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The impact of rewards on the effectiveness of performance feedback in improving writing production in elementary school students

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I am submitting herewith a dissertation written by Leslie Allison Hart entitled "The impact of rewards on the effectiveness of performance feedback in improving writing production in elementary school students." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in School Psychology.

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The impact of rewards on the effectiveness of performance feedback in improving writing production in elementary school students

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Dedication

For the late, great Shirley Mattson.

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Abstract

Approximately a quarter of students in classrooms across the United States meet minimum grade-level expectations in writing in national assessments (National Center for Education Statistics, 2012). The purpose of the present study is to elaborate on the role performance feedback can play in increasing student writing production through novel additions to established methodology. Specifically, an alternating treatments design was used to evaluate the impact of two iterations of a performance feedback intervention. The first evaluated how performance feedback (with two representations of total words written and a velocity indicator) impacts student writing production across production-dependent and production-independent variables. The second intervention combined performance feedback (presented in the same fashion as above) with rewards contingent on improved performance. Participants completed two writing prompts a week across a six to eight-week intervention phase. Results were evaluated through the visual analysis of each individual's writing production on measures of Total Words Written, Correct Writing Sequences, and Percent Correct Writing Sequences. Supplemental social validity scales and statistical analyses of effect sizes were also included. Results suggest no differentiation in data patterns between the two intervention phases, although the intervention phase did seem to improve writing production as compared to baseline.

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CHAPTER I
Review of the Literature

Writing is a foundational skill for students and is identified among the three areas that are fundamental to education - reading, writing, and arithmetic. It is a skillset that facilitates both creative and functional communication (Graham, 2008). Adept writers can compose anything from a poem to a grocery list. They can apply their knowledge of grammar, syntax, and prose to any number of subject areas and express both their understanding of concepts and their feelings about that same idea.

Writing is described as a necessary skill, one that begins in early elementary school, continues through higher education settings and into the workplace (Graham, 2008). The appearance of writing instruction and facilitating student writing success across educational policy in the United States echoes the importance the skill is given. Despite this importance, the national trend is not one of highly skilled writers. In fact, what is more often found is a compounding of poor writing skills across grade levels (Graham, McKeown, Kiuhara & Harris, 2012).

The National Assessment of Educational Progress (NAEP) evaluates writing skills across grade levels in a nationwide assessment of students in the fourth, eighth, and twelfth grade. To achieve proficiency in these assessments, students must meet minimal grade-level expectations. In 2011, only 27% of students in the 8th grade (and 24% of students in the 12th grade) were writing at the 'proficient' level (National Center for Education Statistics, 2011). These results replicates earlier data trends from 2002, where 28% of students in the fourth grade, 31% of students in the eighth grade, and 23% of students in the twelfth grade performed at the 'proficient' level for their grade (National Center for Education Statistics, 2003). This trend

follows years of nationalized assessment finding the same pattern of data, where writing performance skewed heavily towards underperforming writers across grade levels.

Nationwide assessments demonstrate that students across grade levels have difficulty performing to expectations when given a writing task (National Center for Education Statistics, 2003; National Center for Education Statistics, 2012). This lack of skill impacts student perceptions of writing assignments. Students from kindergarten through high school persist with the mindset that writing is a difficult task. When prompted, explanations for this opinion vary. Some students pin a distaste for writing on difficulty spelling, others cite an inability to think of anything to write, and some mention the lack of time spent teaching them how to write as adding to the stress. The pervasive opinion that writing is a difficult task creates a self-fulfilling prophecy. What was just an opinion on an academic area begins to impact performance. These students begin to display strategic behavior, writing skills, knowledge, and motivation that differ significantly from more skilled writers (Graham & Harris, 2010). Addressing this cyclical problem of struggling writers again becomes the focus.

Following the National Assessment of Educational Progress' 2003 report, policymakers responded by establishing commissions to address this writing deficit. The National Commission on Writing spoke directly to addressing these shortfalls through writing-centered instruction across subject areas. While no national standards resulted from the establishment of the commission, the task was put to the states to create best-practices centered writing standards for their classrooms (National Commission on Writing, 2003). The most recent iteration of public policy, the Common Core State Standards, again emphasizes writing as an invaluable component of the classroom. The Common Core State Standards build a K-12 curriculum that

aims to produce high school graduates capable of writing coherently in both academic and vocational settings (Costa, Hooper, McBee, Anderson, & Yerby, 2012).

As suggested by the writing goals for graduates in the Common Core State Standards, writing skills are not only important to the public education system in the United States. An inability to write clearly and effectively can be seen even at the undergraduate and graduate level (Achieve, Inc., 2005; Duijnhouwer, Prins & Stokking, 2012). A survey of university faculty found that nearly half of high school graduates cannot meet the requirements of writing at the university level. Of those students who enter the workplace following high school graduation, 38% do not have the skills to write of sufficient quality for their job (Achieve, Inc., 2005). This statistic is particularly disheartening as businesses shifted towards models dependent on producing clear written documents, ranging from daily reports to email messages (Graham & Harris, 2010).

When the National Commission on Writing (2003) described writing as the "neglected R" (p. 9), they framed it as a direct comparison to the fields of reading and arithmetic education. Both researchers and politicians have noted the trend of declining writing skills across grade levels compounded by little time dedicated to writing instruction and practice in the classroom. While literacy is a coupling of an individual's ability to read and write, it seems that reading garners quite a bit more attention, funding, and interest (Graham, 2008). The No Child Left Behind Act of 2001 specifically emphasized reading in its realization of education standards, with no mention of writing (Gansle, VanDerHeyden, Noell, Resetar, & Williams, 2006). This leaves half of the puzzle of developing literacy in students unanswered. To complete the puzzle, it is important to understand how writing develops.

Theories of Writing Development

Cognitive Processing Models. At their core, cognitive models describe how stimuli bridge the gap between the external environment and the internal cognitive processing of an individual. That transference from external stimuli to internal cognitive processes is fundamental in so many areas of life, and finds particular application to the writing process.

Stimuli in the environment are initially stored in a very limited-capacity sensory input. To maintain this information, it is transferred to the Short-Term Memory (STM) component. STM, then, is composed of several smaller units dedicated to processing different types of information. While initial models of STM proposed a three-part process, revisions include a total of four units: a phonological loop, a visuospatial sketchpad, an episodic buffer, and the central executive (Baddeley & Hitch, 1974; Baddeley, 2000; Cowan, 2008).

The phonological loop processes auditory information (Baddeley, 2000; Baddeley, 2003; Cowan, 2008). A student who strings together phonemes mentally prior to pronouncing a word makes good use of their phonological loop. Dissimilar-sounding phonemes and short words are more easily rehearsed and remembered (Baddeley, 2000). This aspect of short-term memory is hypothesized to mediate sentence construction, particularly for those students who verbally mediate their brainstorming during a writing session (Baddeley, 2003). The visuospatial sketchpad allows for storage and manipulation of visual and spatial information (Baddeley, 2000; Baddeley, 2003; Cowan, 2008). Applied to writing, this component would involve the maintenance of a logical spacing between letters, words, and spaces on a page. More complex visual data might be the structuring of an essay, or the formatting of a letter (Baddeley, 2003). The episodic buffer allows for chunking of information across the two initial processing units and plays a role in long-term storage (Baddeley, 2000; Baddeley, 2003; Cowan, 2008). This

chunking could allow an individual to couple the phonemes, letters, and spacing units of information required to write a single word on a piece of paper. The final component, the central executive, attends to the different aspects of short-term memory. This element is the likely cause for individual differences in short-term memory (Baddeley, 2000; Baddeley, 2003). The central executive plays a role in the fluidity of sounding out or spelling unfamiliar words (Baddeley, 2003).

Initial models had a simple dual relationship between short- and long-term memory, with no additional stages or processes (Baddeley & Hitch, 1974; Baddeley, 2003, Cowan, 2008). More recent researchers of writing struggled to agree with a concise and linear definition of writing. What was once a hierarchical, orderly set of instructions morphed into a new understanding of working memory. This stage of cognitive processing balances a large number of ideas and stimuli simultaneously and attempts to make sense of it all. In practice, working memory in the writing process is a process similar to composing a sentence in your mind and forgetting it entirely when the time comes to put pen to paper (Hayes, 2006). That forgetting stems from the number of tasks the working memory attempts to complete. It balances words, inflection, cohesiveness, lexical structure, and every other minute detail of the writing process contained in the scope of one written composition (Torrance & Galbraith, 2006). Therefore, writing is a problem-solving process, one that draws across the components of working memory to produce words on paper (Bruning & Horn, 2000; Cowan, 2008).

Capacity theory of writing. Flower and Hayes (1981) identified the involvement of working memory as primarily coming from the executive control, or monitor. The central executive receives input across the multiple domains of short-term memory and attends to the relevant information (Baddeley, 2003). The writer, in this understanding, is conscious of all

steps associated with the task and involved in all parts of organizing and orienting their short-term memory to the writing task at hand. It is an entirely deliberate process, completely and consciously controlled by the writer. Those writers who have higher levels of executive control, in turn, make for better writers (Torrance & Galbraith, 2006). Therefore, writing performance stems from a writer's ability to control the three cognitive writing processes- planning, translating, and revision (Flower & Hayes, 1981; Hayes, 2000). While the writer balances a number of ideas and stimuli in short-term memory, the central executive component holds the responsibility for producing a coherent, logical, and grammatically correct sentence (Torrance & Galbraith, 2006).

One of the first theories of writing development was the cognitive approach described by Flower and Hayes (1981). Writing was understood as a production of the inner workings of one's mind, where a hierarchical ordering of multiple processes worked towards goal-directed writing (Flower & Hayes, 1981). This focus on the inner cognitive workings stemmed from what they viewed as a shift from product-oriented instruction in writing to process-oriented instruction. By modifying existing theory, the researchers aimed to better link theory and practice, and better provide evidence-based teaching practices for this perceived shift in writing instruction (Hayes & Flower, 1986). Flower and Hayes conceptualized writing as a logical, linear progression from the idea of a sentence, processing through working memory, and resulting in a coherent written sentence. These stages of planning, translating, and revising were thought to describe the writing process across ages and skill levels. Both planning and revising were hypothesized to engage several sub-processes along the way to composing a fluid written piece (1981).

At the first stage, the writer, cognizant of the goal of their writing, develops a plan of action (Flower & Hayes, 1981). For an experienced writer, this plan is flush with ideas and

knowledge representations, drawing across different subject areas to create a writing plan. It is organized in a hierarchical fashion, but a dynamic hierarchy, where ideas can shift, be reorganized or restructured entirely based on the demands of the task at hand. The sheer amount of information in an experienced writer's plan differentiates it from a beginning writer (Hayes & Flower, 1986).

The second stage describes the writer's ability to transcribe the information in their writing plan to the writing itself (Flower & Hayes, 1981). This is likely one of the more cognitively taxing aspects of writing. Sentences are pieced together in phrases, building from left to right. When asked to think aloud while composing a written piece, writers (regardless of expertise) used only 75% of those phrases in their think-aloud in the final written piece. Where expertise makes a difference is in the length of the phrases when building sentences and the length of the final written product (Hayes & Flower, 1986).

The final stage in the Flower and Hayes model is revising. Here, the writer makes changes across the whole draft (Flower & Hayes, 1981). An effective revision stems from both recognition of mistakes and the knowledge of how to improve upon said mistakes. Here, expertise plays a significant role. Inexperienced writers might not recognize where editing is needed, or apply unnecessary changes to their writing (Hayes & Flower, 1986).

The Simple View of Writing. The Flower and Hayes (1981) model best describes the writing process of writers with some established skill. The simple view of writing refines the capacity theory of writing to focus on a population developing writing skills. The cognitive processes of developing writers are not synonymous with a theoretical model for established writers (Berninger & Swanson, 1994).

While still centered in the working memory component of cognitive processing, this theory reworks the planning and revising stages described earlier. Rather than each acting as a distinct cognitive process, they function jointly under the umbrella of higher-level executive functions in the simple view of writing. Also included amongst these executive functions are other self-regulatory processes, like reviewing (Berninger & Chanquoy, 2012). When these processes work together, the individual is able to produce text and create a written product (Berninger et al., 2002). The higher-level executive functions, in turn, manage smaller self-regulation processes during writing (Berninger & Chanquoy, 2012). Self-regulation processes in beginning writers differ from their presentation for adult writers (Berninger & Chanquoy, 2012). An initial self-regulation process is goal-setting. Novice writers use their working memory to constantly self-check, reassess, and reestablish different goals associated with their writing (Berninger et al., 2002). Those students who struggle with spelling and handwriting might establish smaller goals than their peers. Establishing a goal to write a sentence (and accomplishing that feat!) is a strong step in self-regulation during the writing process.

Translation skills make up the second component of the simple model of writing. From the developmental perspective, translation involves two individual steps: transcription and text generation (Berninger et al., 2002; Berninger & Chanquoy, 2012). Here, the beginning writer must first identify ideas and thoughts to put to paper. These initial thoughts must be translated to be manipulated in the working memory. Transcription, then, comes into play as the idea flows from the representation in the working memory into appropriate language symbols. Put simply, transcription is the development of handwriting and spelling (Berninger & Chanquoy, 2012). This skill can be dependent on motor milestones, as the child must also have the motor coordination to produce legible text (Abbott & Berninger, 1993; Berninger et al., 2002).

Text generation skills are the next developmental step, where students generate ideas and words and transpose them into grammatically correct, coherent sentences (Berninger et al., 2006). The skill focus here is first on word generation, then sentence composition, and finally a whole written composition (Berninger & Chanquoy, 2012). As a beginning writer hones their transcription skills and becomes more skilled in their alphabetic coding, spelling, and knowledge of syntax, more and more of the working memory can be dedicated to higher-level composition processes (McCutchen, 1996).

In application, the simple view of writing describes a progression in writing skills beginning in the elementary years. The first writing skill to develop is transcription. Text generation is the next skill, followed by revision and planning. Revision requires editing of individual words at the elementary level, but develops to sentence-level revisions as the student ages. The planning component is involved in word selection, word planning, and sentence planning as the individual is composing a written work. As the writing skill develops, the individual produces words first, then complete sentences, and finally a coherent paragraph (Berninger & Chanquoy, 2012; Berninger & Swanson, 1994). An individual's development of writing skills can best be honed through practice. Repeated exposure and practice in transcribing and generating written text can help build to mastery of the writing skill (Berninger et al., 2006).

Application. Each of these two theoretical approaches to understanding writing center on unseen cognitive processes. A solid understanding of these different processes can shape the efficacy and usefulness of interventions. Effective interventions stem from effective theories. De La Paz and Graham (2002) explicitly link their intervention to theory, and credit the validity of their intervention to that theory-intervention link. Through direct instruction of different cognitive components from writing theory (*e.g.* planning, revising), the researchers further

validated the writing-process instruction and continue the understanding of cognition as it relates to writing (De La Paz & Graham, 2002).

Instructional Hierarchy

To link theory and practice, Haring and Eaton (1978) suggested a systematic approach to understanding student skill acquisition in the classroom. Their approach was behavioral in nature. By understanding how students acquire academic skills, educators could better shape their instruction to encourage students along the stages (Ardoin & Daly, 2007; Daly, Lentz & Boyer, 1996). As opposed to cognitive theories of how students think while writing, the instructional hierarchy focuses more on output: what their writing looks like and how their skills compare against their peers. Through understanding the current academic skills of a student, an educator is better able to tailor instruction and intervention (Wright, 2003). This model has stood the test of time, and continues to shape both education research and intervention in the classroom through to the present day (Ardoin & Daly, 2007; Martens & Eckert, 2007).

The first stage of the instructional hierarchy is acquisition. At this stage, a student progresses from the first initial understanding of an academic skill to producing that skill independently and accurately (Haring & Eaton, 1978; Wright, 2003). The instructional hierarchy dictates the form intervention should take (Daly et al., 1996). Initial emphasis is on developing accuracy (Haring & Eaton, 1978, Wright, 2003). In writing, this could be the development of writing the letter ‘s’ from initial scribbles on a piece of paper to the complete letter. At this point, instruction should include modeling, prompting of the skill, and repeated practice (Haring & Eaton, 1978). In addition, the teacher should work to provide immediate, corrective feedback to shape future instances of the skill and promote accuracy (Wright, 2003).

The second stage considered in the instructional hierarchy is fluency. At this point, the student can accurately complete the academic task at hand, but does so slowly (Haring & Eaton, 1978, Wright, 2003). Here, a child might take a long amount of time, but be able to write the alphabet. When writing, the child might focus primarily on the construction of each individual letter, which takes away from the task at large. By building fluency in handwriting, later, more advanced, writing skills can build and develop. Fluency can be taught through a number of instructional strategies. Teachers can build fluency through drill and practice activities, or use strategies such as explicit timing with feedback to the student on work completion rates (Wright, 2003). Reinforcement of the desired skill can also facilitate fluency building and incentivize student performance on repetitive fluency-building exercises (Daly et al., 1996; Haring & Eaton, 1978).

