your child's writing skills or math skills may improve over time. In addition, you child's motivation toward writing or math may also improve over time.

Risks of Participation

The risks of participating in this study are minimal as your child will be practicing the writing and math skills he/she is learning in school. There are two potential risks to participating in this study. First, your child may experience discomfort, such as becoming mildly frustrated or tired, while participating in the project. Second, your child may become worried that others may find out how he/she is doing on the academic tasks. We will attempt to reduce these risks by working with your child for a small amount of time (15 minutes), allowing all children to withdraw from the study without penalty, and encouraging all of the children to respect the privacy of their peers.

Number of Participants

All of the third grade students at your child's school as well as two other elementary schools in the Syracuse City School District are being asked to participate in this study. This will result in a total of 180 third grade students participating in the study.

Duration of Participation

Each week for a period of nine weeks, we will be working with your child in a group setting (20-25 students per group) for about 15 minutes.

Confidentiality of Records

Any information obtained in this study will be kept confidential. That is, the work that your child produces when working with us, and the teacher ratings of your child's writing skills will not be shared with anyone. Your child's work and the surveys filled out by your child's teacher will be kept in a locked office at Syracuse University and only our

research team will have access to it. Your child's work will not be shared with school staff. Furthermore, your child's grades will not be based on the work he/she does while working with us. Please note that this promise of confidentiality does not apply if your child discloses (a) an intention to harm himself/herself or another person, and (b) an incident of child abuse or neglect. In the event of a disclosure, we are mandated by the state of New York to notify the appropriate agencies.

At the completion of this study we will be writing a report about the results. This report will not include any identifiable information about your child. All information in this report and the summary that is presented to your child's school will be in the form of group averages, with each group containing approximately 20-25 students.

As stated in the section on Voluntary Participation below, you can refuse to sign this consent and not have your child participate in the study. You can also discontinue your child's participation in this study at any time by contacting us or your child's teacher. By signing this consent form, you give us permission to allow your child to participate in the study.

Cost and Payment

Participation in this study does not involve any cost to you or your child. At the conclusion of the study, your child will receive a small writing journal and writing instrument for participating in the study.

Contact Persons

If you have any questions, concerns, or complaints about the research, please contact the primary investigators: Adrea Truckenmiller or Dr. Tanya Eckert at Syracuse University, 430 Huntington Hall, Syracuse, NY 13244 by telephone: (315) 443-3141 or email: ajtrucke@syr.edu. If you have any questions about your rights as a research participant, if you have questions, concerns, or complaints that you wish to address to someone other than the investigator, or if you cannot reach the investigator, please contact the Syracuse University Institutional Review Board at 315-443-3013 or 121 Bowne Hall, Syracuse, NY 13244.

Voluntary Participation

Your child's participation in this study is voluntary. You are free to choose not to have your child's work included in this study. You may also withdraw your child from the study at any time, for whatever reason, without risk to your child's school grades or relationship with the school. In the event that you do not give consent or withdraw consent, your child's work will be kept in a confidential manner. Furthermore, if you choose not to have your child participate in this study, your child's teacher will choose an educationally relevant activity for your child during the time your child's classmates are participating in our study.

You are being provided with two copies of this letter. Please sign the next page of this letter indicating if you consent to have your child participate in our study or if you do not consent to have your child participate.

Please return the signed copy to school with your child and keep the second copy of this letter for your records.

PARENT CONSENT FORM

Treatment Research in Academic Competence
Examining Elementary-Aged Children's Written Expression and Mathematical Computation Skills

I, _____give my consent for my child, _____
(please print your name) (print child's name)

to participate in Syracuse University's Treatment Research in Academic Competence project for the 2008-2009 school year.

_____ _____
Parent/Guardian signature Date

OR

I, _____do **NOT** give my consent for my child, _____
(please print your name) (print child's name)

to participate in Syracuse University's Treatment Research in Academic Competence project for the 2008-2009 school year.

_____ _____
Parent/Guardian signature Date

Appendix M

Student Assent

Important Question

I would like to work with you each week for the next couple of months. We will be working on writing stories and math facts. Your parent has said that it is okay that I work with you. However, I want to make sure that it is okay with you. If you change your mind it is okay to stop working with me at any time.

Would it be okay if I worked with you on writing?

Yes ***No*** ***I don't know***

Name:_____

Appendix N

Script–Performance Feedback Condition

Directions: Please fill out each area detailed below. Please make sure that the identifying information (box 1) is complete before you submit the form.

I.	Identifying Information		
Name of primary research assistant:			
Name of secondary research assistant:			or N/A
School/Classroom:			
Date:			
Notes:			
II.	Data Collection – Material Preparation	Circle	
a.	Five (5) sharpened pencils	Yes	No
b.	Assessment packets	Yes	No
c.	Experimenter's copy of packet	Yes	No
d.	Two (2) stopwatches	Yes	No
e.	Insert names	Yes	No
Notes:			
III.	Data Collection Procedures [Please check [✓] each box as you complete each step]✓		
1.	State to the students: "*Hello. If you have not already done so, please clean off the top of your desk, except for a pencil. Please listen for your name as _____ and I hand out the packets. Raise your hand when we call your name.* "		
2	Both research assistants should distribute the packets. (This should be very quick and not take longer than 2-3 minutes.		
3.	After all of the packets have been distributed, State to the students: "*When I call your group color, please line up at the door with your packet and your pencil*." *"The Green Group will be staying in this classroom to work with us.* *"The Gold Group will be going to _____'s classroom. Please line up now and show me how you walk quietly through the halls at _____ .* *"The Blue Group will be will be going to _____'s classroom. Please line up now and show me how you walk quietly through the halls at _____ .*		

4.	As students from other classes enter the classroom, the research assistant should direct students to sit down at the nearest desk in a systematic fashion. Do not let students talk you into letting them sit next to friends. Once the desks fill up, place any remaining students at tables in the room. The other research assistant should be standing outside the classroom holding up the green sheet of paper that says Green Group. The research assistant should assist students with quickly getting to the appropriate classroom.	
5.	Once you have confirmed that all the students from the other classrooms have arrived, state to the students: "*Welcome to the Green Group. Please turn to the red page of your packet that has stop sign in the middle of the page. Today I want you to write a story. Before we do that I want to tell you how you are doing with your writing skills. Last week we took all your stories back to SU and we counted all of the words that each of you wrote in your stories. Please turn to the next page of your packet. This page has a funnel with some numbers going into it at the top of the page.*"	
6.	The research assistant should scan the room to make sure all the students are on the correct page.	
7	State to the students: *"The box in the middle of the page* [The research assistant should point to the box.] *tells you how many words you wrote last week. Next to the box you will see an arrow.* *If the arrow is pointing up towards the sky, you wrote more words since the last time I worked with you.* *If the arrow is pointing down towards the floor that means you wrote fewer words since the last time I worked with you.* *Every week when I work with you, I will tell you how you are doing with your writing."*	
8	The research assistant should monitor the students for questions.	
9.	State to the students: "*Now I want you to write another story. I am going to read a sentence to you first, and then I want you to write a story about what happens next. You will have some time to think about the story you will write and then you will have some time to write it."*	
10.	State to the students: "*Please turn to the next page of your packet. This page has a thinking dog at*	

