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A Closer Look into Treatment Integrity: Examining the Effects of Student Intervention Adherence on Intervention Outcomes

Alec Ryan Goldstein
Syracuse University

Abstract

It is widely accepted that treatment integrity is an important component in evaluating the validity of an intervention (Collier-Meek et al., 2013), and empirical research has demonstrated a positive relationship between high treatment integrity and intervention outcomes (Hengeller et al., 1997; Huey et al., 2000; Noell et al., 2002; Scott et al., 2019; Wilder et al., 2006). Participant adherence, a foundational dimension of treatment integrity (Sanetti et al., 2021), should also be examined in order to make valid conclusions regarding intervention effectiveness. The current study sought to descriptively explore students' adherence to a performance feedback, goal setting, and self-graphing intervention in the content area of writing, as well as examine the relationship between student intervention adherence and intervention outcomes. A total of 30 third-grade students were assessed for intervention adherence at the conclusion of the intervention. Results of this study indicated that students typically adhered to the intervention examined in the context of the present study with high levels of intervention completion (*M* =98.5%) and accuracy (*M* = 85.5%). Small and statistically nonsignificant relationships (range, *r* = .213 to .207) were found between student intervention adherence and intervention outcomes.

Keywords: treatment integrity, intervention adherence

A CLOSER LOOK INTO TREATMENT INTEGRITY: EXAMINING THE EFFECTS OF STUDENT INTERVENTION ADHERENCE ON INTERVENTION OUTCOMES

By

Alec R Goldstein

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Fidelity of treatment is generally considered to be confirmation that the manipulation of the independent variable occurred as planned. Treatment fidelity has significant implications for the internal validity, external validity, and construct validity of treatment outcome research, and is needed to ensure that fair, powerful, and valid comparisons of treatments can be made (Moncher & Prinz, 1991). Although important to report, only a small proportion of published articles in the field of school psychology provide information on treatment fidelity (Gresham et al., 1993; McIntyre, et. al., 2007; Peterson et al., 1982). This situation exists despite long-standing discussions on how to collect such data (e.g., Billingsley et al., 1980; Gresham et al., 1993; Hall & Louchs, 1977; LeLaurin & Wolery, 1992). Recently, in a survey of 132 nationally certified school psychologists, 100% of respondents endorsed treatment fidelity as a key component of intervention success, but when asked whether school-based problem-solving teams measure treatment fidelity to inform their decisions about student response to interventions, 0% indicated “always”, and 14% indicated “most of the time” (Cochrane et al., 2019).

In this introduction, I will review the theoretical conceptualization of treatment fidelity and treatment integrity within the current literature. I will then review the specific construct of participant adherence as it relates to treatment integrity. Next, I will review the empirical research surrounding a specific writing intervention that was developed to improve elementary students’ writing performance and incorporates a number of strategies (i.e., performance feedback, goal setting, self-graphing). The importance of examining intervention adherence within the context of this intervention will be discussed and I will present a rationale

for conducting the present study, which examines the relationship between intervention adherence and intervention outcomes within the context of this writing intervention.

Treatment Integrity: Important Foundational Considerations

Although treatment integrity has been identified as an important consideration in intervention research and methods have been developed to measure treatment integrity, a consensus has not been reached regarding treatment integrity assessment guidelines (Fallon et al., 2015). In an effort to advance our understanding of the empirical research associated with the assessment of treatment integrity in school settings, Collier-Meek, Fallon, and Gould (2018) conducted a systematic review of 58 single-case research studies that specifically focused on improving teachers' treatment integrity of classroom interventions by providing them with performance feedback regarding their treatment integrity. A key contribution of this work was the analysis of methodological features associated with the treatment integrity assessment that was conducted, which included: (a) intervention component operationalization (i.e., one-to-one correspondence or weighted), (b) dimensions assessed (i.e., adherence, quality, exposure, dosage, responsiveness), (c) assessment methods used (i.e., direct observation, permanent product review, or self-report measurement), (d) rating methodology (i.e., occurrence, frequency count or rate, interval recording), (e) sampling methods (i.e., reporting of decision rules for permanent products or self-report forms), and (f) treatment integrity reliability outcomes (i.e., inter- and intra-observer agreement levels).

Results of the systematic review indicated several important findings. First, most studies (75.8%) assessed treatment integrity by means of direct observation, although permanent products generated by teachers were examined in a moderate (31%) number of studies. No studies included in the review examined permanent products generated by students. Second,

most studies applied one-to-one correspondence (39.6%) of intervention steps in the integrity assessment, with few studies incorporating weighted intervention steps (13.7%). Third, treatment integrity was most likely to be rated as occurrence or nonoccurrence of the intervention step (56.90%), with a smaller percentage of studies using frequency estimations (22.41%) or interval recording (17.24%). These results reflect integrity ratings on all treatment integrity measures that were examined (i.e., direct observation, permanent product review, and self-report). Fourth, most studies (98.2%) examined teachers' adherence to intervention steps.