The third stage in the instructional hierarchy is generalization. Here, the student is able to apply the academic skill across a variety of novel stimuli (Daly et al., 1996; Haring & Eaton, 1978). While initial reinforcement of generalization may involve some direct instruction on the part of the educator, the ideal application has the student independently generalizing their skillset (Wright, 2003). For example, a student comfortable with the construction of first-person narratives in their writing should generalize those core grammar and writing skills to novel writing tasks. This could involve constructing a book report or an essay for social studies. To guide students into generalization of a skill set, teachers might incorporate differentiation or discrimination tasks (Haring & Eaton, 1978).

The fourth stage is application and adaptation, where a student can accurately and fluently produce the academic skill in question, but now must adapt it to fit any number of scenarios. For a student whose writing is successful in the classroom, this might be applying

their knowledge of writing to cover letters and other vocational areas. To build adaptability of a skill, teachers may introduce any number of scenarios in the classroom, allowing simulated practice of established skills (Haring & Eaton, 1978).

When compared to reading and arithmetic, little evidence exists at the intersection of the instructional hierarchy and writing skill acquisition. A student who performs at a frustrational level might benefit from interventions targeted to the earlier stages of the hierarchy. This could involve modeling (from the teacher) in writing simple sentences in response to a prompt. Accuracy could also be built through the use of feedback that helps to correct student writing. Those students able to accurately write could instead focus on fluency-building and generalization (Parker, McMaster, & Burns, 2011).

Effective Writing Interventions

Researchers have focused on constructing effective programs to build writing skills. Duijnhouwer et al. (2012) describe writing interventions as falling in line with one of two approaches. The first approach targets the affective response of the student, addressing self-efficacy, anxiety, and other psychological responses to a writing assignment. Another approach focuses specifically on the writing product itself, promoting skill acquisition and improvement of existing skills (Duijnhouwer et al., 2012). A number of researchers have attempted to identify effective ways to address writing skills in students. Meta-analyses allow researchers to assess which programs demonstrate more-than-chance improvements in student performance. However, few studies clearly delineate the impact of skill-based interventions in writing (Graham, McKeown, Kiuhara & Harris, 2012; Graham & Perin, 2007).

Writing Instruction. Given the vast number of students who do not meet grade-level expectations, initial hypotheses suggested that ineffective writing instruction was the primary

cause of the problem. A meta-analysis by Graham and Perin (2007) reviewed writing instruction approaches for students in grades 4-12. Average weighted effect sizes were calculated for 11 types of interventions, all of which produced positive effect sizes above zero except for the category of grammar instruction (-0.32). The remaining interventions included teaching planning/revising strategies (0.82), instruction in summarization (0.82), peer planning/revising groups (0.75), goal-based writing instruction (0.70), word processing (0.55), sentence combining (0.55), process writing approach (0.50), inclusion of inquiry in the writing process (0.32), prewriting (0.32) and use of writing models (0.25) were all found to have positive effects on student writing. Limitations to this meta-analysis included only one approach (strategy instruction) being linked to positive outcomes for 'struggling' writers. Additionally, instruction that targeted beginning writers was excluded from analysis (Graham & Perin, 2007).

A further study by Graham et al. (2012) examined different instructional approaches (i.e., explicit instruction and scaffolding). Instructional techniques in the explicit instruction group with significant effect sizes included strategy instruction (1.02), self-regulation and strategy instruction (0.50), instruction in text structure (0.59), instruction in creativity (0.70), and instruction in transcription (0.55). A second category of instructional approaches included effective techniques in supporting and/or scaffolding student writing. These included prewriting (0.54), peer help and facilitation (0.89), goal setting (0.76), and revision/assessing (0.42) (Graham et al., 2012).

Writing Interventions. Following writing instruction, research focused next on how to supplement instruction with effective interventions. Rogers and Graham (2008) focused on writing skill acquisition at the individual level, examining single-subject design research to find effective writing strategies. With the exception of one intervention, self-monitoring, all

programs showed some improvements in writing skill, quantified as both median and mean Percentage of Nonoverlapping Data (PND) above 50%. A number of categories were determined to be effective intervention programs: strategy instruction for planning (median PND for elements, productivity, and quality = 100%, 95%, 99%), instruction in writing a paragraph (median PND =100%), instruction in editing (median PND = 100%), instruction in grammar (median PND = 84%), word processing (median PND = 75%), sentence construction (median PND = 83%), prewriting (median PND = 55%), goal setting (median PND = 91%), and reinforcement (median PND = 100%). These practices resulted in increases in writing production for elementary-aged students, and the results included both average and struggling writers. The specifics of the data included in the scope of the PND analysis depended on the variables within each study. While most looked at writing production, some included other elements, like writing elements, in their analysis.

None of the above meta-analyses specifically mention performance feedback as an effective strategy for either writing instruction or individual intervention. However, Rogers and Graham (2008) found that establishing clear goals and providing rewards for student writing was effective for individual participants. In addition, classwide goal-setting was reviewed in the Graham et al. (2012) study and found to be an effective writing instruction strategy. Furthermore, research has shown performance feedback to be useful for improving reading fluency and recent research indicates that performance feedback may be a very effective strategy for improving writing production (Eckert et al., 2006; Truckenmiller et al., 2014).

Performance Feedback

Performance feedback describes a dynamic relationship between an individual and an evaluation of their work. This evaluation can come in many forms and from a number of

different sources, ranging from a teacher or peer to a computer (Hattie & Timperley, 2007). Early consideration of performance feedback as an academic intervention was derived from behavioral theory, where students would respond to feedback about their work and shape future instances of the target behavior. Van Houten first tested this link across a number of studies that evaluated the efficacy of performance feedback and found positive results in writing production gains. However, the function of various other aspects of the methodology (e.g. public posting of individual performance, explicit timing, tangible rewards, and self-scoring) makes it difficult to claim a singular relationship between performance feedback and writing fluency (Van Houten, 1979; Van Houten, Morrison, Jarvis, & McDonald, 1974; Van Houten, Hill, & Parsons, 1975). As the field and education policy has evolved, public posting of performance may now cross ethical lines with regard to individual student's privacy and is no longer used in educational settings. However, these studies were among the first to point to performance feedback as an intervention for writing production.

Performance feedback, not linked solely to writing, is discussed in the context of feedback as an effective teaching practice. A consideration by Kluger and DeNisi (1996) found that feedback on a task is most beneficial when linked to a students' correct answers (rather than highlighting the incorrect) and when it links performances across time or trials. In this study, the effect size for feedback on performance, broadly defined, was 0.55, indicating a moderate effect. Taking this broad brushstroke of effective feedback and applying it to specific academic areas becomes the challenge.

A modern perspective on performance feedback does not keep the strict behavioral definition. Rather, students interact with the feedback received on their work. Their ability to process this feedback plays a significant role in how future work will change. This speaks more

to a cognitive-behavioral perspective on performance feedback as an instructional tool (Eckert et al., 2006; Eckert, Truckenmiller, Rheinheimer, Perry, & Koehler, 2008) and allows for the individual to consciously or unconsciously shape how feedback is processed. Struggling readers may not respond well to written performance feedback, due to that inability to make the cognitive connection. That missed connection could prevent future improvement because a link was not made between the feedback and the student's performance. Lovett and Eckert (2009) elaborated on this relationship and postulated that those students who demonstrated a responsiveness to the performance feedback (particularly, in receiving good feedback for improved performance) accounted for 40% of the variability in intervention effectiveness.

More recent considerations of performance feedback with elementary aged populations have found encouraging results. A two part intervention by Eckert et al. (2006) found that performance feedback once a week on CBM-WE prompts resulted in moderate gains in writing production. In the first study, 50 third-grade students were randomly assigned to either performance feedback or control conditions. Those students in the performance feedback condition completed a writing prompt once a week, with one minute of prewriting and three minutes of composition. They also had an individual performance feedback sheet, where they could reference the previous week's prompt and view their performance. Feedback was based on the total number of words written the previous week, along with a velocity indicator symbol used to represent an improvement, maintenance, or decrease in production. This velocity indicator was an arrow, pointing up or down, or an equal sign. This intervention took place across 8 weeks, with students in both the intervention and control conditions completing one writing curriculum-based measure (CBM-WE) per week. Analyses indicated a significant difference between the control and performance feedback groups across the two dependent

variables considered, a fluency metric (Total Words Written, TWW) and accuracy metric (Words Spelled Correctly, WSC). Significant differences were found across both TWW ($F(1, 49) = 10.82$, $p = 0.002$) and WSC ($F(1, 49) = 13.87$, $p = 0.001$).

The second consideration of performance feedback included 42 students in the third grade. Here, researchers considered how the frequency of feedback might impact student gains in writing. Participants were randomly assigned either the control condition, once-weekly feedback, or feedback three times a week. The feedback, again, was an indication of the total number of words written and a velocity indicator. Across the six-week intervention phase, all conditions wrote stories for 20 minutes three times a week. Significant differences relative to mean slopes between the intervention and control conditions were found with TWW, ($F(1, 41)=3.28$, $p=0.03$). No significant difference between mean slopes was found for WSC. Additionally, there was no significant difference between the two intervention conditions, implying that the amount of feedback a student receives on their work may not result in significant differences in their writing production (Eckert et al., 2006).

A follow-up study with 28 third-grade students analyzed how different writing metrics (TWW, CWS) changed across the scope of a performance feedback intervention and/or control condition. Those students in the performance feedback intervention group were considered 'academically at-risk.' The intervention consisted of an instructional feedback sheet where students could see how many words they wrote the previous week and a velocity indicator (i.e., up or down arrow). After two weeks of baseline and six weeks of intervention, results indicated a significant improvement for those students in the performance feedback condition as they made greater gains over time across both TWW and CWS metrics. Significant differences were found between groups for TWW, $F (1, 27)= 4.57$, $p=0.04$. Using grade-level expectations, further

analyses showed a significant percentage of students in the performance feedback condition were identified at the frustrational level at baseline progressed to either instructional (25%) or mastery (41.7%) levels at the end of the intervention phase. For those students who began at the instructional level, 66.7% met mastery-level criteria following the intervention (Eckert et al., 2008).

Truckenmiller and colleagues (2014) elaborated on the gains made in writing with performance feedback and found that gains in writing production exceed those made through practice alone. Participants included 139 students in the third grade who were randomly assigned to one of three conditions: performance feedback, practice-only, and a control. Those students in the performance-feedback condition completed a curriculum-based measurement of writing along with access to a feedback page, where students could view their total words written and an arrow indicating how their performance compared to the week prior. Analyses found that the performance feedback intervention resulted in statistically significant improvements in writing fluency. The researchers also noted an additional level of clinical significance, where participating students in the performance feedback condition moved from below instructional level to above instructional level.

Hier and Eckert (2014) built on the role of performance feedback as a tool for writing instruction with a three-part study. Two groups, performance-feedback and practice-only, progressed through baseline, intervention, and generalization/maintenance stages. The students in the performance feedback group again had a delay in their feedback, with the researcher prompting students to refer to their previous performance at the beginning of each session, prior to completing a CBM. Following six weeks of intervention, students completed a generalization prompt and three maintenance sessions. Again, results supported the role of performance

feedback as a weekly intervention to promote writing production (defined as CWS and TWW). Feedback was given based on improvement in CWS, and analyses found that those students in the performance feedback condition showed weekly gains of 2.62 CWS, as compared to 0.35 CWS in the practice only condition.

Across recent iterations of performance feedback, a constant of classwide, group design remains (Eckert et al., 2006; Eckert et al., 2008; Hier & Eckert, 2014; Truckenmiller et al., 2014). While a classwide research design allows for an intervention to reach a large number of students and provides power to more complex statistical analyses, there is a significant gap in the application to small n design. Given the past research, it is not clear how individual students respond to the performance feedback interventions. In addition, the interventions evaluated in these studies did not incorporate the use of reward.

Reward. Research into extrinsic reinforcement in the classroom setting include 40 years of successful applications across academic and behavioral concerns (Akin-Little, Eckert, Lovett, & Little, 2004). Reinforcement for exhibiting certain academic behaviors appears as an effective teaching technique in Haring and Eaton's (1978) instructional hierarchy. For a student transitioning from initial skill acquisition to rapid, accurate skill production, reinforcement can be useful in helping that student build fluency and encourage motivation.

Use of extrinsic rewards in promoting student writing remains an ill-defined area. In the scope of an analysis by Rogers and Graham (2008), reinforcement was operationally defined to include a number of different elements. This definition included public posting of student performance, teacher praise, and group contingencies for reinforcement. While writing productivity improved, the studies involved in this review lacked experimental control. This calls into question the generalizability of the results.

Summary

Writing, a foundational skill for students across the nation, remains an area of difficulty for educators and researchers alike. National assessment of writing skills indicates approximately 75% American students' writing is categorized as not proficient (National Center for Education Statistics, 2012). Decades of research focused on creating effective and efficient writing interventions. Meta-analyses specific to single-subject writing interventions identify several interventions as significantly improving student writing production (see Rogers & Graham, 2008). Performance feedback interventions grasp several instructional strategies identified as effective for students in the first stage of the Instructional Hierarchy (Eckert et al., 2006; Eckert et al., 2008; Truckenmiller et al., 2014). While seminal (Van Houten, 1979; Van Houten, Morrison, Jarvis & McDonald, 1974; Van Houten, Hill, & Parsons, 1975) and recent (Eckert et al., 2008; Hier & Eckert, 2014; Truckenmiller et al., 2014) group studies have supported the use of performance feedback as a writing intervention, there has been no examination of the impact of performance feedback on individual student progress. In addition, performance feedback often is used as one component within a multi-component intervention program. The isolated impact of performance feedback on individual student performance has not been examined. Furthermore, research has not examined the role that reinforcement has on the effectiveness of performance feedback. Therefore, the following study is proposed to fill these gaps in the research.

Purpose of Proposed Study

As demonstrated by a national writing evaluation, many students lack writing skills appropriate to their grade-level expectations (National Center for Education Statistics, 2003; National Center for Education Statistics, 2012). The research on performance feedback as an

instructional tool has found success both in production-dependent writing metrics and in social validity, framing it as a successful and well-liked intervention to promote student writing (Eckert et al., 2008; Hier & Eckert, 2014; Truckenmiller et al., 2014). This intervention paradigm, then, can reach a large number of students who do not meet grade-level expectations for writing and can help them improve writing production.

However, performance feedback interventions are not frequently used in a classroom setting, due to any number of reasons stemming from the training found in teacher education programs, misinformation, and a lack of awareness of the link between fluency-building interventions and student academic achievement and progress (Eckert et al., 2008). A national survey found that 42% of teachers made few to no adaptations for students who fall behind expectations for writing, perhaps due to some underlying assumption that an intervention would be both time-consuming and a simple matter of re-teaching the material (Graham, Harris, Fink-Chorzempa, & MacArthur, 2003). However, previous research describes performance feedback as an effective writing intervention that does not require an extensive amount of time or energy to implement (Eckert et al., 2008; Hier & Eckert, 2014; Truckenmiller et al., 2014). Moreover, it seems a strong fit for promoting student writing in the scope of several different theories of how students acquire the skills to write and cognitively process the demands of the task.

While these easy-to-use interventions focused on promoting writing fluency have gained momentum in the literature, it is difficult to bridge the gap between research and practice. Eckert et al. (2008) describe fluency-based interventions as a missing piece in writing instruction. While performance-based interventions are being used in reading and mathematics instruction, there is a considerable deficit in its consideration in both writing research and practice. For an intervention that takes little instructional time, produces effective results, and is inexpensive to

use, it certainly does not get enough credit. For those students able to accurately write a response to a writing prompt, fluency building seems the next logical step. This is particularly salient when viewing academic skill development through the instructional hierarchy paradigm, where the second stage in academic skill acquisition relies on fluency building (Wright, 2003).

One principle strength of this proposed study will be the use of a small n design. By focusing on the individual student, researchers will more clearly ascertain how performance feedback shapes student writing. Previous research at the classwide level demonstrated significant improvements for at-risk students (Eckert et al., 2008). Several recent studies of performance feedback focused on between-groups analyses to demonstrate gains in writing fluency and performance (Hier & Eckert, 2014; Truckenmiller et al., 2014). The second intervention component in this proposed study, individual reward, has not been examined as an intervention linked to improvements in writing production, and was notably absent from a recent meta-analysis (see Rogers & Graham, 2008).

The purpose of this study is to blend several established lines of research to evaluate their joint impact on student writing performance. Multiple components of the intervention, explicit feedback and extrinsic reward, seem effective when used as a singular intervention. However, significant limitations both in this area of writing research and writing research in general merit further investigation. This study aims to further validate the use of performance feedback as a tool to improve student writing production. It will provide the first consideration of performance feedback within the scope of single-subject design and provide idiosyncratic data on the acceptability of the intervention for each participant. While previous study designs have allowed for statistical analysis at the individual level (Hier & Eckert, 2014; Truckenmiller et al., 2014), this study will couple the framework and design of a single-subject study with individual

participant writing performance, their opinions on the intervention itself, and behavioral observations from the graduate researchers. Additional information on the role of extrinsic rewards in promoting writing production alongside an existing intervention will be analyzed through visual inspection of the trends across the alternating treatments design.