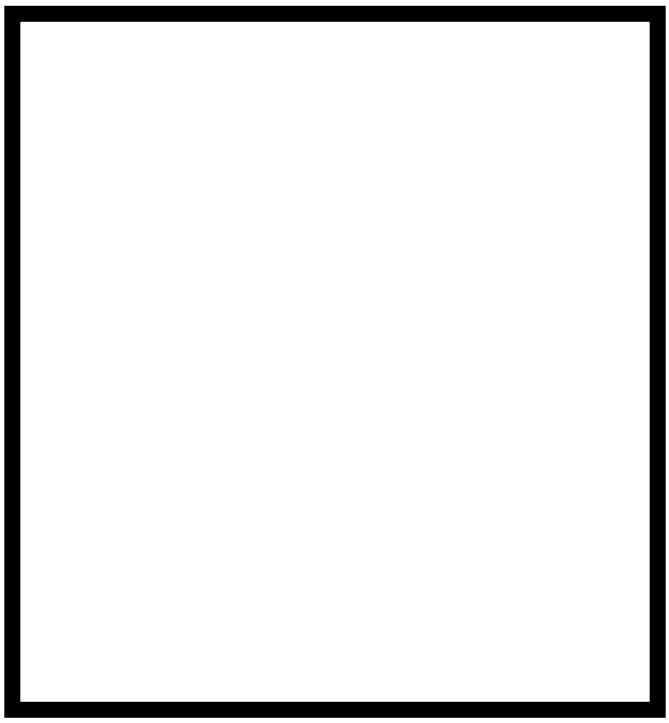
	the top of the page."	
11.	State to the students: "*For the next minute think about writing a story that begins with this sentence* – <u>I was talking to my friends when all of a sudden. . .</u> *Remember, take time to plan your story. A well-written story usually has a beginning, a middle, and end. It also has characters that have names and perform certain actions. Use paragraphs to help organize your story. Correct punctuation and capitalization will make your story easier to read.* *Please do not write the story. Just think of a story that begins with this sentence* - – <u>I was talking to my friends when all of a sudden. . .</u>"	
12.	The research assistant should begin the stopwatch and time the students for 1 minute.	
13.	At the end of 1 minute, state to the students: "*Okay, stop thinking, turn to the next page of your packet which has a bee holding a pencil, and raise your pencil in the air."*	
14.	State to the students: *"When I tell you to start, please begin writing your story. Remember, if you don't know how to spell a word, you should try your best and sound it out. It is important that you do your best work. If you fill up the first page, please turn to the next page and keep writing. Do not stop writing until I tell you to. Do your best work."*	
15.	State to the students: "*Okay, you can start writing.*" The research assistant should begin the stop watch and time the students for 3 minutes.	
16.	The research assistant should monitor the students during the 3-minute period and make sure students are following the directions stated in step #38. Also monitor the students to make sure that they are not re-copying the story starter. If a student is re-copying the starter, state to the student *"you do not need to copy the words that have been provided"*	
17.	After 1 minute, 30 seconds has elapsed, state to the students: *"You should be writing about* - – <u>I was talking to my friends when all of a sudden "</u>	
18.	After 3 minutes has elapsed, state to the students:	

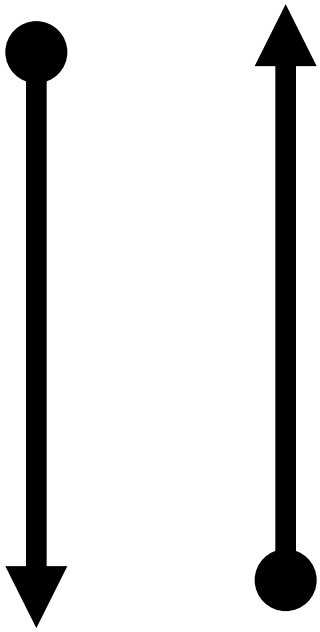
	"Please stop writing, put your pencils back in the air, and turn to the next page of your packet that has several boxes on it."	
19.	The research assistant should scan the room to make sure that all of the students have followed the directions. State to the students: *"Lastly, I want you to answer some questions about the story you just wrote. Look at question number 1. It says 'How much did you like writing about I was talking to my friends when all of a sudden . . .?' Make an 'X' through the box which tells how much you liked writing about I was talking to my friends when all of a sudden..."*	
20.	Continue reading each of the remaining 4 questions.	
21	State to the students: *That is all of the writing that we are going to do today. All of you did a very nice job following my directions.* If the other 2 classrooms are not finished, state to the students: "*Please turn to the last page of the packet. This page has a word find on it. You may work quietly on this word find until the other classrooms are ready to switch."* When the other 2 classrooms are ready to switch, continue to step #	
22.	State to the students: "Please hand in your packets. *Thank you for working with us today.*" If students complain about not finishing the word find, let them tear off the back page and tell them they may complete it at home.	
23.	The research assistant should collect all of the packets.	
24.	State to the students: *All of the students in _____'s classroom, please pick up your pencil and line up to the left side of the door. All of the students in _____'s classroom, please pick up your pencil and line up to the right side of the door.*	
25.	The research assistants should then assist the students in getting back to their classrooms quickly and quietly.	
Total number of steps completed:		

Appendix O

Feedback Page for Performance Peedback Condition

Here is how you are doing in writing:





Appendix P

Script– Practice-Only Condition

Directions: Please fill out each area detailed below. Please make sure that the identifying information (box 1) is complete before you submit the form.