The systematic review conducted by Collier-Meek and colleagues (2018) provided a thorough examination of treatment integrity within the context of performance feedback research provided to teachers to increase implementation integrity. Although the review provided a descriptive analysis of the most used methods of measurement (i.e., direct observation, permanent product review), their analysis did not examine whether several key aspects of treatment integrity varied as a function of the measurement method. Specifically, their review failed to examine whether intervention component operationalization, dimensions assessed, rating methodology, sampling methods, or treatment integrity reliability outcomes varied based on whether direct observation or permanent product reviews were conducted. Further, no analyses were conducted that examined whether the measurement method or level of treatment integrity impacted student intervention outcomes. Because school-based interventions are implemented to improve student performance, an examination of whether the measurement method and associated level of treatment integrity impact students' performance are critical.

Participant Adherence

When consolidating information on the current state of treatment integrity in order to construct a working definition of the term, Sanetti and Kratochwill (2009) identified the word

"adherence" as the most common construct used. Adherence is the extent to which intervention steps are implemented as planned and is typically considered a foundational dimension of treatment fidelity (Sanetti et al. 2021). Previous literature has conceptualized participant adherence as being applied to both participants and interventionists (Sanetti et al., 2021). Interventionist adherence is defined as the extent to which intervention components are implemented as planned (Dane & Schneider, 1998), and participant adherence is defined as the extent to which the participant implements essential intervention strategies as planned (Jones et al., 2008). Interventionist adherence is the construct typically measured when assessing treatment integrity and is measured through direct systematic observation, self-report, or a review of interventionist-produced permanent products. Participant adherence, specific to academic interventions, can only be measured through an examination of permanent products produced by the participants receiving the intervention. For example, to see whether students graphed their progress correctly while participating in a self-monitoring intervention, the permanent product graphs would be evaluated. As a result, permanent product examination is a means to assess participant adherence, which is a critical dimension of treatment integrity.

School-Based Interventions: Performance Feedback, Goal Setting, and Self-Graphing

One type of school-based intervention that produces student permanent products is combining performance feedback with goal setting and self-graphing. This combined intervention approach is based on theoretical work emphasizing the importance of providing students with (a) information regarding their performance (i.e., feedback; Hattie & Timperley, 2007; Kluger & DeNisi, 1996), (b) a standard of desired performance (i.e., goal setting; Locke et al., 1981), and (c) a visual representation of performance over time (i.e., self-graphing; Sutherland & Snyder, 2007). The next sections provide an overview of each intervention

including a description of the procedures used as well as supporting theoretical and empirical work.

Performance Feedback

Performance feedback is defined as providing information to an individual regarding one or more aspects of an individual's performance (Hattie, 2012). When implemented, performance feedback often results in changes in the individual's behavior, which are thought to be due to either the individual's motivation to reduce the presented discrepancy (Carver & Scheier, 1982; Kluger & DeNisi, 1996) or to surpass the presented standard (Bandura, 1991; Hattie & Timperley, 2007; Latham & Locke, 1991; Locke et al., 1981). A recent meta-analysis conducted by Wisniewski and colleagues (2020) evaluated 435 studies that examined the effectiveness of performance feedback in school and related academic settings. Results indicated a medium overall effect (d = 0.48) on student learning of the different forms of feedback examined in the studies. In addition, results indicated that some forms of feedback are more effective (e.g., providing written feedback) than others (e.g., providing oral feedback).

Goal Setting

A goal is considered the object or aim of an action, and goal setting is a technique used to promote change by means of goals (Epton et al., 2017). Goal Setting Theory (Latham & Locke, 1991), a comprehensive theory based on a meta-synthesis of over 20,000 studies, posits that there is a linear, functional relationship between the degree of goal difficulty and performance, such that difficult goals lead to increased performance. Interestingly, this theory emphasizes the reciprocal relationship between goal setting and feedback, in that feedback influences which goals are set, and those new goals influence change that warrants feedback. In addition, it is also suggested that goal setting is moderated by feedback, wherein feedback must be provided

regarding the progress of reaching the goal in order for goal setting to be effective (Erez, 1977). A recent meta-analysis conducted by Epton and colleagues (2017) reported that goal setting interventions had a moderate effect on altering behavior (d = 0.40).