Research Questions and Hypotheses

Research Question 1. Does performance feedback improve elementary student writing production? While recent considerations (Eckert et al., 2006; Truckenmiller et al., 2014) have supported the use of performance feedback as an effective tool for classwide intervention, its full ramifications are not fully known. This study will evaluate this intervention using a single-subject design and evaluate its ability to cause measureable increases in student writing production (Total Words Written; TWW). It is hypothesized that the performance feedback intervention will result in an increase in student writing production relative to baseline. As the number of correct writing sequences (CWS) is a production-dependent variable, it is hypothesized that CWS will increase, although not to the same extent as TWW. Given the nature of %CWS as a production-independent measure of writing quality, no measureable impact is expected.

Research Question 2. Does adding an extrinsic reward to performance feedback further improve student writing? This question differs from a simple extrinsic reward system for promoting student writing. In their meta-analysis, Rogers and Graham (2008) found that extrinsic rewards for student writing productivity was an effective intervention and found it to be effective in producing gains in writing production. The degree to which this intervention acts as a value-added component to an existing intervention has not been determined. Thus, this study will act as a component analysis of the performance feedback intervention, with the added

component of rewards. It is hypothesized that students will produce more writing on days when a reward is offered along with the performance feedback intervention. The number of CWS is hypothesized to increase, although not as dramatically as TWW. Given the nature of %CWS, no measurable impact is hypothesized.

Research Question 3. Does performance feedback and/or rewards have social validity for students? Other considerations of a performance-feedback linked intervention measured student opinion of the acceptability of intervention to inform and shape future versions of the intervention. Exploratory analyses demonstrated that students had strong opinions on the intervention (Eckert et al., 2008; Trunkenmiller et al., 2014). Previous studies describe performance feedback as a well-liked intervention by students (Eckert et al., 2008). Thus, it is hypothesized that students will report enjoying the intervention and feel it had some positive impact on their writing production. Additionally, it is hypothesized that students will report enjoying the reward condition more so than the performance feedback alone.

CHAPTER II
Methods

Participants and Setting

This study took place at a public elementary school in the Southeast region of the United States. An afterschool, year-round program was offered to all students at the elementary school. The program was grant-funded and assisted by a large, public university through a University-Assisted Community Schools (UACS) initiative. The program ran for four hours each weekday and spent equal time on academics, extracurricular activities, and a dinner open to the community.

The intervention phase took place the spring semester of 2016. Students in the 3rd, 4th and 5th grade were invited to participate and were referred to the study by their teachers and administrators. The intervention took place during the academic hour of the UACS. Students were taken from the classroom for participation in the intervention with a graduate student. The intervention took place at kidney-bean shaped tables in the hallway immediately outside the classroom. These tables are typically used for academic tutoring. Students were returned to class immediately following the intervention.

Participants. Seven participants were included in initial data collection. Of those seven participants, one was in fifth grade, four in fourth grade, and two students were in third grade. One participant was excluded for not meeting inclusionary criteria standards. Two participants withdrew during the intervention phase. The remaining four participants were all enrolled in fourth grade. Three participants (Ciara, D.W., and Rosa) were female. One (Optimus) was male. Both Rosa and Ciara were African-American, D.W. was Hispanic, and Optimus was white. All participants chose their research names.

Inclusionary criteria. Prior to beginning the intervention, participating students were administered three brief curriculum-based measures to assess oral reading fluency. A grade-level appropriate oral reading fluency measure was selected from AIMSweb. Research suggested that those students who struggle with reading (particularly oral reading measures) will have significant difficulties with writing (Shanahan, 2006). Initial intervention in that case should focus on reading, not writing. Thus, those students whose median oral reading fluency score fell above the 25th percentile in grade level reading were included in the study. Grade level norms and percentile ranking were obtained from AIMSweb.

To verify difficulty in the area of writing, the researchers administered three writing probes. Each was taken from the AIMSweb directory and were appropriate to the student's grade. The median number of words written were compared to national norms. Those students that fell below the 50th percentile for their grade were included in the intervention.

Materials

First, UT IRB-approved consent materials were sent home to parents of students identified by teachers and/or administrators as having difficulty with writing assignments. In addition, the program coordinator for the UACS spoke with the child's parents about this project. The Parent Consent Form is included in Appendix B. Consent was either obtained by being sent home with the child or through parent consultation during student pick-up. During the first baseline session, the students were presented with the Youth Assent Form (Appendix C), informed of the research, and asked to sign. The primary material used to implement the intervention was the participant's writing journal, which was a folder with pockets and brads. This journal was unique to each child and supplied by the researcher. The front flap held the student's performance feedback chart, which indicated the total number of words written for

each story prompt and provided two forms of feedback, a visual graph and a 'velocity indicator.' An example of this page is located in Appendix D. Each student had individual pages to write responses to story starters. Each story starter had its own page with the prompt typed across the first line. An example of this page is included in Appendix E. The folder had a divider in the middle of the story starters. This divider served as a condition prompt to the student. It also held the second performance feedback chart, used for the second intervention condition.

The CBM story starters were obtained from AIMSweb. Prompts selected by researchers for inclusion were randomly assigned to students across the different stages of the intervention. Narrative prompts were selected for inclusion based on their grade-level appropriateness. The list of prompts is included in Appendix F.

To implement the intervention with integrity, several scripts were developed for researchers to follow. A typical baseline script is included in Appendix G. A typical intervention script is included in Appendices J and L. Each script is linked to a checklist for procedural integrity. These checklists are included in Appendices I, K, and M.

At the conclusion of the intervention phase, a social validity scale was administered to participating students. The questions were derived from a scale used by Truckenmiller et al. (2014). Supplemental questions (Items 7, 8, and 9) were included to address the specifics of this intervention. Students responded on a likert-type scale with a range of smiley faces. This scale is included in Appendix N.

Dependent Measures

CBM for written expression has been found to have adequate reliability and validity for both production-dependent and production-independent measures (Gansle et al., 2006; Tindal & Parker, 1989). . Production-dependent measures (i.e., TWW, CWS) correlate with criterion

measures of written expression, such as the Stanford Achievement Test (Gansle et al., 2006). Production-independent measures describe any metric where the amount of words a student produces has no weight on their performance on a metric, such as the percentage of correct word sequences (%CWS). These measures have been found to more strongly correlate with middle school teachers' holistic ratings of student writing (Tindal & Parker, 1989).

Student writing performance was evaluated using CBM probes for writing taken from the AIMSweb program. Those prompts included fell within the grade-level expectations appropriate to the individual participant. Prompts were narrative, as research suggested this is the most appropriate probe for the elementary years (McMaster, Du, & Petursdottir, 2009). Prompts were randomized across individual participants. A complete list of included prompts can be found in Appendix F.

Total Words Written (TWW). The primary dependent measure in the scope of this study was the amount of words written by each participant. Total Words Written (TWW) was calculated by counting the number of words written by the participant for each prompt. Spelling, syntax, and grammatical errors do not weigh into this measure. This measure is production-dependent, meaning the amount of text causes fluctuations in the measure. Evaluation of TWW as a metric found adequate reliability and validity and that it correlated highly with Correct Writing Sequences in the elementary school years (Gansle et al., 2006). Likewise, improvements in writing production were been demonstrated to link with improvements in overall quality of writing and performance on standardized assessments (Powell-Smith & Shinn, 2004).

Reliability of TWW as a metric has been assessed in multiple ways. McMaster and Campbell (2007) administered 3-minute writing probes across a school year and found the

reliability to range between .60 and .76 across students in third, fifth, and seventh grades. Criterion validity data, taken from an analysis by Jewell and Malecki (2005), found diminishing correlations with the Stanford Achievement Test, Ninth Edition across students in the second, fourth, and sixth grades (.24, .22, -.14 respectively).

Correct Writing Sequences (CWS). A Correct Writing Sequence (CWS) is defined as two adjacent words that make sense in the context of the English language (Videen et al., 1982). This measure, like TWW, is considered a production-dependent variable. However, it may be a more nuanced production-dependent measure as it considers the context of two words (e.g. grammar, spelling, mechanics, and punctuation) (Jewell & Malecki, 2005).

Further analyses of CWS have found it to have acceptable reliability. McMaster and Campbell (2007) administered 3-minute writing probes across a school year and found the test-retest reliability of CWS to range between .57 and .86 across students in third, fifth, and seventh grades. Criterion validity data, taken from an analysis by Jewell and Malecki (2005), found diminishing correlations with the Stanford Achievement Test, Ninth Edition across students in the second, fourth, and sixth grades (.57, .46, .23 respectively). Compared to other metrics, CWS has been shown to have a higher validity coefficient against criterion-referenced writing assessments (Gansle et al., 2006).

Percentage Correct Writing Sequence (%CWS). Percentage Correct Writing Sequences was calculated by taking the total number of CWS, dividing by the total number of CWS and incorrect writing sequences (IWS). The result were multiplied by 100 to obtain a percentage. This production-independent metric is not influenced by writing quantity and provides more information on a student's writing (Jewell & Malecki, 2005). This particular metric may provide more nuanced information (and have stronger validity and reliability) for

upper elementary, middle, and high-school writers. A meta-analysis found criterion validity (against teachers' holistic ratings) to have a correlation coefficient that ranged from .40 to .71 in elementary studies (McMaster & Espin, 2007).

Interscorer agreement. To ensure that there was adequate agreement between scorers of student writing samples, agreement was calculated across 40% of sessions across baseline and intervention phases to evaluate all writing variables (TWW, CWS, %CWS). Agreement was calculated by taking the number of agreements of each writing metric (e.g. the number of TWW) and dividing by the total number of agreements and disagreements. Minimum acceptable agreement was 80%.

Independent Variables

Performance Feedback. The primary independent variable examined in this study was performance feedback. Student writing performance was gathered each week in folders that have a dedicated page at the front that allowed students to monitor their performance. Students received two forms of visual feedback. Total words written for each story was included in a box at the bottom of the chart. This number was graphed in a vertical bar graph. At the bottom of the bar for each story starter, a 'velocity indicator' was drawn. The 'velocity indicator' allows students to judge their writing performance relative to their previous session's performance. An upwards-facing arrow indicated improved performance, a downwards-facing arrow meant a decrease in the total number of words written relative to the previous week, and an equal sign meant no change in the total number of words written. This performance feedback sheet is included in Appendix D. The script for this intervention is included in Appendix J.

Performance Feedback + Reinforcement. The second independent variable was performance feedback intervention combined with extrinsic rewards. On these intervention

days, the students were instructed that they would have the opportunity to earn a reward for improving their writing production. The same performance feedback steps took place following the response to the CBM prompt. If the student showed improvement from the previous intervention time point, they earned a reward. The script for this intervention is included in Appendix L.

Design

The design of this study allows for a dual exploration of both a performance feedback intervention and a performance feedback plus reinforcement condition. Using an alternating treatments design allows for an exploration of two distinct interventions within the same intervention phase (Kazdin, 2011). Each intervention condition was presented once a week and order of intervention presentation was randomized. See Appendix F for a prototype of randomized assignment. This randomization allowed for a balancing of the students' exposure to the interventions and reduced the impact of order effects. Experimental control was achieved when the two data series differentiated (or separated) during the intervention phase (Kazdin, 2011).

Procedures

Approval for the study was obtained through the Institutional Review Board (IRB) at the University of Tennessee, along with the principal of the elementary school and the director of the Full-Service School Initiative. The intervention was planned to minimize disruption at the UACS afterschool program. Particular care was be taken to not interrupt high-value activities and to limit the intervention to the academic hour. Those students identified as struggling writers had letters sent home asking permission to participate in the intervention. Right to withdraw was emphasized both in the parent consent and student assent.

Researcher training. The primary researcher in this study was a graduate student in School Psychology. The primary researcher and other graduate students supporting this project participated in training sessions on the administration of curriculum based measures of writing. In addition, an assessment, intervention, and procedural script were provided to ensure regularity of administration. Graduate student researchers participating in data collection were trained to reliably administer and score student writing using the dependent measures included in this study. Several prompts were completed as a part of a training session. Scorers then individually scored 10 prompts. Scorers were not included in the study until they could reach 90% agreement for each dependent variable. Using TWW as an example, reliability was calculated by taking the total number of words correctly identified minus the total number of words incorrectly identified divided by the total number of words. The result, multiplied by 100, served as the scorer's percent agreement.

Baseline. Baseline data were collected in six sessions across three weeks. While following a prepared script, the researcher administered a writing prompt from the AIMSweb database of curriculum-based measures of grade-level writing. The prompt was presented both orally and in a written format. Students had one minute to plan their story, then five minutes to compose a response, with the researcher noting the last word written at the three-minute mark for normative comparisons. Students did not receive feedback on these prompts.

Preference Assessment. The researcher presented an array of potential rewards (approximately 10) to the student and conducted a preference assessment using multiple stimulus without replacement assessment procedures (Piazza, Roane & Karsten, 2011). Each potential reward was displayed on the table. The student was prompted to select the reward they would most like. When the student responded (either verbally or with a gesture), the researcher

removed the item from the array, reshuffled, and prompted the student again to select the reward they would most like. This was repeated until the student either did not respond or only one item remained. This type of preference assessment quickly allowed the researcher to create a hierarchy of potential rewards individualized to each participant (Piazza, Roane & Karsten, 2011). Additionally, it has been shown an effective option for general education students (Daly et al., 2009). A selection of each student's most preferred rewards was available for them to choose from if they earned a reward on an intervention day. As the intervention progressed, the researcher opted to re-administer the preference assessment to ensure the reinforcement value of the rewards remained high.

Intervention. The interventions took place twice a week in 12-16 sessions across 6-8 weeks. Flexibility in the timing of the intervention allowed for the program to not interfere with planned activities at the UACS and for researchers to be responsive to the data. The researcher pulled students from an hour-long academic period to kidney-bean shaped tables in the hallway to work on writing for approximately ten minutes. The researcher provided a writing folder for the students, where performance feedback information was listed inside the front flap and writing journal pages were be separated by intervention type. Intervention conditions were randomly assigned prior to the first meeting of the week. Each intervention type had a tab in the student's writing journal. The researcher administered one writing probe each session. When the student either finished their story or ran out of time, the researcher and student counted the number of words written. This number was graphed on the performance feedback page in the front pocket of the writing journal. An additional velocity indicator was drawn on the bottom of the bar graph for that day. If the student was in the performance feedback and reward condition, they were eligible to select a reward.

Procedural Integrity. At least two trained graduate student researchers collected data in forty percent of sessions. Procedural integrity checklists were completed during both baseline and intervention conditions. A checklist, derived from the relevant script, was used to assess how closely the graduate student researcher followed the intervention steps. The checklists are included in Appendices H, J, and L. Percent agreement with the established procedures was calculated by taking the total number of steps completed, dividing by the sum total number of applicable steps to the script, and multiplying by 100. This assessment of procedural integrity ensured the intervention remained consistent across all participants. Procedural integrity data was collected across 40% of sessions across each different graduate researcher and across the different phases of the study. 100% procedural integrity was calculated across conditions.

Social Validity. Social validity of the intervention was collected through surveys administered to the participating students. Given the small number of participants, results from the survey were analyzed through descriptive statistics. The survey was administered at the conclusion of the intervention. The first seven items of the survey were adapted from a social validity scale described by Truckenmiller et al. (2014). Three additional items were generated by the researcher to address specifics about this particular intervention. Students responded across a 5-point Likert scale with smiley faces. This scale is included in Appendix N.

CHAPTER III
Results

Each participant had his or her performance monitored for the primary dependent variable of Total Words Written (TWW). Both the self-graphing component of the intervention and the researchers' decision making of when to introduce the intervention phase was based on these graphs. Results, described below, include visual analyses, descriptive statistics, and effect size calculations for each participant and each variable (TWW, CWS, and %CWS).

Ciara

Ciara was a female African-American student enrolled in the fourth grade. She wrote 22 stories in total. She had six opportunities to earn a reward for her writing, and earned a total of four rewards.

Visual analysis. Visual analysis of TWW (seen in Figure 1) across baseline and intervention phases found a high degree of variability in the baseline phase with two outlier data points (1, 5). No immediate level change occurred upon the introduction of the intervention phase. While in the Performance Feedback (PF) intervention, Ciara's writing stabilized with an increasing trend; however, the Performance Feedback Plus Reward (PF+) condition continues to show a large degree of variability.

Looking to Figure 2, and the CWS metric, significant variability is found in the baseline phase. The two outliers identified in Figure 1 remain. No level change exists at the introduction of the intervention phase. The PF+ treatment has significant variability in the trendline, with one outlier (session 15).

Figure 3 shows a graphical representation of Ciara's performance on %CWS. On this variable, the baseline trend is much more stable than previous representations. Performance across the intervention phase is more varied. The two intervention data series do not separate.

Descriptive Statistics. Information on the descriptive statistics for Ciara's writing is included in Table 1. Her performance across phases on TWW shows an increasing pattern, with 52.6 words written at baseline increasing to 73.3 words under PF and 71 words under PF+. She increased her writing performance (CWS) from an average of 43.3 CWS at baseline to 57.3 and 57.2 correct sequences in the PF and PF+ conditions, respectively. A third metric, %CWS, fluctuated across phases. Under baseline, Ciara had 81.2 %CWS. This decreases slightly to 78.7 %CWS under PF and 77.9 %CWS under PF+.