I.	Identifying Information		
Name of primary research assistant:			
Name of secondary research assistant:			or N/A
School/Classroom:			
Date:			
Notes:			
II.	Data Collection – Material Preparation	Circle	
a.	Five (5) sharpened pencils	Yes	No
b.	Assessment packets	Yes	No
c.	Experimenter's copy of packet	Yes	No
d.	Two (2) stopwatches	Yes	No
e.	Insert names	Yes	No
Notes:			

III.	Data Collection Procedures [Please check [✓] each box as you complete each step]✓	
1.	State to the students: "*Hello. If you have not already done so, please clean off the top of your desk, except for a pencil. Please listen for your name as _____ and I hand out the packets. Raise your hand when we call your name.* "	
2	Both research assistants should distribute the packets. (This should be very quick and not take longer than 2-3 minutes.	
3.	After all of the packets have been distributed, State to the students: "*When I call your group color, please line up at the door with your packet and your pencil*." *"The Gold Group will be staying in this classroom to work with us.* *"The Green Group will be going to _____'s classroom. Please line up now and show me how you walk quietly through the halls at _____.* *"The Blue Group will be will be going to _____'s classroom. Please line up now and show me how you walk quietly through the halls at _____.*	

4.	As students from other classes enter the classroom, the research assistant should direct students to sit down at the nearest desk in a systematic fashion. Do not let students talk you into letting them sit next to friends. Once the desks fill up, place any remaining students at tables in the room. The other research assistant should be standing outside the classroom holding up the green sheet of paper that says Green Group. The research assistant should assist students with quickly getting to the appropriate classroom.	
5.	Once you have confirmed that all the students from the other classrooms have arrived, state to the students: "*Welcome to the Gold Group. Please turn to the red page of your packet that has stop sign in the middle of the page. Today I want you to write another short story. You will have some time to think about the story you will write and then you will have some time to write it."*	
6.	The research assistant should scan the room to make sure all the students are on the correct page.	
7.	State to the students: "*Please turn to the next page of your packet. This page has a thinking dog at the top of the page.*"	
8.	State to the students: "*For the next minute think about writing a story that begins with this sentence* – <u>I was talking to my friends when all of a sudden. . .</u> *Remember, take time to plan your story. A well-written story usually has a beginning, a middle, and end. It also has characters that have names and perform certain actions. Use paragraphs to help organize your story. Correct punctuation and capitalization will make your story easier to read.* *Please do not write the story. Just think of a story that begins with this sentence* - – <u>I was talking to my friends when all of sudden. . .</u>"	
9.	The research assistant should begin the stopwatch and time the students for 1 minute.	
10.	At the end of 1 minute, state to the students: "*Okay, stop thinking, turn to the next page of your packet which has a bee holding a pencil, and raise your pencil in the air."*	
11.	State to the students: *"When I tell you to start, please begin writing your story. Remember, if you don't know how to spell a word, you should try your best and sound it out. It is important that you do your best work. If you fill up the first page, please*	

	turn to the next page and keep writing. Do not stop writing until I tell you to. Do your best work."	
12.	State to the students: "*Okay, you can start writing.*" The research assistant should begin the stop watch and time the students for 3 minutes.	
13.	The research assistant should monitor the students during the 3-minute period and make sure students are following the directions stated in step #38. Also monitor the students to make sure that they are not re-copying the story starter. If a student is re-copying the starter, state to the student *"you do not need to copy the words that have been provided"*	
14.	After 1 minute, 30 seconds has elapsed, state to the students: *"You should be writing about - –* <u>I was talking to my friends when all of sudden</u> *"*	
15.	After 3 minutes has elapsed, state to the students: *"Please stop writing, put your pencils back in the air, and turn to the next page of your packet that has several boxes on it."*	
16.	The research assistant should scan the room to make sure that all of the students have followed the directions. State to the students: *"Lastly, I want you to answer some questions about the story you just wrote. Look at question number 1. It says 'I was talking to my friends when all of a sudden . . .?' Make an 'X' through the box which tells how much you liked writing about I was talking to my friends when all of a sudden ..."*	
17.	Continue reading each of the remaining 4 questions.	
18	State to the students: *That is all of the writing that we are going to do today. All of you did a very nice job following my directions.* If the other 2 classrooms are not finished, state to the students: "*Please turn to the last page of the packet. This page has a word find on it. You may work quietly on this word find until the other classrooms are ready to switch."*	

	When the other 2 classrooms are ready to switch, continue to step #19	
19.	State to the students: "Please hand in your packets. *Thank you for working with us today.*" If students complain about not finishing the word find, let them tear off the back page and tell them they may complete it at home.	
20.	The research assistant should collect all of the packets.	
21.	State to the students: *All of the students in _____'s classroom, please pick up your pencil and line up to the left side of the door. All of the students in _____'s classroom, please pick up your pencil and line up to the right side of the door.*	
22.	The research assistants should then assist the students in getting back to their classrooms quickly and quietly.	
Total number of steps completed:		

Appendix Q

Script– Instructional Control Condition

Directions: Please fill out each area detailed below. Please make sure that the identifying information (box 1) is complete before you submit the form.

I.	Identifying Information		
Name of primary research assistant:			
Name of secondary research assistant:			or N/A
School/Classroom:			
Date:			
Notes:			
II.	Data Collection – Material Preparation	Circle	
a.	Five (5) sharpened pencils	Yes	No
b.	Assessment packets	Yes	No
c.	Experimenter's copy of packet	Yes	No
d.	Two (2) stopwatches	Yes	No
e.	Insert names – step 1, 6	Yes	No
Notes:			

III.	Data Collection Procedures [Please check [✓] each box as you complete each step]✓	
1.	State to the students: "*Hello. If you have not already done so, please clean off the top of your desk, except for a pencil. Please listen for your name as _____ and I hand out the packets. Raise your hand when we call your name.* "	
2	Both research assistants should distribute the packets. (This should be very quick and not take longer than 2-3 minutes.	
3.	After all of the packets have been distributed, State to the students: "*When I call your group color, please line up at the door with your packet and your pencil*." *"The Blue Group will be staying in this classroom to work with us.* *"The Green Group will be going to _____'s classroom. Please line up now and show me how you walk quietly through the halls at _____ .* *"The Gold Group will be will be going to _____'s classroom. Please line up now and show me how you walk quietly through the halls at _____ .*	

4.	As students from other classes enter the classroom, the research assistant should direct students to sit down at the nearest desk in a systematic fashion. Do not let students talk you into letting them sit next to friends. Once the desks fill up, place any remaining students at tables in the room. The other research assistant should be standing outside the classroom holding up the green sheet of paper that says Green Group. The research assistant should assist students with quickly getting to the appropriate classroom.	
5.	Once you have confirmed that all the students from the other classrooms have arrived, state to the students: "*Welcome to the Blue Group. Please turn to the red page of your packet that has stop sign in the middle of the page. Today we are going to practice our math facts again. Before we do that I want to tell you how you are doing with your math facts. I counted all of the math facts that each of you got right when you practiced with us last week. Please turn to the next page of your packet. This page has a funnel with some numbers going into it at the top of the page.*"	
6.	The research assistant should scan the room to make sure all the students are on the correct page.	
7	State to the students: *"The box in the middle of the page* [The research assistant should point to the box] *tells you how many math facts you got right last week when we worked with you. Next to the box you will see an arrow.* *If the arrow is pointing up towards the sky, you got more right since the last time I worked with you.* *If the arrow is pointing towards the floor, that means you got fewer right since the last time I worked with you.* *Every week when I work with you, I will tell you how you are doing with your math facts."*	
8	The research assistant should monitor the students for questions.	
9.	State to the students: "*Now, today I want you to practice more math facts. Turn to the next page of your packet with 1 star at the top of the page and raise your pencil in the air."*	
10.	The research assistant should scan the room to make sure all the students are	