Self-Graphing

Self-graphing requires students to graph their performance which results in a visual representation of their performance over time (Sutherland & Snyder, 2007). Self-graphing is conceptualized as a behavioral self-management tool that allows individuals to become more aware of their behavior (McDougall et al., 2017). Although there are no meta-analyses that have synthesized the existing self-graphing research, a meta-analysis of single-case research designs conducted by Briesch and colleagues (2019) included 5 studies in which self-graphing was examined. Results of their work indicated that students without disabilities in a general education classroom were significantly likely to see academic success in the implemented intervention when graphing their performance (PAND = .86). Additionally, a meta-analysis conducted by Fuchs and Fuchs (1986) found that class-wide academic interventions that incorporated graphing performance were more effective (d = .70) than interventions that did not graph performance (d = .26).

Combining Performance Feedback, Goal Setting, and Self-Graphing

Due to the efficacy of these three interventions and their applicability to classroom learning (Fuchs & Fuchs, 1986), there have been several studies that have combined these interventions to improve students' academic performance. In the first study, Moxley and colleagues (1995) examined the effects of a combined performance feedback, goal setting, and self-graphing intervention in four single case research designs that collapsed students' performance across grade levels and only examined intervention effects (i.e., B design). Only

two of the designs, examining first- and second-grade students in general education classrooms, are relevant to this literature review. Two groups of students, one comprised of first-grade students (n = 24) and one comprised of second-grade students (n = 26), were instructed to write in their journals during specific times. The writing times occurred twice a week for the first-grade students and daily for the second-grade students, each for 15 minutes. Immediately following the writing, students were instructed to count the total number of words they had written and record that number on both an individual graph and a chart posted in the classroom. When each student surpassed a set fluency goal (e.g., 300 total words written) the student would be awarded a pizza lunch or extra recess.

Based on a visual inspection of the trend in the average number of words written per session by each student group over the course of the study, results indicated an increasing trend for both first- and second-grade groups of students. Descriptively, the authors reported that the median improvement for first-grade students ranged from 5 to 18 words written per session. Although the authors did not report improvement rates for the second-grade students, they did report that the average number of words written per week increased from 1,000 to 5,000 by the end of the intervention.

Within the context of this study, there was no assessment of treatment integrity, either by systematic direct observation or by permanent product review, or of student intervention adherence. Although the intervention could have been examined by reviewing the permanent products (i.e., physical writing and graphing) that the students produced, no information was provided regarding the assessment methods or any associated features (e.g., intervention component operationalization, dimensions assessed, rating methodology, sampling methods). Further, no treatment integrity reliability outcomes were reported. As a result, there is a

possibility that the combined interventions were not implemented correctly, and the results may not truly reflect the effects of the combined interventions.

In addition to the limitations associated with the lack of treatment integrity, there are several threats to the internal validity of this study. First, all participants included in this study received the intervention and no control condition was included for comparison. As a result, it is impossible to determine whether the combined intervention was responsible for the reported effects or whether other factors (e.g., cognitive development, typical curriculum) contributed. Second, no interscorer agreement was recorded. Minimal information regarding the data collection process was provided resulting in ambiguity surrounding its validity. There are also threats to the external validity of this study. Because the study only focused on typically developing students in the first and second grades, the results cannot be generalized beyond these grade levels.

A second study, conducted by Alitto (2008), examined the effects of this combined intervention on writing fluency, as measured through the completion of Curriculum Based Measurement – Written Expression (CBM-WE; Shapiro, 2010) probes. A total of 106 general education students in fifth grade participated in two sessions per week over eight weeks. Half of the students were randomly assigned to a practice-only control group, and the other half were assigned to the combined interventions. During each session, students were instructed to complete the CBM-WE and to exchange their finished compositions with a peer. The students were instructed to (a) score their peer's writing fluency (i.e., count the total words written), (b) provide feedback (i.e., three things they liked about it and three things they would suggest improving upon), and (c) provide a fluency goal for their peer (i.e., indicate the number representing one word higher than the student's highest fluency score). Students were returned

their original compositions and instructed to graph their performance for that session in comparison with the fluency goal they were presented with.

Alitto found that the students in the combined intervention condition showed significantly higher growth rates (*M* = increase of 2 words per week) than students in the control condition (*M* = increase of 0.38 words per week). Alitto reported implementation integrity with a Procedural Integrity Form (PIF) developed by the author for use in their specific study and administered to all classroom teachers. Teachers were required to indicate: (a) the dates on which the probes were administered each week, (b) if the students in the experimental group exchanged papers, (c) if the students graphed their progress, (d) if there were any extraordinary circumstances during the intervention (e.g., student absences, procedural errors), and (e) the amount of time spent on writing instruction. Procedural integrity forms were also completed by the school psychologist and acting researcher during which they directly observed the intervention and interviewed the classroom teachers about their progress. If inaccuracies in implementation were found, the school psychologist and researcher would meet with the classroom teacher to provide feedback.