Effect Sizes. The first effect size calculation is the percentage of non-overlapping data (PND). Across intervention conditions and baseline, this variability in TWW is reflected in a PND of 83.3% for PF and 50% for PF+. For CWS, Ciara had minimally effective PND calculations with 0% for PF and 33% for PF+. Table 5 shows additional effect size calculations through Hedges' *g* (Hedges, 1981). Calculated effect sizes of Hedges' *g* found large effect sizes between baseline and either intervention for production-dependent measures (TWW, CWS). Small negative effect sizes were found when comparing PF to PF+. Similarly, small, negative effect sizes were found for %CWS. Due to the lack of differentiation in data series, experimental control could not be established.

Summary. Overall, Ciara's writing production did improve over baseline for TWW and CWS. However, the two data series did not differentiate, indicating that the addition of a reward to the performance feedback condition did not impact Ciara's writing production (TWW) or performance (CWS). However, her performance (CWS) stabilized under the PF+ condition. Large effect sizes were found when comparing baseline to either PF or PF+ (TWW, CWS). In these two variables, Ciara also had several outliers, particularly with points 1 and 5. Here, the researcher noted that she expressed a strong opinion about the randomized writing prompt she

was given, and reported that she could not come up with anything to write about. Point 15 was also an outlier, and was the session immediately after the researcher re-administered the preference assessment. Ciara reported a strong preference for a spiral notebook with dogs on the cover, and, with that reward as her goal, wrote a personal best number of words.

D.W.

D.W. was a female student enrolled in the fourth grade. She wrote 23 stories across the two phases of the intervention. She had eight opportunities to earn a reward for improving her performance, and earned a reward a total of five times.

Visual analysis. Figure 4 contains D.W.'s performance within TWW across different phases of the study. Some variability exists in the baseline data; however, the trend appears to be stable over the entire baseline phase. One intervention phase, PF+, showed an immediate level change. While the two treatments initially appeared to converge, there was a separation of the data series in the final three sessions.

Visual analysis of Figure 5, similar patterns are apparent through CWS. The baseline data have less variability than in the TWW graph. The PF+ treatment again shows a level change upon introduction of the intervention. The PF+ data series has one outlier, story 15.

D.W.'s performance across the different phases through %CWS, shown in Figure 6, appear more stable. No significant level change is shown for either intervention condition. Save one outlier (Story 15), the intervention phases are stable and converge.

Descriptive Statistics. Information on the descriptive statistics for D.W.'s writing is included in Table 1. Her writing production (TWW) increased from 52.6 TWW at baseline to 68 TWW in PF and 81.4 TWW in PF+. She increased her writing performance (CWS) from an average of 50.3 CWS at baseline to 57.1 CWS and 72.6 CWS in the PF and PF+ conditions,

respectively. Each of these production-dependent measures indicate increased production under the intervention condition, with some separation between the two. Looking across these two indicators of D.W.'s writing, less variability (e.g., a smaller standard deviation) is evident in the PF+ phase as compared to PF.

The third metric, %CWS, did not have as straightforward of results. Under baseline, D.W. had 89.1 %CWS. She decreased slightly under PF to 79.8 %CWS, but increased to 84.9 %CWS under PF+.

Effect Sizes. There is some differentiation in the PND calculations between the two different interventions, as suggested by the descriptive statistics. Looking first at TWW, D.W. had a minimally effective PND (57%) for the PF intervention, but had no overlapping data points for PF+. This same pattern holds across PND calculations for CWS, where PND calculations of 42.9% suggest a minimally effective intervention for PF, but a calculated PND of 85.7% for PF+ shows a moderate effect. Further effect size calculations were done through Hedges' *g*, and are shown in Table 5. Here, D.W. had large, positive effects across TWW and CWS, indicating that both treatments (PF, PF+) outperformed baseline. Interestingly, D.W. had similar large, positive effect sizes (g=1.16 for TWW, g=1.23 for CWS) when comparing PF to PF+. The production-independent measure, %CWS, had large, negative effect sizes for baseline to intervention comparisons. There was a small, positive effect size comparing PF to PF+.

Summary. D.W. did improve her writing across the production-dependent variables of TWW and CWS. Given that the intervention data series did not separate, little experimental control can be established. This result also suggests that neither D.W.'s writing production nor performance were impacted by the additional reward contingent on improvement. However, the PF+ condition did have more immediate results, with less variability. There was one outlier in

the PF+ data series, point 15, for both CWS and %CWS. Here, D.W. had many more spelling errors than usual. Calculated PND values found a difference between the two interventions, with PF+ either highly (with TWW) or moderately (with CWS) effective. The same cannot be said for PF, where both calculated PND values were minimally effective. Analysis through Hedges' *g* found large, positive effect sizes between baseline and intervention across production-dependent variables. There was a similar large, positive effect size when comparing the two treatments (PF/PF+), suggesting that there was some difference between the two treatments for D.W.

Optimus

Optimus, a male student enrolled in the fourth grade, wrote a total of 18 stories across the scope of the intervention. He had a total of seven opportunities to earn a reward for his writing, and did earn for four of those.

Visual Analysis. Figure 7 shows Optimus' writing production (TWW) across baseline and intervention phases. The baseline phase shows a flat, stable trend. The intervention phase has no significant level change. The two data series converge and intersect often, with a small positive, upward trend in both.

Figure 8 examines Optimus' writing performance (CWS). Overall, the trends look similar to Figure 7. While the baseline trend remained flat, both intervention phases have more variability. Again, there is no significant level change and no separation of the data series.

Finally, %CWS, the production-independent measure of writing, is shown in Figure 9. Here, there is an increasing trend in baseline performance not apparent in either Figure 7 or 8. There is no level change upon the introduction of the intervention phase. The two intervention data series do not separate.

Descriptive Statistics. All descriptive statistics are included in Table 1. Unique to Optimus was an increase from baseline to the intervention phases across all three measures of his writing. First, his writing production increased from 36.8 TWW at baseline to 43.4 TWW (PF) and 48.1 TWW (PF+). Second, his writing performance also increased. At baseline, he had an average of 36.3 CWS, which increased to 42.3 CWS (PF) and 47.9 CWS (PF+). Third, his production-independent measure of writing, %CWS, also increased. At baseline, he had an average of 84.3 %CWS, which increased to 86.4 %CWS (PF) and 85.2 %CWS (PF+). While Optimus had increasing variability from baseline to intervention phases across both writing production and writing performance, he actually showed a decrease in variability with %CWS.

Effect Sizes. Optimus did have a difference between the calculated effect of the two interventions in his writing production (TWW). Here, he had a minimally effective PND (57%) for PF, but moderately effective PND (85.7%) for PF+. This same pattern did not hold true for his writing performance, where, across both PF and PF+, the PND suggested a minimally effective intervention (57.1%). Table 5 shows further effect size calculations with Hedges' *g*. Optimus had large, positive effect sizes when comparing baseline to either treatment in the intervention phase for writing production. Looking at writing performance, Optimus had a medium effect size comparing baseline to PF *(*g = 0.68) and a large, positive effect between baseline and PF+ (*g* = 1.54). The production-independent measure %CWS had mixed results, with small positive effect sizes when comparing baseline to either treatment and a small, negative effect between PF and PF+.

Summary. Optimus did show improvement in his writing production and performance across the PF and PF+ interventions. Optimus was unique in that his production-independent measure did increase from baseline to intervention. While descriptive statistics show small

positive growth in his writing, the results were not echoed in PND calculations. Every calculated PND, save one, showed a minimally effective intervention. Calculated effect sizes through Hedges' *g* found large, positive effect sizes between baseline and either of the two interventions for both production-dependent variables. Interestingly, there were medium effect sizes for these same variables when comparing PF to PF+.

Rosa

Rosa was a female fourth grade student. She wrote 19 stories in total. She had eight opportunities to earn a reward for her writing, and did receive a reward five times.

Visual Analysis. Looking first at Figure 10 and Rosa's writing production (TWW) across baseline and intervention phases, the baseline phase shows a stable trend with no variability. There is a level change at the introduction of the intervention phase. Her performance under PF improved, and under PF+ there was a decrease. The PF condition has little variability, with a slight upward trend in the final sessions. The PF+ treatment has one initial outlier and the trend following is cyclical. There is no separation of the two data series.

Figure 11 shows Rosa's writing performance (CWS) across the different phases of the study. Compared to Figure 10, there is more variability in the baseline phase. There is a level change for the PF+ intervention. There is no meaningful separation of the intervention data series.

Finally, Figure 12 shows the production-independent %CWS for Rosa. Here, even more variability is introduced in the baseline phase. Again, there is no level change or separation of the intervention data series.

Descriptive Statistics. All calculated descriptive statistics can be found in Table 1. Rosa increased her writing production (TWW) from baseline (37.3 TWW) to each intervention

phase (58.1 TWW for PF, and 54.9 TWW for PF+). Her writing performance (CWS) trended similarly. She increased from 24.8 CWS at baseline to 38 CWS in PF and 34.4 CWS in PF+. While the variability in CWS and TWW did increase upon the introduction of the intervention phase, it increased much more under PF+ as compared to PF.

The production-independent measure, %CWS, nearly maintained its average of 65.8 %CWS under baseline- but fell to 65.5 %CWS in PF. Rosa had an average of 62 %CWS under PF+.

Effect Sizes. The first consideration of effect size was a calculation of the percentage of non-overlapping data. Rosa had a highly effective PND (100% across interventions) when looking at her writing production. Looking instead at writing performance, Rosa had a moderately effective PND for PF (71.4%) and a minimally effective PND for PF+ (50%). Further effect size calculations were conducted through Hedges' g and are found in Table 5. Here, Rosa had a pattern of strong, positive effect sizes between baseline and each intervention for both TWW and CWS. There was a small negative effect size when comparisons were made between PF and PF+. Any comparisons made through %CWS found small, negative effect sizes.

Summary. Rosa did improve her writing production and performance from baseline to intervention. There was a level change on introduction of the performance feedback intervention. The first point of the PF+ intervention data series acts as an outlier. Here, the student reported that she could not come up with something to write about. There was no separation of the data series and experimental control could not be established. Effect size analyses found large, positive effect sizes when comparing baseline to PF or PF+ on either production-dependent variable. These positive effects did not hold true for further comparisons between PF and PF+, or analyses at any level with the production-independent measure.

Social Validity

Social validity data was taken from a survey completed after termination of both interventions. The survey is included as Appendix N. Individual student responses are included in Table 6. While the participants seemed to think their writing had improved from participation in the study, their opinions on the particular aspects of the methodology differed. Half of participants had a neutral or negative opinion about being timed while writing. This was apparent during data collection, too, where participants seemed hyper-focused on the stopwatch, often protesting when the researcher would prompt them of the time remaining.

Half of participants responded neutrally to the use of the graph. The graph serves as a core part of the performance feedback intervention. Interestingly, the mixed response by participants does not align with the results of the study, where the performance feedback seemed to improve student writing and the contingent reward made no measurable difference.

The majority of students responded favorably to the use of rewards. They reported that they liked earning rewards, and that they did work harder on days when rewards were offered. Their overwhelmingly positive responses on these items suggest that the reward condition was much more effective than the performance feedback condition. However, results from visual analysis showed that the reward condition made no measurable difference in student writing production.

Interscorer Reliability

Interscorer reliability was calculated for each dependent variable, each participant, and overall. The overall agreement was 96% across TWW, CWS, and %CWS. Agreement was taken from the compilation of all stories written by participants. Across all participants, the agreement

for TWW was 99.2 and for CWS was 96.9%. This well exceeds the minimum standard of 80% agreement.

CHAPTER IV
Discussion

Through a structured, alternating-treatments design, this study served as a component analysis of previous performance feedback studies (Eckert et al., 2008; Hier & Eckert, 2014; Truckenmiller et al., 2014). Using a single subject, alternating-treatments design, this study explored the relative effects of self-graphing, velocity indicators, and contingent rewards on student writing production. Overall, the intervention phase did improve student writing, although little to no evidence suggests that the contingent reward goes above and beyond this improvement. Neither visual analysis nor statistical analyses support a differentiation in the two treatments during the intervention phase.

Overall, improvements were noted in production-dependent variables, TWW and CWS. The production independent measure, %CWS, showed very small effect sizes as predicted. Several participants showed negative effect sizes, indicating that a smaller percentage of their writing made sense grammatically when compared directly to their works at baseline. In context, this suggests that while students were able to produce more words, sentences, and paragraphs to meet set goals, they maintained approximately the same percentage of correctly worded phrases. This production independent measure is not influenced by the amount of words students wrote. Qualitative observations during the administration of the writing probes suggests that as students acknowledged goals and worked to meet them, they would often skip words when writing, add nonsense words, or misspell words. Each of these types of errors load onto the calculation of both CWS, a production-dependent measure, and %CWS, a production independent measure.

What became clear across the different participants was that the intervention did seem to be effective but, there was no separation of the data series and no real difference between the performance feedback and performance feedback with contingent reward. This result goes

directly against the hypothesized results. Observations during the implementation of the study supplement the results from analysis of the writing itself. Rewards, and the PF+ condition, were popular amongst the participants. During implementation, the participants seemed to eagerly anticipate days they worked towards a reward. This anticipation and enjoyment of the rewards was also indicated on the social validity data collected at the end of the intervention. The excitement also seemed linked to the rewards themselves, with students planning on earning a new pen or notebook and explicitly telling the researcher their plan.

Not all behaviors were adaptive in nature. Nervous and anxious behavior patterns began to appear during the intervention phase. As the writing intervention began, students would focus in on their previous performance. While the researcher and student would work together to establish how many words they would need to write to get an improved velocity indicator, students supplemented this information with their own planning. D.W. began to glance back at her previous story and roughly estimate how far down the page she wrote. Rather than writing more, then, she would increase her handwriting size to, in her eyes, "write more."

These behaviors were most prevalent in the latter stages of the intervention day, when the researcher would count the words. Most days, students would not want to help count the words. Several participants began to look away when the researcher counted the words in their story or find excuses to look elsewhere in the hallway.

Applied and Theoretical Implications

This study replicates previous research examining performance feedback and writing (Eckert et al., 2008; Hier & Eckert, 2014; Truckenmiller et al., 2014). Prior research has identified performance feedback as an easily implemented intervention that can increase writing production, but these improvement do not necessarily impact production-independent measures.

However, results of this study do not suggest that a reward makes a measurable difference in students' writing production, which directly contradicts stated research hypotheses.

It was hypothesized that a reward would motivate student writing. Previous research has linked academic skill acquisition to the use of rewards as an intervention tool, and an effective one within the framework of the instructional hierarchy. Here, research suggests that rewards are most effective during skill acquisition, and build fluency (Haring & Eaton, 1978; Wright, 2003). While there was some increase in production-dependent variables in the intervention phase, it was not a consistent increase across participants, nor was there a separation of the two treatment conditions. Reinforcement, in a sense, was included in a recent meta-analysis of writing interventions under a number of different operational definitions (Akin-Little et al., 2004; Rogers & Graham, 2008). None of these definitions of reward match the individual, tangible reward used in the scope of this study.

Looking through student responses to the preference assessment administration, their overwhelmingly positive opinions on the possibility of rewards, and their work ethic on reward days, the stage seemed set for student writing production to increase on days a reward was offered. Their reported preference for working towards a reward did not translate to their behavior. Rather than focusing on their writing and story starter for the day, they focused on other aspects of the intervention. Popular distractions were the timer, previous stories written, and the performance feedback page. One participant would increase the size of her handwriting only on reward days to give the appearance of having written more, rather than focus on adding sentences to her story. These behaviors persisted in spite of the initial training, acclimation to the intervention phase, and the scripted administration of the intervention.

Limitations and Future Research

Limitations. A primary limitation of this study was the limited access to the participants. The nature of an afterschool program is more fluid than a traditional classroom setting, particularly as students' attendance began to wane, parents began to pick students up early, and a myriad of other idiosyncratic events took place (e.g., dogs visiting the students). Building on this limited access to participants was that the intervention itself was atypical in the afterschool classroom environment. Being that it was such a far cry from typical classroom procedures, the students were reluctant, initially, and would occasionally report that they were not in the mood. This honesty is particularly reflected in Optimus' responses to the social validity items.

Future Research. Several methodological choices in this study could be built upon by future research. Future explorations of single-subject application of performance feedback could strengthen the alternating-treatments design by adding a baseline probe during the alternating treatments phase. Building this into the design itself would allow the researcher eliminate any questions about the effects of practice and/or carryover effects during the intervention phase. While the reward element did not improve student writing production in the scope of this study, changes to the reward contingency could elaborate on the role of the reward. Here, the reward was known to students. In fact, they would often announce what reward they were working towards that day. Using the reward as a "mystery motivator" instead might add to the value of the reward and increase student motivation.