	on the correct page and not starting yet.	
11.	State to the students: "*For the next 2 minutes I want you to write your answers to several kinds of math problems. Some problems are addition and some are subtraction. Look at each problem carefully before you answer it."* *When I say 'Begin' write your answer to the FIRST problem* (demonstrate by pointing) *and work ACROSS the page. Then go to the next row. Try to work each problem. If you finish the first page, turn to the next page with 2 stars at the top and continue working. Ready?"* (Pause) "*BEGIN"*	
12.	The research assistant should begin the stopwatch and time the students for 2 minutes.	
13.	The research assistant should monitor the students during the 2-minute period and make sure students are following the directions stated in step #12.	
14.	After 2 minutes has elapsed, state to the students: *"Please stop writing, put your pencils back in the air "* [research assistants should demonstrate by holding your writing instrument in the air]. State to the students: *"Please turn to the page in the packet with 1 sun at the top of the page."*	
15.	The research assistant should scan the room to make sure that all of the students have followed the directions.	
16.	When everyone is on the correct page, state to the students: *"We are going to the same thing for another 2 minutes. Remember, some problems are addition and some are subtraction. Look at each problem carefully before you answer it."* *When I say 'Begin' write your answer to the FIRST problem* (demonstrate by pointing) *and work ACROSS the page. Then go to the next row. Try to work each problem. If you finish the first page, turn to the page with 2 suns at the top and continue working."* (Scan the room to make sure everyone is on the correct page and pencil in	

	the air). "*BEGIN"*	
17	The research assistant should time the students for 2 minutes. The other research assistant should go into the hallway to communicate with the other classrooms about how much time is left.	
18	After 2 minutes have elapsed, state to the students: "Please stop writing and put your pencils in the air. *That is all of the math practice that we are going to do today. All of you did a very nice job following my directions.* If the other 2 classrooms are not finished, state to the students: "*Please turn to the last page of the packet. This page has a word find on it. You may work quietly on this word find until the other classrooms are ready to switch."* When the other 2 classrooms are ready to switch, continue to step #	
19.	State to the students: "Please hand in your packets. *Thank you for working with us today.*" If students complain about not finishing the word find, let them tear off the back page and tell them they may complete it at home.	
20.	The research assistant should collect all of the packets.	
21.	State to the students: *All of the students in _____'s classroom, please pick up your pencil and line up to the left side of the door. All of the students in _____'s classroom, please pick up your pencil and line up to the right side of the door.*	
22.	The research assistants should then assist the students in getting back to their classrooms quickly and quietly.	
Total number of steps completed:		

Table 1

Demographic Characteristics of Participating Students (N=133)

	Conditions									
	Performance Feedback		Practice-Only		Instructional Control		Total Sample			
Characteristic	%	(*n*)	%	(*n*)	%	(*n*)	%	(*n*)	χ^2	*p*
Sex										
Female	59	(27)	46	(18)	56	(27)	54	(72)	1.71	.43
Male	41	(19)	54	(21)	44	(21)	46	(61)		
Ethnicity/Race										
African American/Black	76	(34)	80	(32)	71	(35)	74	(99)	8.36	.21
Native American	0	(0)	5	(2)	0	(0)	2	(2)		
White	18	(8)	15	(6)	20	(10)	18	(24)		
Hispanic/Latino	7	(3)	0	(0)	8	(4)	5	(7)		
Receiving Special Education Services	17	(8)	15	(3)	18	(9)	15	(20)	2.43	.30
Age	*M*	*(SD)*	*M*	*(SD)*	*M*	*(SD)*	*M*	*(SD)*	*F*	*p*
	8.78	(.39)	8.77	(.37)	8.93	(.44)	8.85	(.41)	1.71	.19

Table 2

Demographic Characteristics of Participating Teachers (N=9)

	Schools							
	A		B		C		Total sample	
Characteristic	%	(*n*)	%	(*n*)	%	(*n*)	%	(*n*)
Sex								
Female	100	(3)	67	(2)	67	(2)	78	(7)
Male	0	(0)	33	(1)	33	(1)	22	(2)
Highest degree held								
Bachelors	100	(3)	67	(2)	33	(1)	67	(6)
Masters	0	(0)	33	(1)	33	(1)	22	(2)
Not reported	0	(0)	0	(0)	33	(1)	11	(1)
Additional certification								
Special Education	100	(3)	33	(1)	*nd*		44	(4)
Missionary Teacher	0	(0)	33	(1)	*nd*		11	(1)
Literacy	0	(0)	33	(1)	*nd*		11	(1)
Years Taught	*M*	*(SD)*	*M*	*(SD)*	*M*	*(SD)*	*M*	*(SD)*
	17.33	(12.10)	8.17	(5.58)	7.33	(5.86)	10.94	(8.72)

Table 3

Correlation Matrix for Story Starters

Story Starter	1	2	3	4	5	6	7	8
1. It was so hot outside that we…	—	.53*	.50*	.59*	.48*	.54*	.50*	.64*
2. I was on my way home from school and...		—	.68*	.71*	.70*	.64*	.55*	.64*
3. I was talking to my friends when all of a sudden...			—	.65*	.73*	.73*	.58*	.57*
4. One day I found the most interesting thing...				—	.74*	.74*	.64*	.79*
5. One night I had a strange dream about...					—	.75*	.72*	.66*
6. One day my friend told me the strangest story...						—	.81*	.75*
7. I found a note under my pillow that said...							—	.65*
8. One day I went to school but nobody was there except me...								—

* $p < .01$

Table 4

Studies Examining the Validity and Reliability of Curriculum-Based Measurement in Written Expression

Study	Sample Grade Level	Metric	Criterion Measure	Validity Coefficient	Reliability Type	Reliability Measure
Deno, Mirkin, &	3-6	TWW	TOWL[a]	.41 - .82		
Marston, 1980		WSC		.45 - .88		
Marston & Deno, 1981	1-6	TWW			Parallel Forms	.95
		WSC				.95
Marston & Deno,1981	1-6	TWW			Split Half	.99
Study 2		WSC				.96
Videen, Deno, &	3-6	CWS	DSS[b]	.49	Interscorer	.90
Marston, 1982			TOWL[a]	.69		
			Holistic rating	.85		
Tindal, Germann,	4	TWW			Parallel Form	.70
&Deno, 1983						

Study	Sample Grade Level	Metric	Criterion Measure	Validity Coefficient	Reliability Type	Reliability Measure
Fuchs, Deno, &	3 – 6	WSC			Parallel Form	.55 - .89
Marston, 1982						
Marston, Deno, &	3 – 6	TWW			Interscorer	.96
Tindal, 1983		WSC				.91
Tindal, Marston,	1 – 6	TWW			Parallel Form	.73
&Deno, 1983		WSC				.72
Tindal & Parker, 1991	3 – 5	TWW	Stanford[c]	.18 - .25		
		WSC		.22 - .30		
		CWS		.31 - .41		
Parker, Tindal, &	2 – 5	TWW	Holistic rating	.36 - .49		
Hasbrouk, 1991		WSC		.43 - .64		
		CWS		.58 - .61		