Another aspect of the study that deviated from typical writing implementation was the length of time students wrote. Writing CBM research usually allows for one minute of brainstorming and three minutes of writing. To allow students to fully develop their ideas, the researchers in this particular study had one minute of brainstorming and allowed for five minutes

of writing. During baseline, students would typically decide they had finished their stories before time was called. Students rarely finished before the five-minute time limit during intervention. This extra time may have allowed students to build more detail into their stories and have more opportunity meet the goal for the day. There was no consistent use of the brainstorm period from day to day. Some days were quiet planning, others, participants would talk aloud about what they would write about, and some they just looked around the immediate area. Future researchers might allow for a longer writing period, to better mimic a typical classroom writing assignment, or include instruction or structure to the brainstorming period.

An area of consideration for future research could marry these writing interventions with typical classroom procedures. If performance feedback seems an effective way to increase writing production in the short-term, how could this intervention be used over the course of a school year? How would the students' previous level of performance impact the effectiveness of the intervention? While this study targeted struggling writers, a classwide implementation would (theoretically) include students across different achievement levels.

Implications and Summary

This study aimed to address the three-quarters of students who fail to meet grade-level expectations in writing on national assessments (National Center for Education Statistics, 2012). An alternating treatments design was used to examine different elements of performance feedback as an intervention, serving as a component analysis of the intervention itself and the contingent reward. Results support previous research on performance feedback, as students did improve their writing production and performance. However, there was no impact on production-independent measures, nor was there a separation of data series to suggest that a contingent reward increased participant writing.

Results from the current study hold some promise for classroom teachers, intervention specialists, and other education professionals involved with tracking student progress. By adding in elements of the performance feedback intervention educators could encourage growth in writing production and performance. While this specific study more supports this intervention on an individual, one-on-one implementation level, future research could elaborate on how performance feedback might work classwide or in small groups. Results suggest that the performance feedback intervention could be an effective option to build writing fluency. This interaction between educator and student in completing the performance feedback sheet does not need to be supplemented with tangible rewards, as the contingent reward does not dramatically differ from the simple performance feedback intervention.

Performance feedback, then, becomes an even easier intervention to implement. The sheet could be included in a daily writing journal and used as a communication tool between educator and student. The graph (coupled with the velocity indicator) communicates growth in writing. While that tool can be used to frame a writing conference between student and educator, providing a structure and jumping-off point to shape future writing, it could also be an indirect tool.

Previous research in performance feedback had a delay between student writing and feedback from the researcher (Eckert et al., 2006; Eckert et al., 2008; Hier & Eckert, 2014; Truckenmiller et al., 2014). This suggests that performance feedback sheets could be included in a typical writing journal. If students were instructed to write in the journal once a week, the educator would then have the time between journals to count the total words written, complete the feedback sheet, and write in a velocity indicator. This structure of performance feedback

does not require as much in-class time, and could be the easiest option for general education teachers.

Either direct or indirect application of performance feedback helps shape student writing over successive sessions. Direct application of performance feedback could be used in an individual, academic intervention setting, whereas the indirect option could help a teacher provide individual feedback to an entire class of students. The simple process of graphing previous performance over time seems to encourage their writing production and can help produce effective and efficient writers.

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Appendices

Appendix A

Tables and Figures

Table 1

Descriptive Statistics of Total Words Written, Correct Writing Sequences, and Percentage Correct Writing Sequences for Baseline and Intervention Phases

	TWW			***CWS***			***%CWS***		
	Baseline **M** (SD) *Range*	**PF** **M** (SD) *Range*	**PF+** **M** (SD) *Range*	**Baseline** **M** (SD) *Range*	**PF** **M** (SD) *Range*	**PF+** **M** (SD) *Range*	**Baseline** **M** (SD) *Range*	**PF** **M** (SD) *Range*	**PF+** **M** (SD) *Range*
Ciara	**52.6** (15.4) *24-73*	**73.3** (6.3) *64-80*	**71** (19.1) *52-102*	**43.3** (14.3) *18-65*	**57.3** (5.6) *50-64*	**57.2** (23.4) *34-95*	**81.2**(6.8) *72.4-91.7*	**78.7**(10.4) *64.9-95.3*	**77.9**(10.8) *64.2-92.2*
D.W.	**52.6** (9.2) *40-67*	**68** (14.1) *41-81*	**81.4** (8.4) *74-96*	**50.3** (7.1) *39-58*	**57.1** (13.1) *33-70*	**72.6** (11.9) *48-83*	**89.1** (5.2) *80.3-98.3*	**79.8** (6.9) *71.6-87.9*	**84.9** (11.9) *58.5-92.9*
Optimus	**36.8** (3.4) *34-41*	**43.4** (9.5) *30-53*	**48.1** (7.6) *39-58*	**36.3** (4.8) *30-40*	**42.3** (10.3) *29-55*	**47.9** (8.6) *38-58*	**84.3** (8.1) *73.1-90.9*	**86.4** (4.8) *78.4-93.2*	**85.2** (7.6) *76-94.6*
Rosa	**37.3** (1.5) *36-39*	**58.1** (5.8) *52-70*	**54.9** (15.2) *24-73*	**24.8** (6.9) *17-33*	**38** (7.2) *29-49*	**34.4** (11.6) *17-50*	**65.8** (14.5) *50-84.6*	**65.5** (12.7) *52.7-84.5*	**62** (9.9) *46-72.5*

Note. PF indicates Performance Feedback condition, PF+ indicates Performance Feedback plus reward. TWW indicates Total Words Written, CWS indicates Correct Writing Sequences, and %CWS is the Percentage Correct Writing Sequences.

Table 2
PND Across Variables, Phases, and Participants

	TWW		**CWS**	
	PF	**PF+**	**PF**	**PF+**
Ciara	83.3%	50%	0%	33%
D.W.	57%	100%	42.9%	85.7%
Optimus	57%	85.7%	57.1%	57.1%
Rosa	100%	85.7%	71.4%	50%

Note. TWW indicates Total Words Written, CWS indicates Correct Writing Sequences. PF indicates Performance Feedback condition, PF+ indicates Performance Feedback plus reward.

Table 3
Hedges' g Effect Size Calculations Across Variables, Phases, and Participants

	TWW			CWS			%CWS		
	BL/PF	**BL/PF +**	**PF/PF+**	**BL/PF**	**BL/PF +**	**PF/PF+**	**BL/PF**	**BL/PF +**	**PF/PF+**
Ciara	1.61	1.10	-0.16	1.20	0.77	-0.01	-0.31	-0.40	-0.07
D.W.	1.34	3.26	1.16	0.67	2.35	1.23	-1.55	-1.14	0.21
Optimus	0.84	1.76	0.55	0.68	1.54	0.59	0.34	0.11	-0.19
Rosa	4.37	1.38	-0.28	1.87	0.93	-0.37	-0.03	-0.33	-0.30

Note. TWW indicates Total Words Written, CWS indicates Correct Writing Sequences. BL indicates Baseline, PF indicates Performance Feedback condition, PF+ indicates Performance Feedback plus reward.

Table 4
Individual Responses to Social Validity Survey

	Ciara	**D.W.**	**Optimus Prime**	**Rosa**	**Average**
How much did you like writing stories with us each week?	5	5	5	5	5
How much do you like being timed while you are writing stories with us?	5	1	5	3	3.5
Were there any times you didn't want to write stories with us?	4	3	3	4	3.5
Were there any times when you wished you could write more stories with us?	5	5	1	4	3.75
Do you think your writing has improved?	5	5	5	4	4.75
Do you think your writing has gotten worse?***	5	5	5	5	5
Did you like knowing how many words you wrote?	5	4	5	5	4.75
Did you like using a graph to see how many words you wrote?	5	5	3	3	4
Did you like getting a reward for your writing?	5	3	5	5	4.5
Did you try harder on days you might earn a reward?	5	5	5	5	5

Note. *** indicates reverse-scored items. Participants responded across a five-point Likert scale modified to use smiley faces.

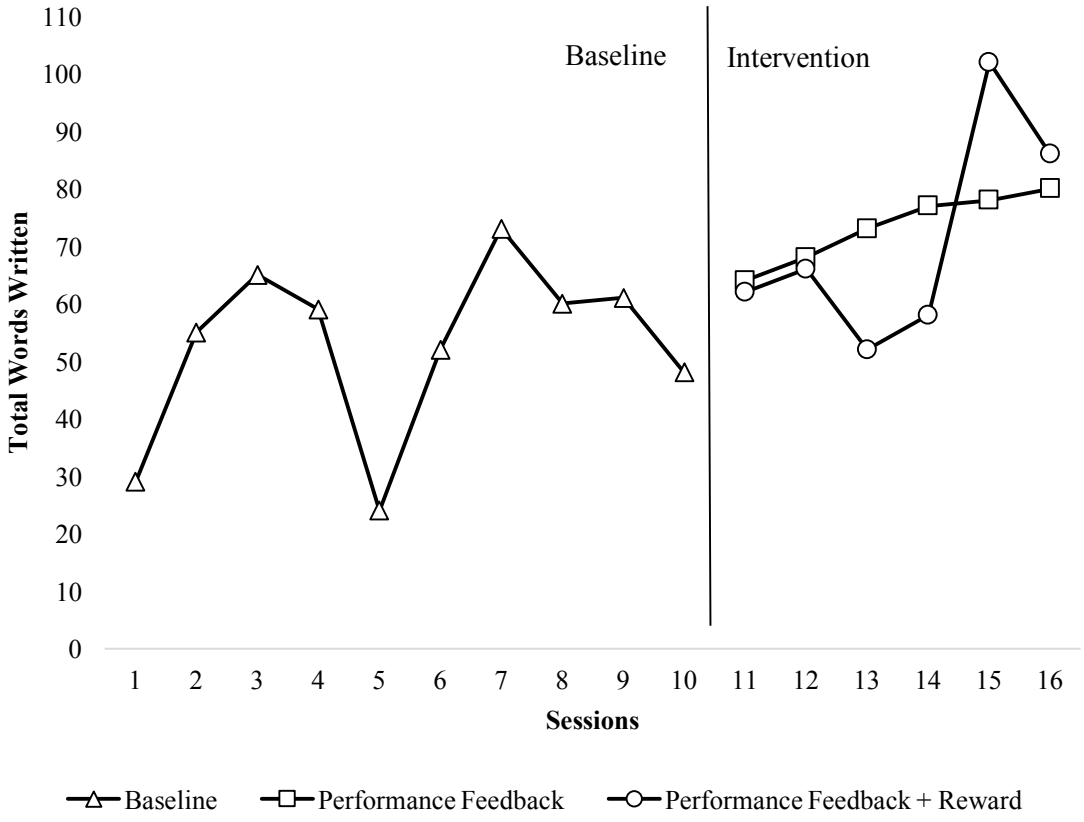


Figure 1. Total Words Written for Ciara across baseline and alternating treatment phases.

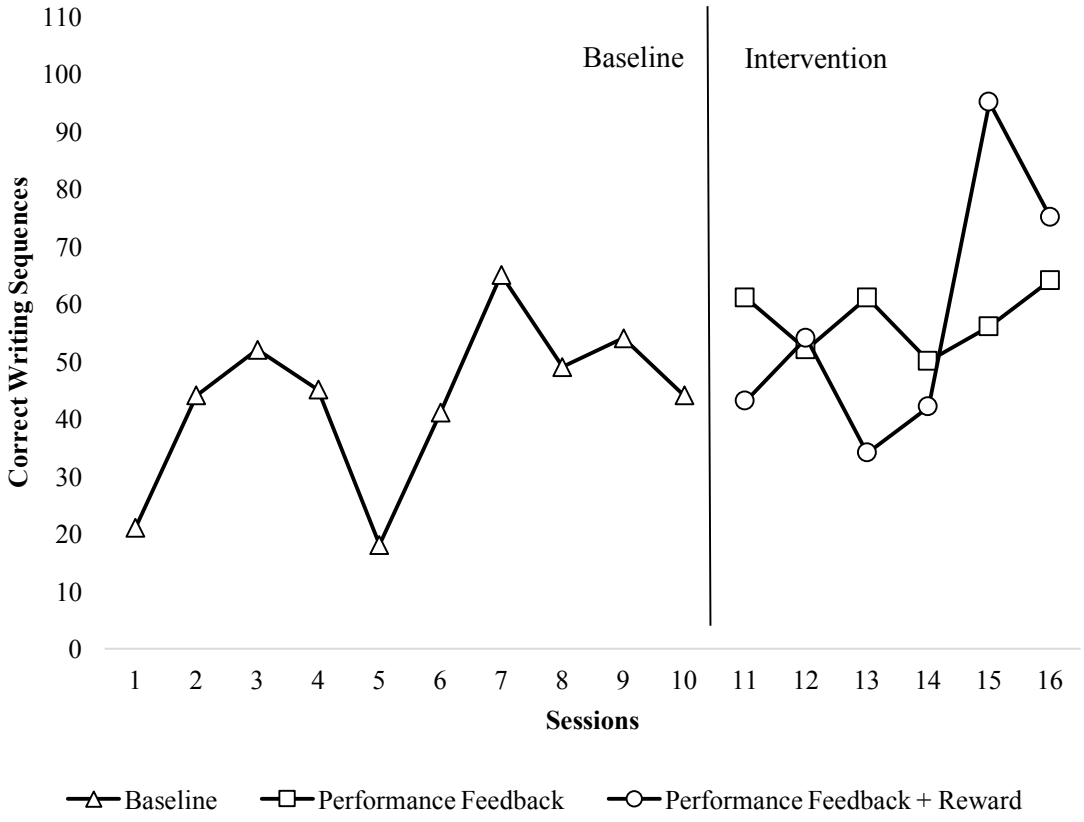


Figure 2. Correct Writing Sequences for Ciara across baseline and alternating treatment phases.

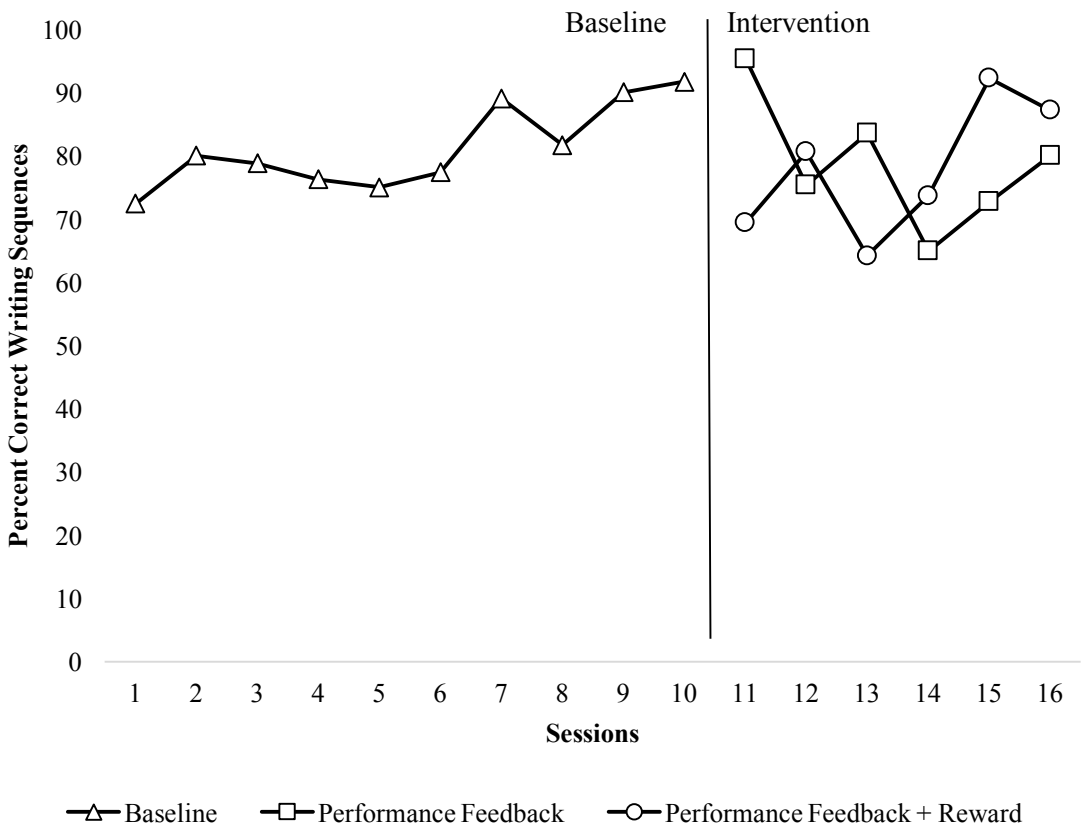


Figure 3. Percent Correct Writing Sequences for Ciara across baseline and alternating treatment phases.