Study	Sample Grade Level	Metric	Criterion Measure	Validity Coefficient	Reliability Type	Reliability Measure
Gansle, Noell,	3 – 4	TWW	WJ-R[d] Writing	.23		
VanDerHeyden, Slider,		CWS	Samples	.36		
Hoffpauir et al., 2004						
Malecki& Jewell 2003	1 – 8	TWW			Interscorer	.99
		WSC				.99
		CWS				.98

Note. TWW = Total Words Written; WSC = Words Spelled Correctly; CWS = Correct Writing Sequences

[a]Test of Written Language (Hammill & Larsen 1978, 1983). [b]Developmental Sentence Scoring (Lee & Canter, 1971).[c]Stanford Achievement Tests – Ninth Edition (Harcourt Educational Measurement, 1996). [d]Woodcock Johnson Tests of Achievement – Revised (Woodcock & Johnson, 1989).

Table 5

Baseline Academic Skills (N=133)

	Standardized Measures				Curriculum Based Measurement[c]					
	Test of Written Language[a]		Paragraph Copy Task[b]		TWW		CWS		Mathematics	
	M	*(SD)*	*M*	*(SD)*	*M*	*(SD)*	*M*	*(SD)*	*M*	*(SD)*
School										
A	96.72	(21.89)*	55.00	(26.24)	31.77	(13.59)	26.40	(12.77)	27.32	(12.87)
B	82.52	(32.42)	53.60	(28.08)	30.12	(11.13)	26.07	(11.16)	28.10	(13.07)
C	71.04	(37.14)	57.03	(31.08)	32.85	(12.17)	28.70	(12.73)	32.68	(13.14)
Condition										
Feedback	83.36	(33.28)	58.59	(28.86)	31.67	(12.63)	26.02	(12.75)	28.34	(13.18)
Practice-only	87.41	(30.35)	60.90	(23.36)	31.23	(12.26)	27.64	(11.27)	30.99	(12.35)
Control	82.70	(32.89)	46.70	(28.90)*	31.56	(12.65)	27.04	(12.64)	27.76	(13.66)
Sex										
Male	82.72	(33.94)	51.56	(29.76)	28.89	(11.58)	24.13	(11.35)	28.77	(14.31)
Female	85.37	(30.96)	58.03	(26.00)	33.72	(12.79)*	29.18	(12.52)*	29.02	(12.07)
Total Sample	84.31	(32.05)	55.04	(27.88)	31.50	(12.44)	26.86	(12.22)	28.91	(13.09)

Note. The Paragraph Copying Task score provided is a percentile rank, with average performance falling between the 25th percentile and the 75th percentile. The Test of Written Language – Third Edition standard scores are based on a standardized mean of 100 and standard deviation of 15.

[a]$n = 108$. [b]$n = 132$. [c]$n = 133$.

*$p < .05$

Table 6

Correlation Matrix for Baseline Measures

Measure	1	2	3	4	5
1. TOWL-3 quotient[a]	—	.42*	.41*	.39*	.39*
2. CBM-WE: TWW		—	.91*	.33*	.64*
3. CBM-WE: CWS			—	.44*	.61*
4. CBM-M: digits correct				—	.50*
5. Paragraph Copying Task[b]					—

Note. TOWL-3 = Test of Written Language-Third Edition; CBM-WE: TWW = Curriculum-Based Measurement in Written Expression, Total Words Written; CBM-WE: CWS = Curriculum-Based Measurement in Written Expression, Correct Writing Sequences; CBM-M = Curriculum-Based Measurement in Mathematics.

[a]The TOWL-3 quotient has a mean of 100 and standard deviation of 15. [b]Performance on the paragraph Copying Task was calculated as the total number of words written correctly in 90 seconds.

* $p < .01$

Table 7

Teachers' Perceptions of Instructional Environment

	School					
	A		B		C	
	M	*(SD)*	*M*	*(SD)*	*M*	*(SD)*
Minutes devoted to instruction/practice						
Handwriting	31.67	(38.84)	0	(0)	93.33	(62.45)
Spelling	45.00	(18.03)	40.00	(17.32)	80.00	(25.17)
Written Composition	160.00	(17.32)	130.00	(17.32)	103.33	(23.09)
Total basic skills[a]	76.67	(50.08)	40.00	(17.32)	173.33	(90.73)
Total	236.67	(53.93)	170.00	(34.64)	276.76	(81.45)
Writing Orientation Scale factors						
Correct writing	3.28	(.63)	3.00	(.33)	3.78	(.42)
Explicit instruction	4.56	(.51)	5.33	(.33)	4.67	(.33)
Natural learning	3.67	(.52)	3.83	(.38)	3.58	(.29)

Note. Ratings on the Writing Orientation Scale (Graham, Harris, MacArthur et al., 2002) were based on a Likert-type scale of 1 through 6, with 1 = strongly disagree and 6 = strongly agree.

[a] Basic skills instruction time was calculated by adding the minutes devoted to handwriting instruction and practice to the number minutes devoted to spelling.

Table 8

Multilevel Prediction Models for Total Words Written

Predictor	Unconditional model	Final model
	Fixed Effects	
Final status		
Intercept	34.82 (1.16)**	36.97 (2.43)**
Female		5.85 (2.03)**
School		-3.92 (1.41)**
Rate of change		
Time	0.56 (.14)**	1.45 (.27)*
Condition x time		-0.44 (.18)*
School x time		-0.50 (.17)**
Group Comparisons		
Final status		
School A vs. School C		6.26 (2.71)*
School B vs. School C		-3.10 (2.85)
Rate of change		
Feedback vs. control		1.65 (.31)**
Practice vs. control		-0.75 (.35)*
School A vs. School C		0.87 (.33)**
School B vs. School C		-0.11 (.35)
	Random Effects	
Final status	127.00**	116.37**
Residual	75.75**	73.98**
Pseudo R^2 statistic		0.12
Goodness of fit: χ^2	5518.5	5493.8
AIC	5526.5	5511.8
BIC	5538.0	5537.8

Note. Standard errors of parameter estimates are denoted in parentheses.

*p <.05.**p<.01.