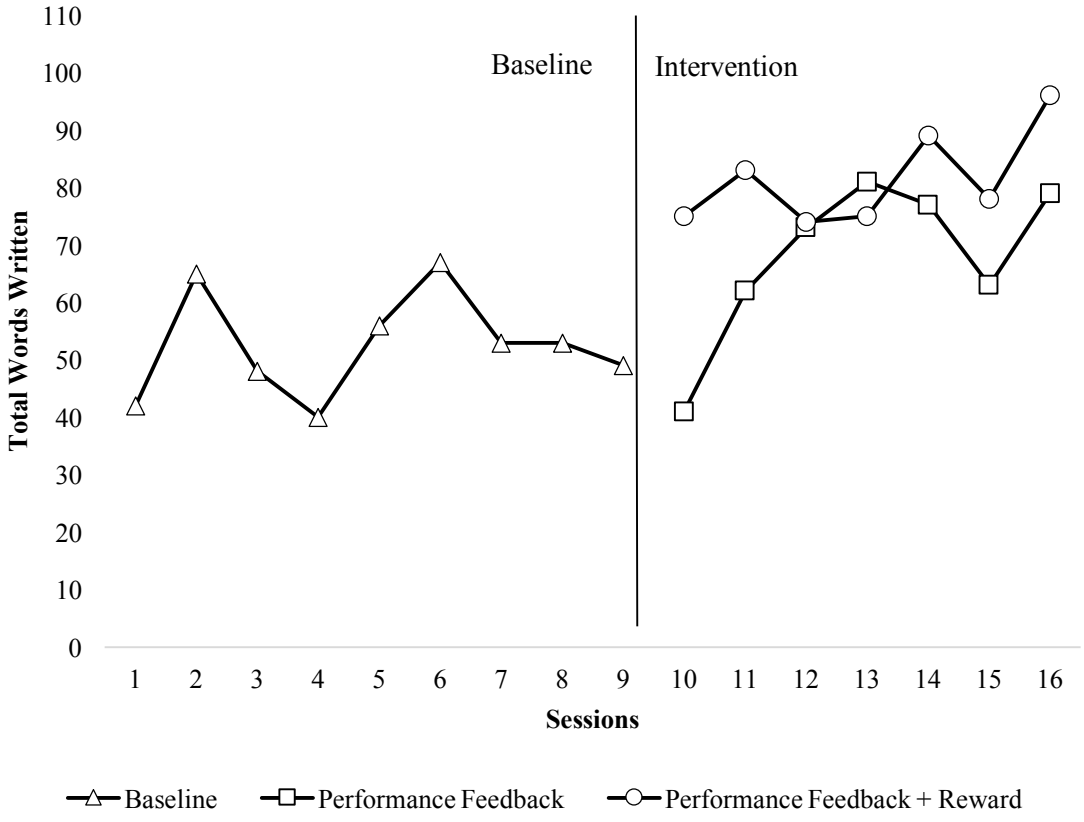


Figure 4. Total Words Written for D.W. across baseline and alternating treatment phases.

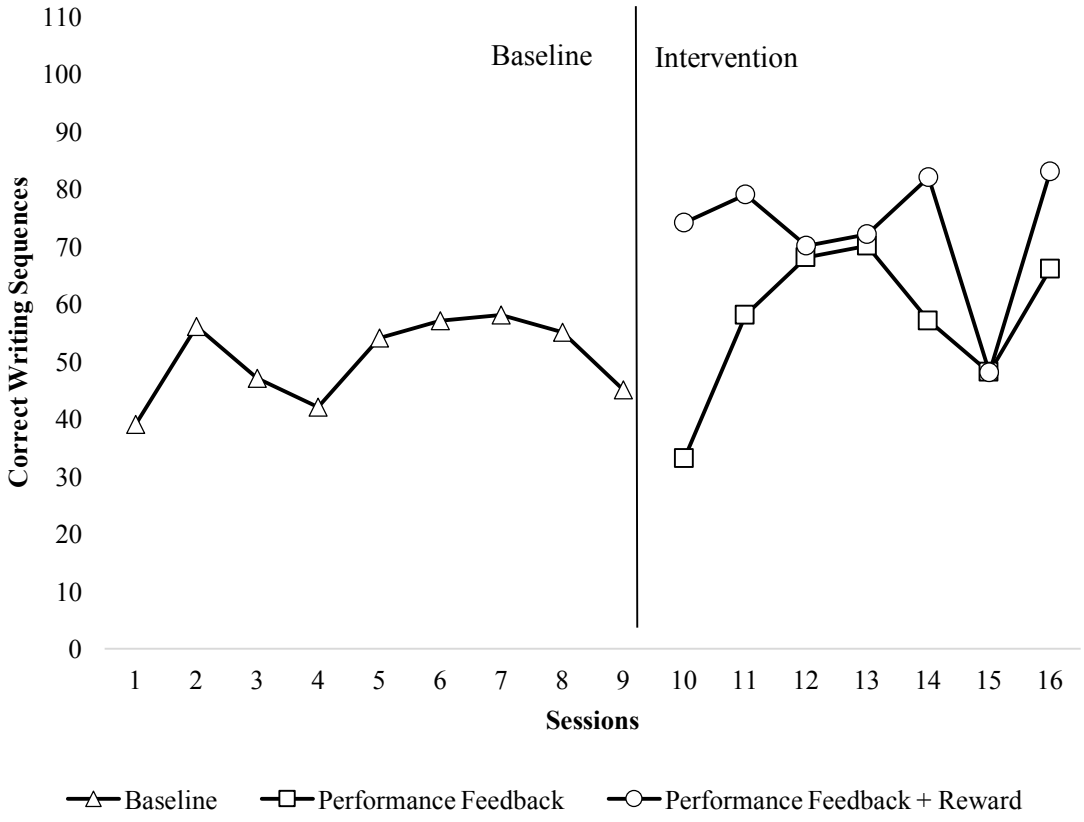


Figure 5. Correct Writing Sequences for D.W. across baseline and alternating treatment phases.

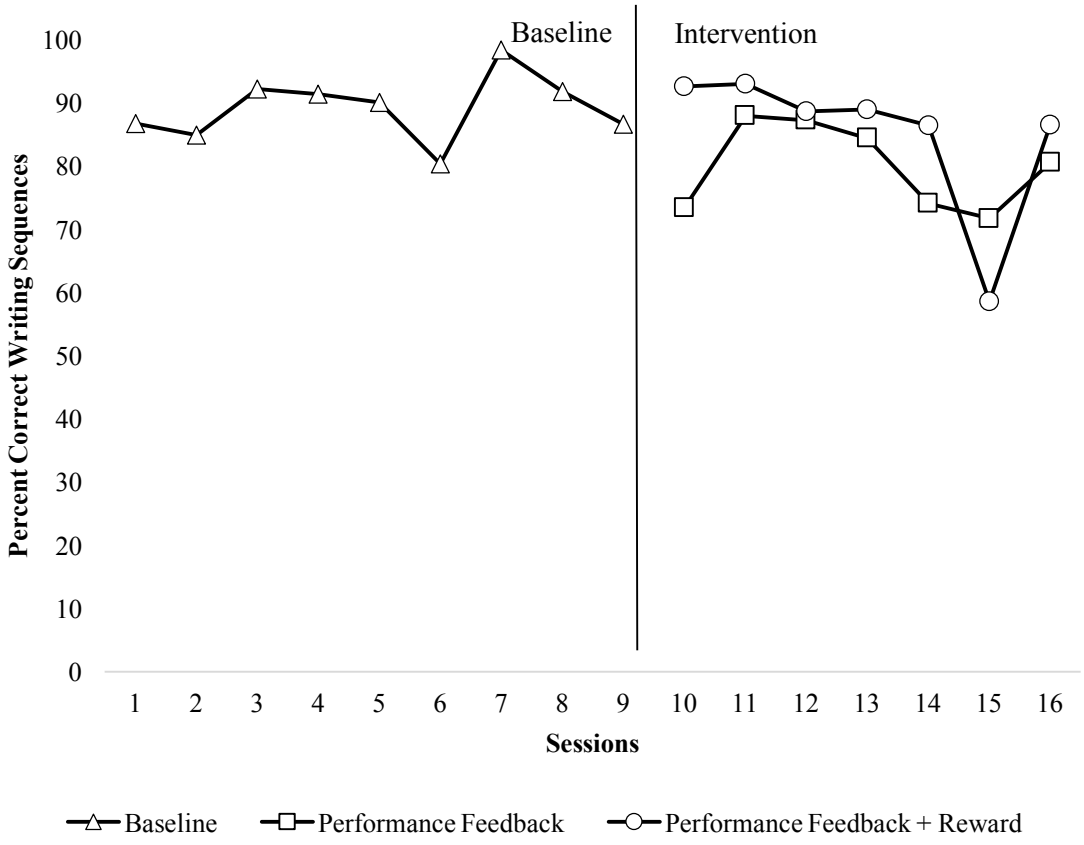


Figure 6. Percent Correct Writing Sequences for D.W. across baseline and alternating treatment phases.

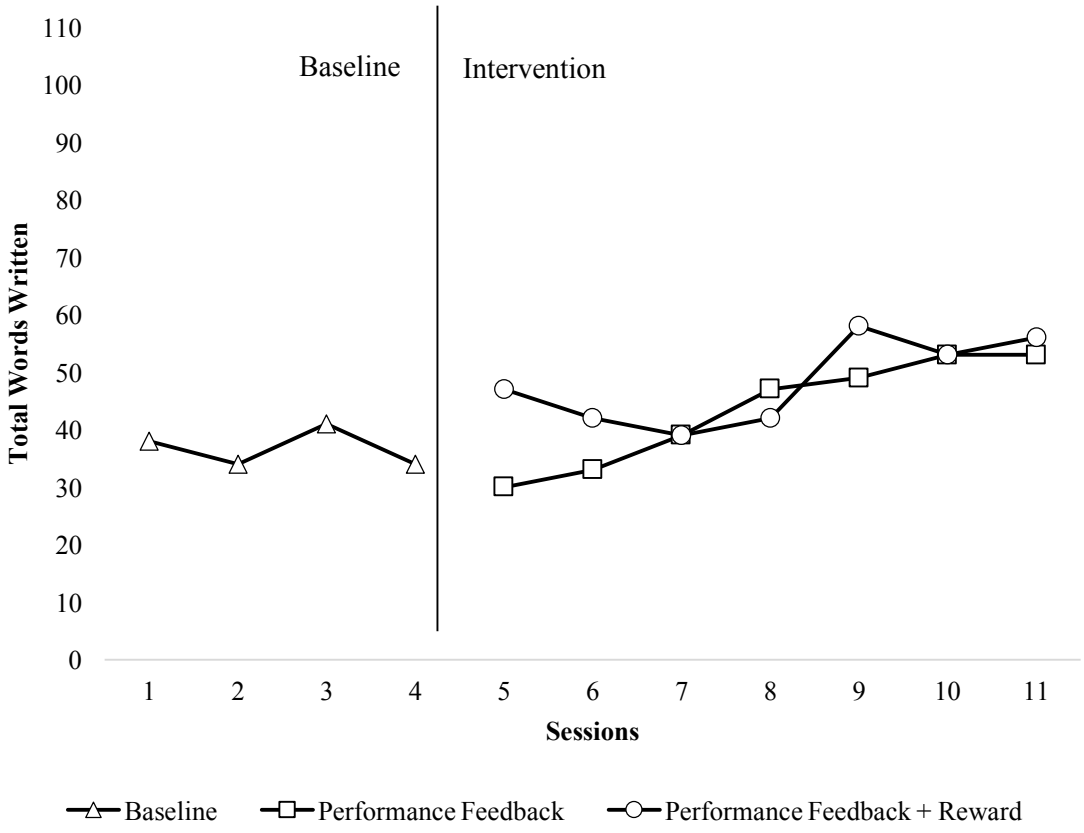


Figure 7. Total Words Written for Optimus across baseline and alternating treatment phases.

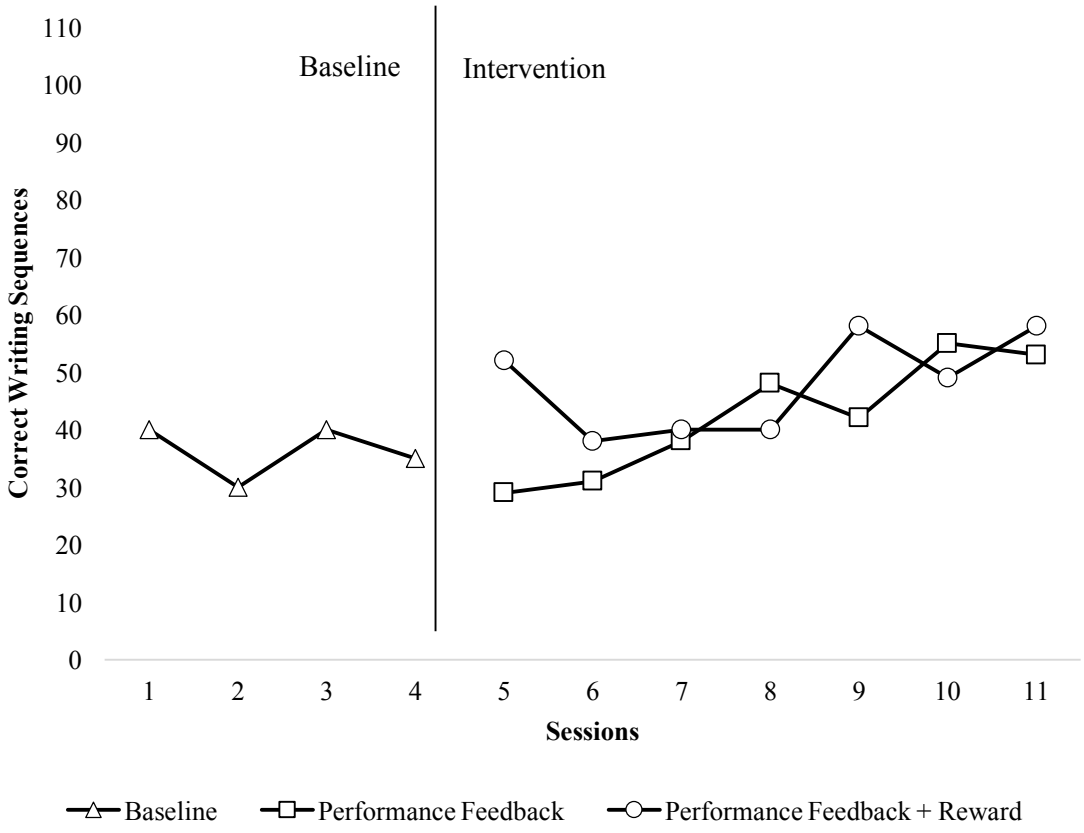


Figure 8. Correct Writing Sequences for Optimus across baseline and alternating treatment phases.

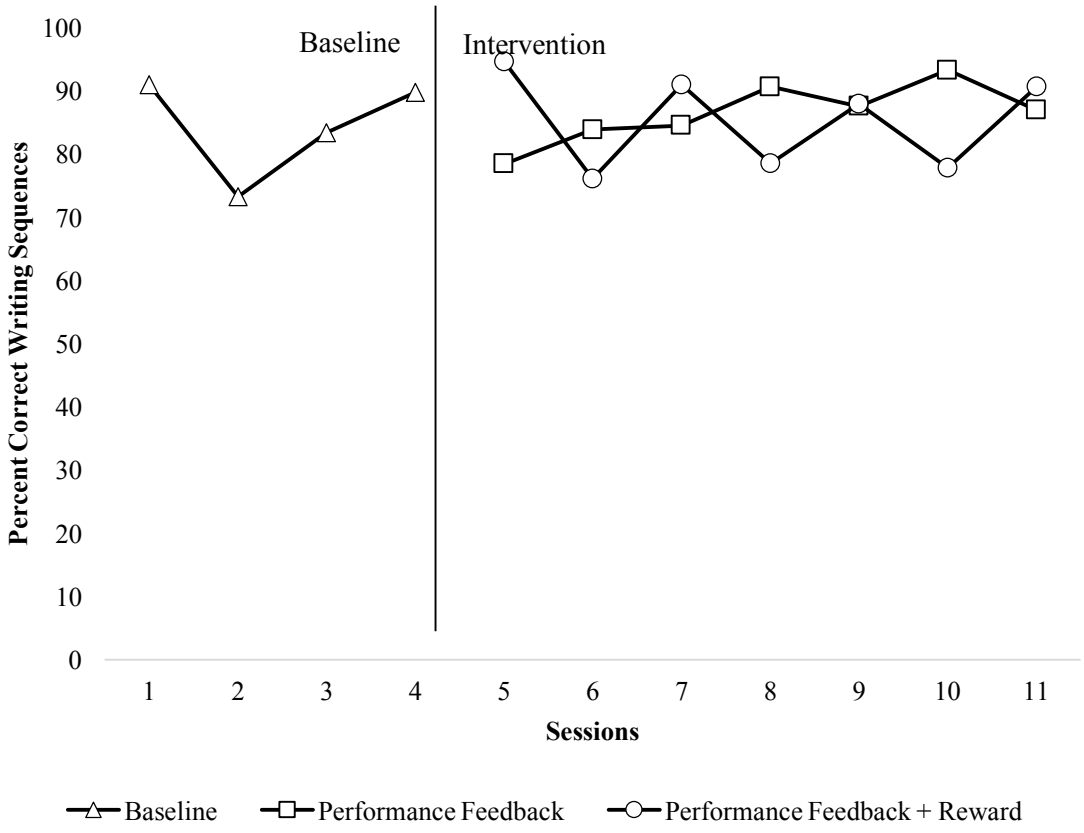


Figure 9. Percent Correct Writing Sequences for Optimus across baseline and alternating treatment phases.