Table 9

Multilevel Models for Correct Writing Sequences

Predictor	Unconditional model	Final model
	Fixed Effects	
Final Status		
Intercept	29.58 (1.06)**	30.13 (2.2)**
Female		5.61 (1.8)**
School		-2.20 (1.3)[a]
Rate of change		
Time	0.46 (.12)**	1.10 (.25)**
Condition x Time		-0.37 (.16)*
School x Time		-0.28 (.15)
Group Comparisons		
Final status		
School A vs. School C		3.32 (2.54)
School B vs. School C		-2.89 (2.67)
Rate of change		
Feedback vs. control		1.20 (.28)**
Practice vs. control		-0.64 (.32)*
School A vs. School C		0.46 (.31)
School B vs. School C		-0.22 (.32)
	Random Effects	
Final status	104.4**	95.75**
Residual	63.2**	62.39**
Pseudo R^2 statistic		0.10
Goodness of fit: χ^2	5518.5	5366.8
AIC	5526.5	5384.8
BIC	5538.0	5410.8

Note. Standard errors of parameter estimates are denoted in parentheses.

* $p<.05$. ** $p<.01$.

Table 10

Student Rating of Story Starter Prompts

Story starter prompt	*M*	*(SD)*
2. I was on my way home from school and…	4.16	(.90)
3. I was talking to my friends when all of a sudden…	4.03	(1.00)
4. One day I found the most interesting thing…	3.92	(1.07)
5. One night I had a strange dream about…	4.01	(1.04)
6. One day my friend told me the strangest story…	3.85	(1.12)
7. I found a note under my pillow that said…	3.90	(1.12)
8. One day I went to school but nobody was there except me…	3.94	(1.01)

Note. Acceptability of the story starters was rated on a Likert-type scale of 1 through 5, with 1 = not at all and 5 = very, very much.

Table 11

Student Ratings of Procedural Acceptability

	Feedback		Practice		Control		Total	
Procedures associated with CBM-WE (*N* = 107)	*M*	(*SD*)	*M*	(*SD*)	*M*	(*SD*)	*M*	(*SD*)
How much do you like writing stories with us each week?	4.12	(1.50)	4.48	(1.01)	3.71	(1.40)	4.07	(1.38)
How much do you like being timed while you are writing your stories with us?	2.00	(1.70)	2.89	(1.65)	1.98	(1.56)	2.22	(1.67)
Were there any times you didn't want to write a story with us?	3.59	(1.77)	4.04	(1.48)	3.00	(1.60)	3.48	(1.67)
Were there any times when you wished you could write more stories with us?	3.79	(1.79)	3.67	(1.52)	3.00	(1.73)	3.46	(1.73)
Do you think your writing has improved?	4.33	(1.30)	4.19	(1.24)	4.39	(0.92)	4.32	(1.15)
Do you think your writing has gotten worse?	4.33	(1.46)	4.37	(1.28)	4.22	(1.37)	4.30	(1.37)
Performance feedback condition (*n* = 39)	*M*	(*SD*)						
How much did you like being told how many words you wrote?	4.26	(1.45)						
How much do you think it helps when you are told how many words you wrote?	4.33	(1.30)						

Note. Answers were based on a Likert-type scale with 1 = not at all, and 5 = very, very much. Items 3 and 6 were reversed scored so that higher numbers represent higher acceptability.

Figure 1. Participant Flow Chart Following Consolidated Standards of Reporting Trials Guidelines