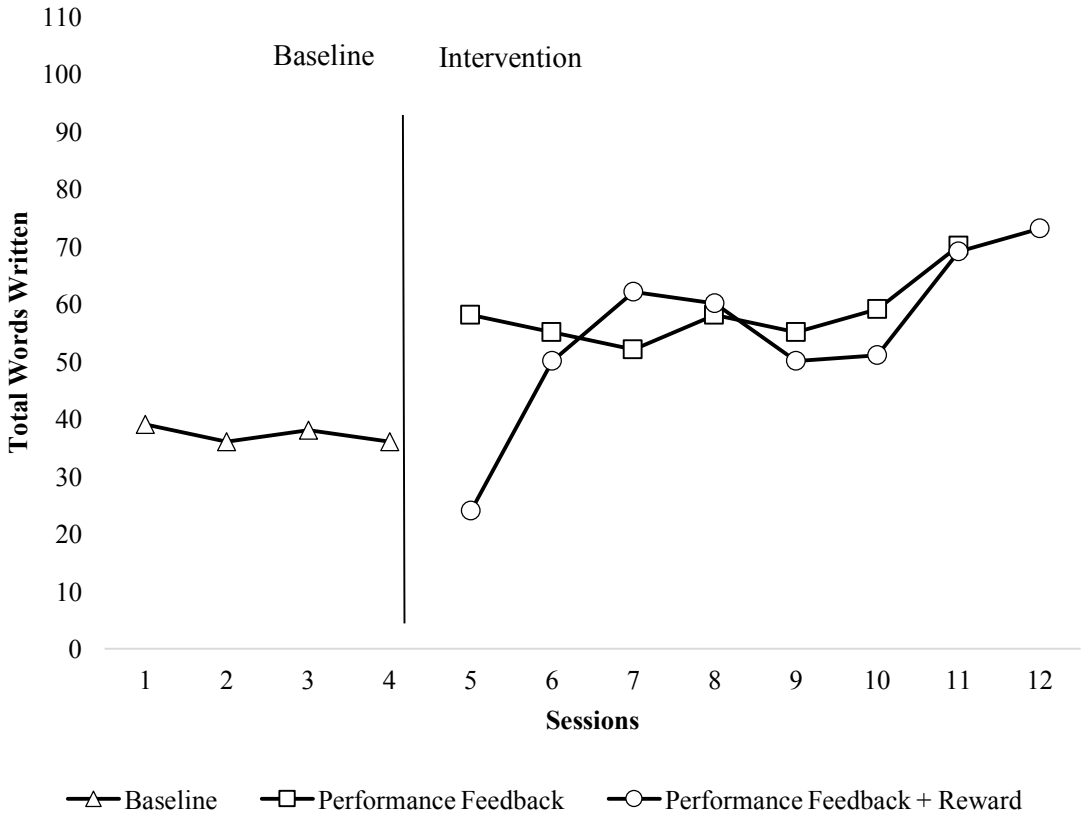


Figure 10. Total Words Written for Rosa across baseline and alternating treatment phases.

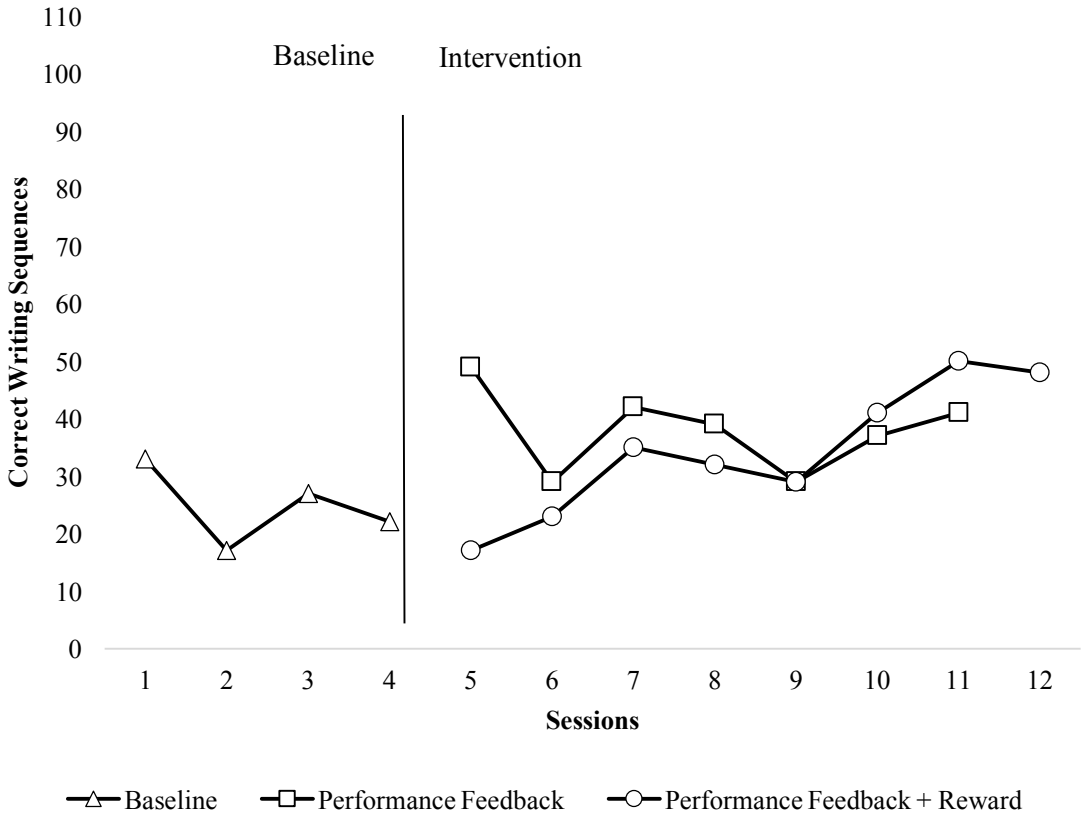


Figure 11. Correct Writing Sequences for Rosa across baseline and alternating treatment phases.

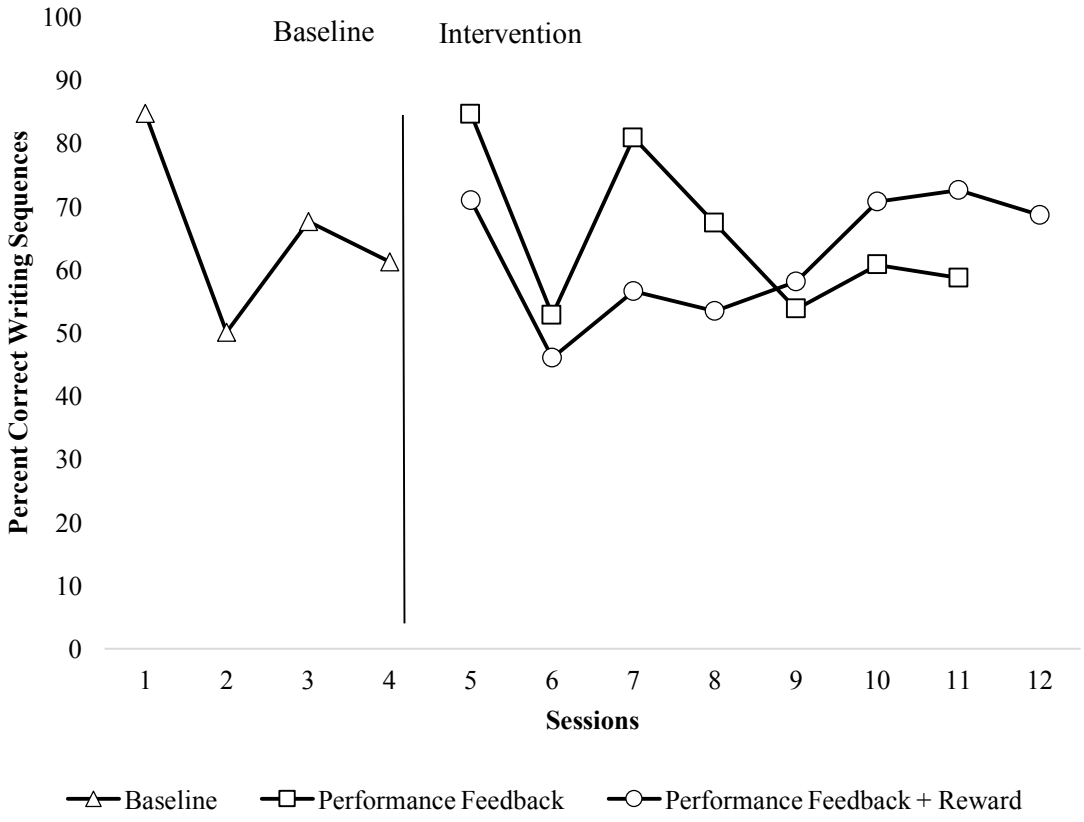


Figure 12. Percent Correct Writing Sequences for Rosa across baseline and alternating treatment phases.

Appendix B
Informed Consent Letter

Parent Informed Consent Form
Evaluating the effectiveness of writing interventions

Purpose of the Research:
This research project will examine the effect of different writing interventions in helping students develop strong writing skills. Your child was selected to participate in this study because he/she was identified by a teacher at Pond Gap elementary school as needing help developing writing skills.

Procedure:
If your child participates in this research project, he/she will be asked to write essays each week during the after-school program at Pond Gap Elementary School. We will be working with students on writing for a maximum of 1 hour per week over a period of up to two months. A researcher will help your child identify how to improve their writing. After learning how to improve their work, you child may receive feedback from researcher or try to meet new goals established for their work. Your child may receive rewards for meeting goals and these goals may include edible snacks.

Risks and/or Discomforts:
Participation in the study poses no known risks to your child. We will monitor your child for frustration levels while writing and provide frequent breaks, if needed.

Benefits:
Through your child's participation, you will be helping us to learn more about the role of using feedback to improve student writing. Additionally, your child will learn strategies to help him/her write longer and better essays.

Confidentiality:
Any information gathered during this study, which may identify your child, will be kept strictly confidential. The information obtained in this research may be published in scientific journals or presented at professional meetings, but data reported will not identify any individual participant.

Contact Information:
If you have questions at any time about the study or the procedures, you may contact the researcher, [Dr. Merilee McCurdy 520 Bailey Education Complex or 865-974-8144. If you have questions about your rights as a participant, contact the Office of Research Compliance Officer at (865) 974-7697.

Parent's Initials _____

IRB NUMBER: UTK IRB-15-02455-XP
IRB APPROVAL DATE: 12/02/2015
IRB EXPIRATION DATE: 12/01/2016

Freedom to Withdraw:
Your child's participation in this study is voluntary. You are free to decide for your child not to participate in this study or to withdraw your child's participation at any time without adversely affecting your relationship with the investigators or the University of Tennessee - Knoxville or those at Pond Gap elementary school. Your decision will not result in any loss of benefits to which you are otherwise entitled.

Participation:
Your child's participation in this study is voluntary; you may decline for your child to participate without penalty. If you decide that your child should not participate, you may withdraw him/her from the study at anytime without penalty and without loss of benefits to which your family is otherwise entitled. If you withdraw your child from the study before data collection is completed your child's data will be returned to you or destroyed.

CONSENT

I have read the above information. I have received a copy of this form. I agree to participate in this study.

_____
Child's name – printed

_____ _____
Signature of parent/guardian date

IRB NUMBER: UTK IRB-15-02455-XP
IRB APPROVAL DATE: 12/02/2015
IRB EXPIRATION DATE: 12/01/2016

Appendix C
Youth Assent Form

Youth Assent Form
Evaluating the effectiveness of writing interventions

Examiner: Hello, my name is (examiner's name). I'm a researcher at the University of Tennessee. Your guardian/parent and your teacher say you might be willing to help me with a research project. If you agree to help me, for the next few months we are going to write stories. We'll work on making your stories better together during your classroom time during the afterschool program. You'll come out to these tables in the hallway for about ten minutes and work on writing a story. You might miss a little time that you might work on other schoolwork during your academic hour.

Are you willing to help me with this project? (YES/NO)

Great! I think you will find this fun to do. If you decide that you don't want to do this anymore, all you have to do is tell me.

I appreciate your help!

If you sign this form, it means you have decided to help me with this research project.

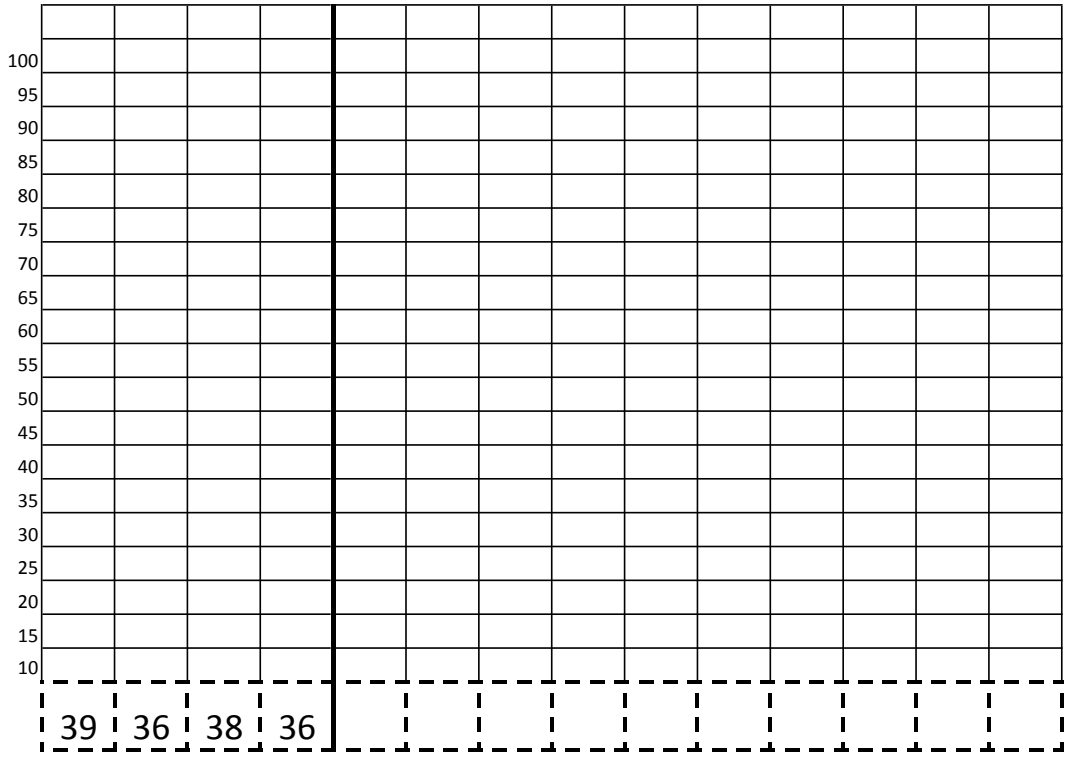
_____
Signature of student

_____
Signature of researcher

IRB NUMBER: UTK IRB-15-02455-XP
IRB APPROVAL DATE: 12/02/2015
IRB EXPIRATION DATE: 12/01/2016

Appendix D

Sample Performance Feedback Page



Appendix E

Example of writing journal page

I looked around the space ship and…

Appendix F

Bank of CBM prompts

1. I would like to be invisible because…

2. I was shipwrecked on a deserted island when…

3. I looked around the space ship and…

4. I once had a magic pencil and…

5. I opened the front door very carefully and…

6. I was in the middle of the lake when…

7. I was sleeping soundly when…

8. I was playing outside when a spaceship landed and…

9. One day my mom surprised me and brought home a…

10. One day I went for an airplane ride and…

11. My 2-year-old brother found a magic marker and…

12. If I were to make a TV show, it would be about…

13. I stepped into the time machine and…

14. One day last summer, the only way I could walk was backwards and…

15. I waved out the window at my family as…

16. “Up we go,” said my friend, and…

17. My heart seemed to stop beating as I opened the door…

18. When the boat went out of control, I …

19. I was riding on an elevator when…

20. I saw colored lights in the sky and…

21. Yesterday, a monkey climbed through the window at school and …

22. Being chased by a shark wasn’t fun. I had to…

23. I was chewing a piece of bubble gum when…

24. My friend and I were walking by an old deserted house and…

25. I decided to follow the huge footprints along the trail, as I was …

26. Working madly in my laboratory, I suddenly realized that my magic formula…

27. It was a hot, dry day and I had been walking for hours without food or water when…

28. As I got up from my chair, I turned around and noticed all the smoke in the room…

29. I couldn’t fall asleep in my tent. I heard this noise outside and…

30. When I was in the Olympics, I…

Appendix G

Baseline Data Collection Script

1. Give each student the paper with the story starter written at the top (provided).

2. Give them the following instructions:

"I want you to write a story. I am going to read the first few words of the story to you first and then I want you to write a story about what happens. You will have 1 minute to think about the story you will write, and then you'll have five minutes to write it. Do your best work. If you don't know how to spell a word, you should guess. Use the words written at the top of your paper as your first sentence. Are there any questions? For the next minute think about….. (read story starter)." Begin timing.