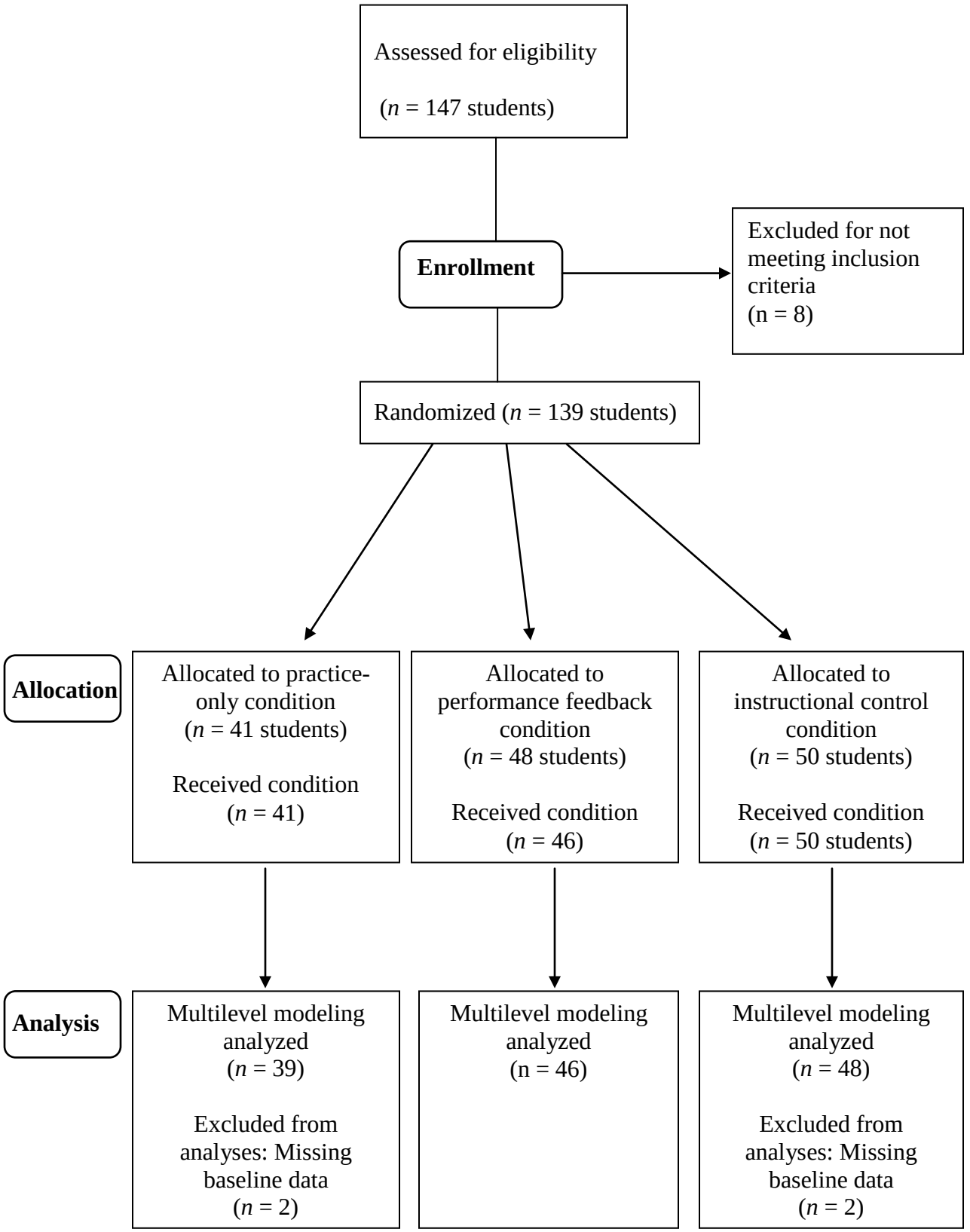


Figure 2. Growth trajectory for students' TWW by instructional practices

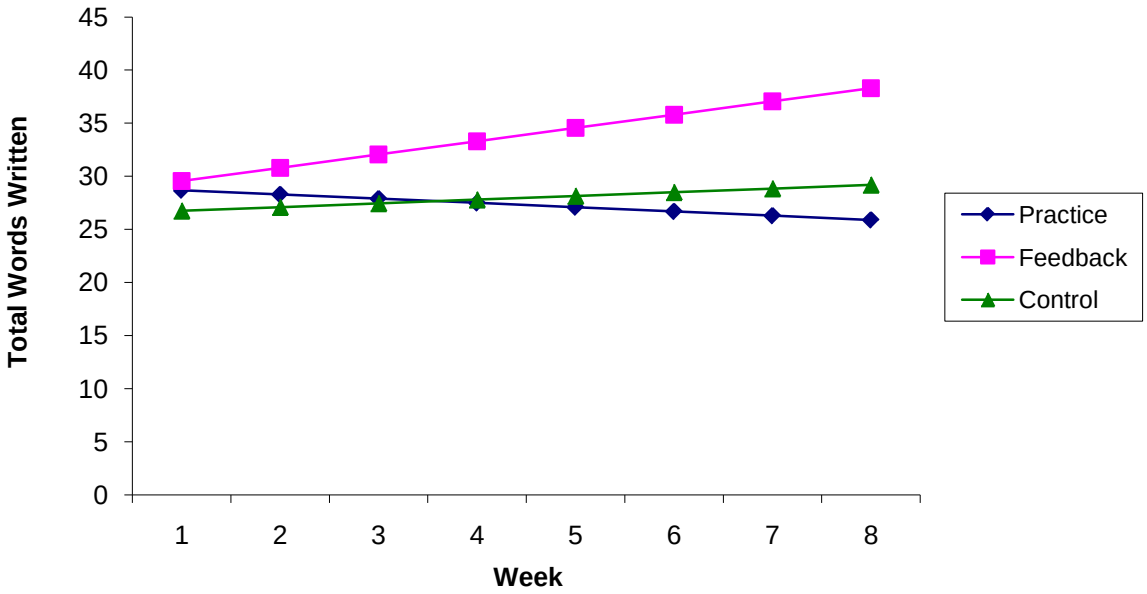


Figure 3. Growth trajectory for students' CWS by instructional practices

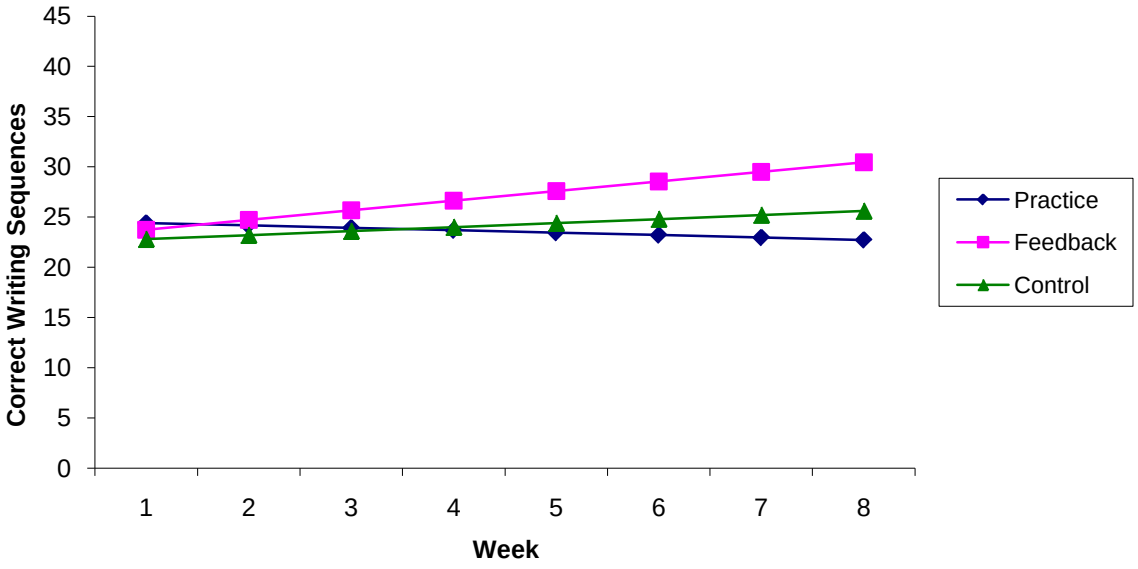


Figure 4. Growth trajectory for students' TWW by sex

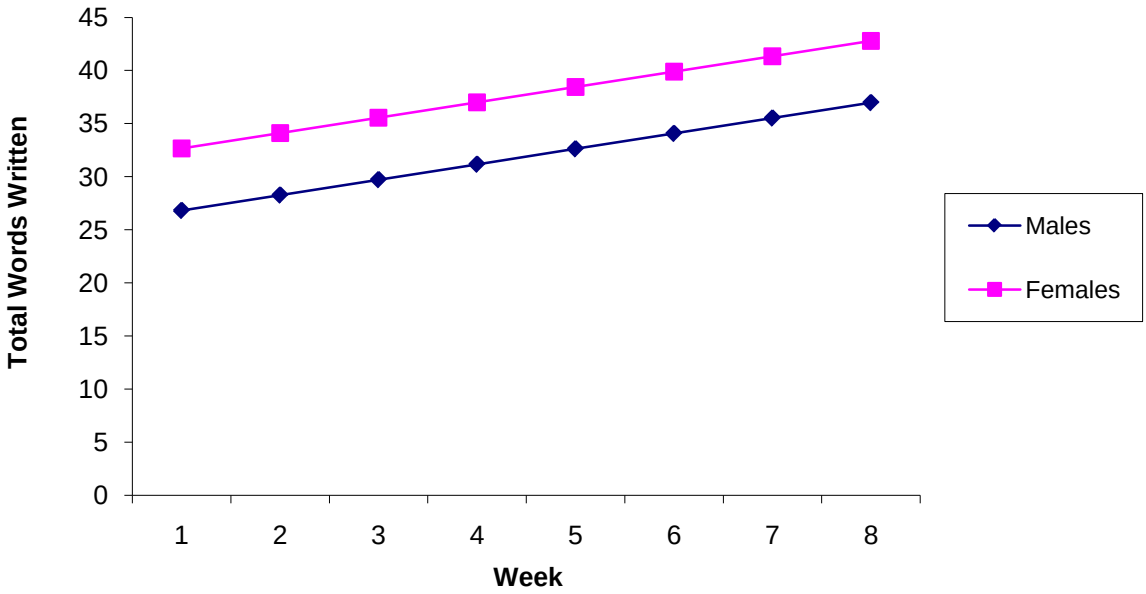


Figure 5. Growth trajectory for students' CWS by sex

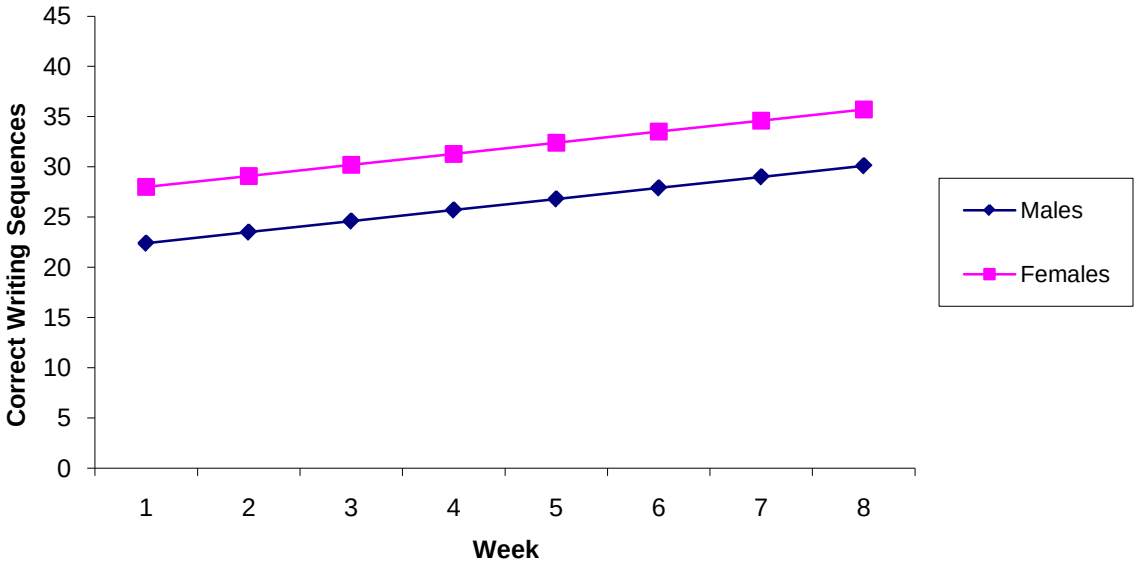


Figure 6. Growth trajectory for students' TWW by school assignment

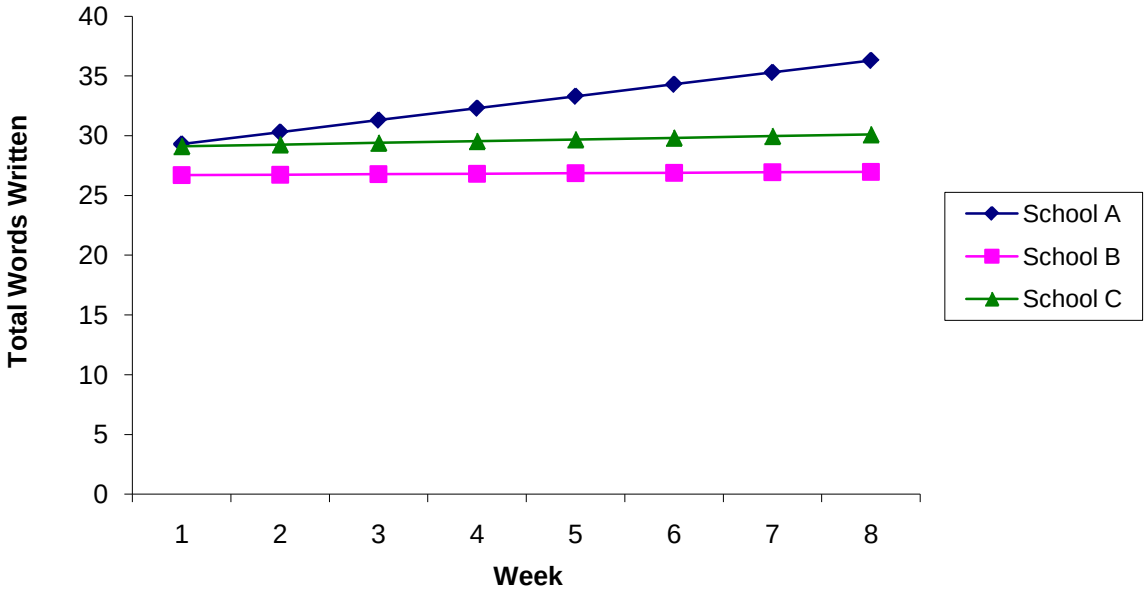
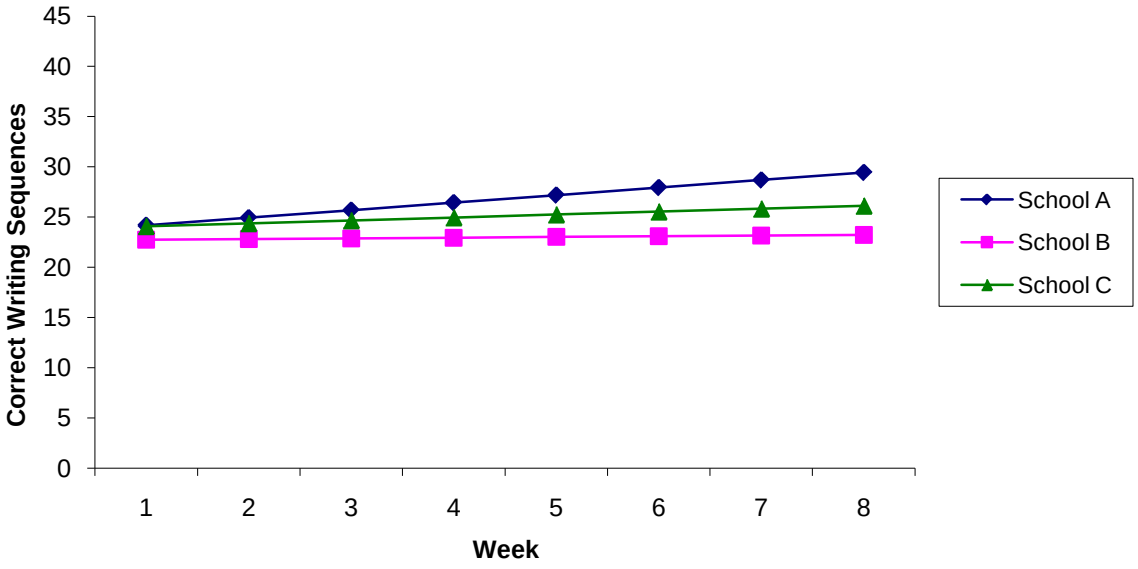


Figure 7. Growth trajectory for students' CWS by school assignment



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