3. If students start writing, instruct them to wait until you tell them to begin writing.

4. After 30 seconds say, "You should be thinking about…"

5. After 1 minute, say, "Start Writing." (Restart the stop watch.) Walk around the classroom to ensure the students are writing.

6. After 90 seconds, say, "You should be writing about…."

7. At three minutes, note the last word written by the student.

8. At five minutes say, "Stop and put your pencil down."

Appendix H

Table 5
Randomization of Alternating Treatment Interventions

Participant	Wk 1	Wk 2	Wk 3	Wk 4	Wk 5	Wk 6	Wk 7	Wk 8
Student1	1	0	1	1	0	1	0	0
Student2	0	0	1	0	0	1	1	1
Student3	0	0	1	0	1	1	0	1
Student4	0	0	1	0	1	1	0	1
Student5	0	0	0	1	0	1	1	1
Student6	0	0	0	0	1	1	1	1
Student7	1	0	1	0	1	0	1	0
Student8	1	0	0	1	0	1	1	0
Student9	1	0	0	1	1	0	1	0
Student10	0	1	0	1	1	1	0	0

Note. Randomization established through random number generator, where 1 indicates performance feedback plus reward condition and 0 indicates performance feedback. This determined the first of two interventions the participant would have in a week.

Appendix I

Baseline Procedural Integrity Checklist

	Procedural Integrity- Baseline	✔
1.	Give each student his or her writing journal.	
2.	A. Explain CBM, timing.	
	B. Begin 1 minute brainstorm time.	
	C. Prompt at 30 s.	
	D. End brainstorm at 60 s.	
3.	A. Instruct students to begin writing.	
	B. Prompt at 90s.	
	C. Note at 3 mins.	
	D. Stop writing at 5 mins.	
4.	Thank student for participation!	

Appendix J
Performance Feedback Data Collection Script

1. Give each student their writing journal.

2. Direct participating students to the performance feedback page. Say,

"Before we write our story today, look back on your story from our last session. We counted how many words you wrote, graphed it, and drew an arrow. An arrow pointing up means you wrote more, an arrow pointing down means you wrote less, and an equals sign means you wrote the same."

3. Give them the following instructions:

"I want you to write a story. I am going to read the first few words of the story to you first and then I want you to write a story about what happens. You will have 1 minute to think about the story you will write, and then you'll have 5 minutes to write it. Do your best work. If you don't know how to spell a word, you should guess. Use the words written at the top of your paper as your first sentence. Are there any questions? For the next minute think about….. (read story starter)." Begin timing.

4. If students start writing, instruct them to *wait* until you tell them to begin writing.

5. After 30 seconds say, "You should be thinking about…"

6. After 1 minute, say, "Start Writing." (Restart the stop watch.) Monitor students to make sure they are writing.

7. At 90 seconds, say, "You should be writing about…."

8. At three minutes, note the last word written by the student.

9. At five minutes say, "Stop and put your pencil down."

10. Give the following instructions:

"Let's see how you did! Count along with me and we'll graph your performance."

11. Count all words, write the number at the bottom of the performance feedback graph, and graph the bar graph of the student's performance.

12. Say,
"Thanks for writing with me today!"

Appendix K

Performance Feedback Procedural Integrity Checklist

	Procedural Integrity- Performance Feedback Intervention	✔
1.	Give each student his or her writing journal.	
2.	A. Turn to performance feedback page.	
	B. Refer to bar graph of previous performance	
	C. Refer to arrow from previous performance.	
3.	E. Explain CBM, timing.	
	F. Begin 1 minute brainstorm time.	
	G. Prompt at 30 s.	
	H. End brainstorm at 60 s.	
4.	E. Instruct students to begin writing.	
	F. Prompt at 90s.	
	G. Note word at 3 mins.	
	H. End writing at 5 mins.	
5.	Count all words with student.	
6.	A. Write number of words on performance feedback page.	
	B. Graph student performance.	
	7. Thank student for participation!	

Appendix L

Performance Feedback + Reinforcement Data Collection Script

1. Give each student their writing journal.

2. Direct participating students to the performance feedback page. Say,

"Before we write our story today, look back on your story from our last session. We counted how many words you wrote, graphed it, and drew an arrow. An arrow pointing up means you wrote more, an arrow pointing down means you wrote less, and an equals sign means you wrote the same. *Today, if you improve your performance, you will earn a reward!* "

3. Say,

"We're going to write in a special area today. Turn to the divider. These are the stories you'll write to earn a reward."

4. Give them the following instructions:

"I want you to write a story. I am going to read the first few words of the story to you first and then I want you to write a story about what happens. You will have 1 minute to think about the story you will write, and then you'll have five minutes to write it. Do your best work. If you don't know how to spell a word, you should guess. Use the words written at the top of your paper as your first sentence. Are there any questions? For the next minute think about….. (read story starter)." Begin timing.

5. If students start writing, instruct them to *wait* until you tell them to begin writing.

6. After 30 seconds say, "You should be thinking about…"

7. After 1 minute, say, "Start Writing." (Restart the stop watch.) Monitor students to make sure they are writing.

8. After 90 seconds, say, "You should be writing about…."

9. At three minutes, note the last word written.

10. At five minutes say, "Stop and put your pencil down."

11. Give the following instructions:

"Let's see how you did! Count along with me and we'll graph your performance."

12. Count all words, write the number at the bottom of the performance feedback graph, and graph the bar graph of the student's performance.

1. IF student increases their performance, say: *"You've earned a reward! Great work!"*
2. IF student did not increase their performance, say: *"You'll have another chance to earn a reward next week."*

13. Say,
"Thanks for writing with me today!"

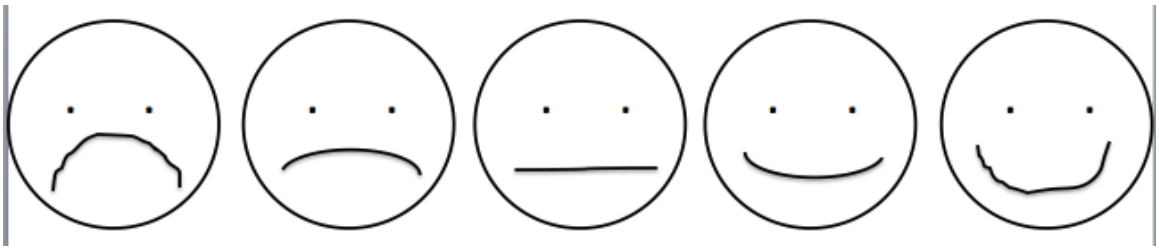
Appendix M

Performance Feedback + Reinforcement Intervention Procedural Integrity Checklist

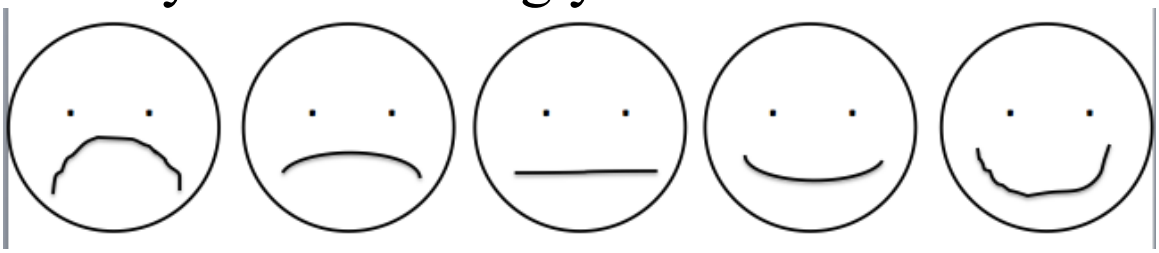
	Procedural Integrity- Performance Feedback +Reinforcement Intervention	✔
1.	Give each student his or her writing journal.	
2.	D. Turn to performance feedback page.	
	E. Refer to bar graph of previous performance	
	F. Refer to arrow from previous performance.	
3.	Inform student of opportunity to earn a reward for improving performance today.	
4.	Turn to the divider in the notebook.	
5.	I. Explain CBM, timing.	
	J. Begin 1 minute brainstorm time.	
	K. Prompt at 30 s.	
	L. End brainstorm at 60 s.	
6.	I. Instruct students to begin writing.	
	J. Prompt at 90s.	
	K. Note word at 3 mins.	
	L. End writing at 5 mins.	
7.	Count all words with student.	
8.	C. Write number of words on performance feedback page.	
	D. Graph student performance.	
9.	Either: Inform student they've earned a reward, give reward. OR Inform student they'll have another chance to earn a reward next week.	
10.	Thank student for participation!	

Appendix N
Social Validity Scale

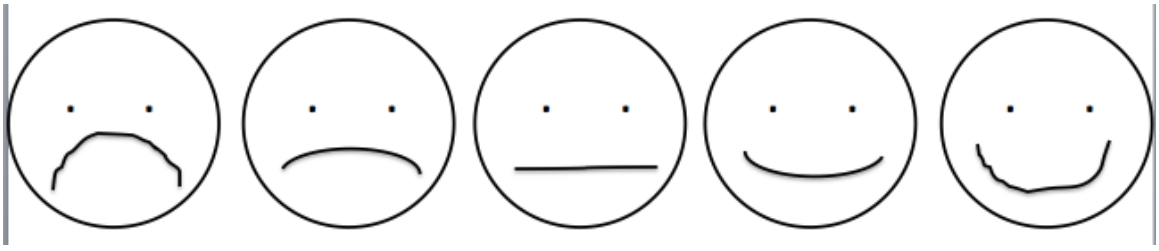
1. How much do you like writing stories with us each week?



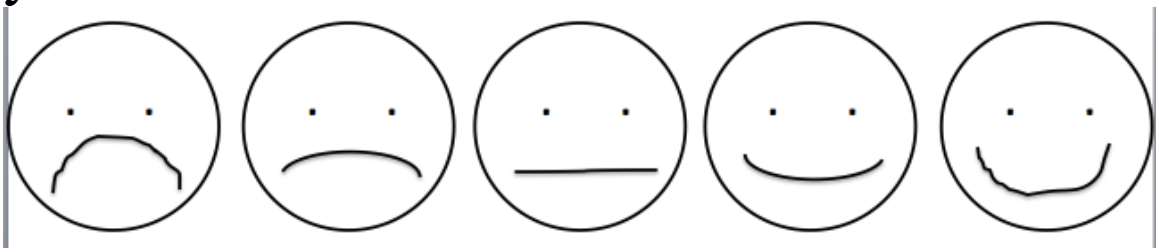
2. How much do you like being timed while you are writing your stories with us?



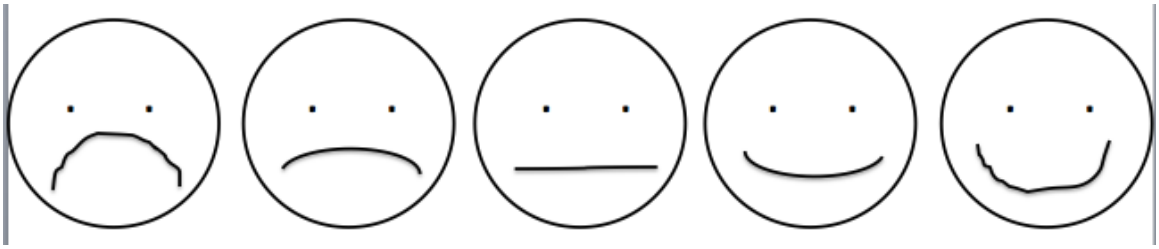
3. Were there any times you didn't want to write a story with us?



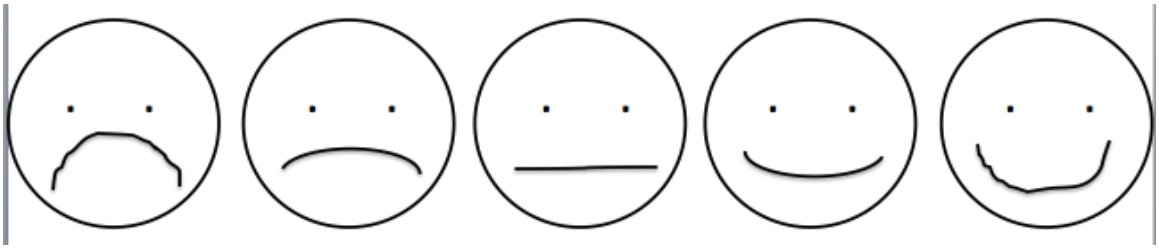
4. Were there any times when you wished you could write more stories with us?



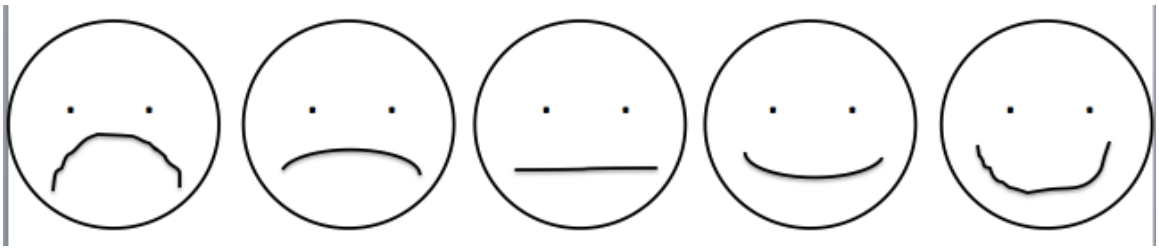
5. Do you think your writing has improved?



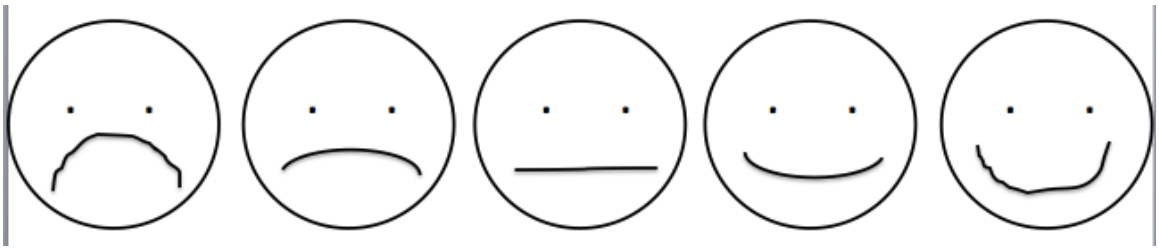
6. Do you think your writing has gotten worse?



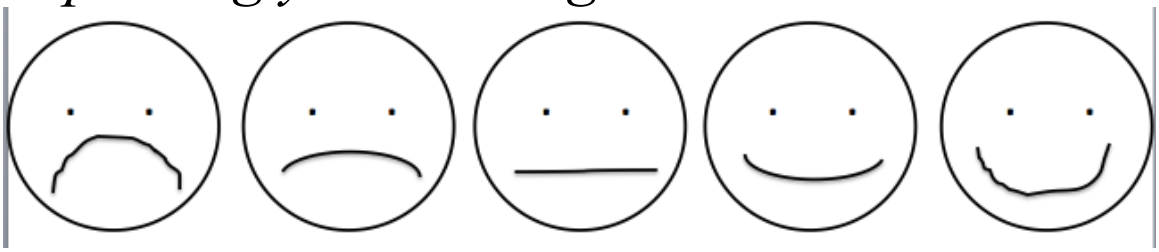
7. Did you like knowing how many words you wrote?



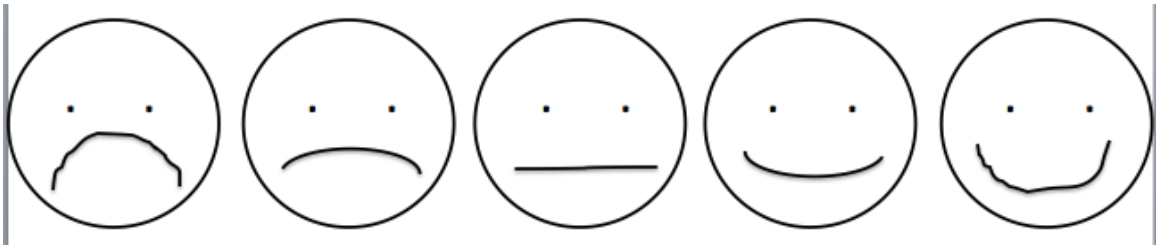
8. Did you like using a graph to see how many words you wrote?



9. Did you like getting a reward for improving your writing?



10. Did you try harder on days you might earn a reward?



Vita

Leslie Allison Hart was born in Illinois and raised in Alpharetta, Georgia. She graduated from Elon University in 2012 with a B.A. in Psychology and a minor in Neuroscience. She began work in the University of Tennessee School Psychology Ph.D. Program in August of 2012. In 2014, she earned an M.S. in Applied Educational Psychology. She will serve as an intern in the 2016-2017 Predoctoral Professional Psychology Internship Training Program with the Cypress-Fairbanks I.S.D in Cypress, Texas and will complete her doctoral requirements in August 2017.