Within the context of this study, treatment integrity was assessed by the PIF, however, no quantitative data were reported regarding treatment integrity outcomes. Although the authors reported that "data were collected in accordance with the specific study procedures during all of the observations" (p. 73), no external verification of treatment integrity was reported. Additionally, although specific aspects of the intervention, such as student intervention adherence, could have been examined by permanent product review (i.e., physical writing and graphing), no assessment was conducted. Thus, similar to the work of Moxley and colleagues

(1995), it is impossible to verify whether intervention components completed by the students were implemented correctly.

In a third study, Koenig and colleagues (2016) conducted a randomized controlled trial with third-grade students in general education classrooms. The study compared the effects of (a) a control condition (n = 38), (b) performance feedback condition (n = 39), and (c) a combined performance feedback and goal setting condition (n = 39) on students' writing fluency. Students participated in weekly 30-minute sessions. Students assigned to the control group were assessed with CBM-WE probes during baseline, the middle intervention, and during the final intervention session. For those students assigned to the performance feedback condition, students were provided both oral and visual feedback on their writing progress from the week before and completed a CBM-WE probe. For students assigned to the combined intervention condition, students received performance feedback identical to the performance feedback condition. In addition, these students were provided a fluency goal regarding how many additional words they should be writing each session prior to completing a CBM-WE probe. After writing, the students were instructed to count the number of words they had written, which provided an opportunity for students to receive immediate feedback on their performance. The students then graphed the total number of words they had written to visually represent their progress. At the conclusion of the intervention, students were administered a measure that assessed their adherence with two components of the intervention (i.e., student goal setting, self-graphing); however, these data were not analyzed.

Conditional growth modeling indicated that the combined intervention resulted in statistically significant increases in students' writing performance when compared to a control condition. Specifically, students in the control condition improved an average of 0.82 correct

writing sequences per session, and students in the combined intervention condition improved an average of 2.24 correct writing sequences per session. As part of the study, Koenig and colleagues implemented procedural scripts for the research teams to follow while administering the interventions. Secondary research assistants observed more than half of the implementation sessions (64%, n = 32 sessions) to record Integrity, which was reported as very high (97.8% across conditions). Additionally, the researchers randomly selected and rescored 37% of the CBM-WE probes and reported high levels of interscorer agreement (*M* range, 96.2% to 99.5%).

Within the context of this study, treatment integrity was measured using procedural scripts and direct systematic observation of intervention implementation by the primary research assistants. Although student intervention adherence could have been examined by reviewing the permanent products (i.e., physical writing and graphing) that the students produced, no assessment was conducted. Thus, similar to the studies conducted by Moxley et al. (1995) and Alitto (2008), it is impossible to verify whether students implemented critical intervention strategies as planned.

Purpose of the Present Study

Treatment integrity is an important component in evaluating the validity of interventions (Collier-Meek et al., 2013). It has been argued that treatment integrity increases the probability of changes in treatment outcome measures (Gresham, 1989; Perepletchikova & Kazdin, 2005) and empirical research has demonstrated positive outcomes when treatment integrity is high (Hengeller et al., 1997; Huey et al., 2000; Noell et al., 2002; Scott et al., 2019; Wilder et al., 2006). However, there is little empirical guidance regarding how to assess treatment integrity, and no consensus regarding assessment guidelines (Collier-Meek et al., 2013; Fallon et al., 2015). When interventions are not implemented as planned, participant outcomes are less likely

to improve (Scott et al., 2019), and given that participant adherence is a foundational dimension of treatment integrity (Sanetti et al., 2021), it is important that school-based intervention studies comprehensively assess participant adherence and interventionist adherence in order to make valid conclusions regarding intervention effectiveness. To date, no studies have been conducted that examine the relationship between student intervention adherence and intervention outcomes. As a result, a closer examination of student intervention adherence and the impact on intervention outcomes is warranted.

The purpose of the present study was to add to the existing literature on intervention implementation and to our working knowledge of treatment integrity. Specifically, the present study expands upon the work of Koenig and colleagues (2016) by analyzing the post-intervention adherence measure that was administered to the students that were assigned to the performance feedback, goal setting, and self-graphing intervention. As a result, the present study utilizes a secondary data analysis of the work of Koenig and colleagues (2016), which served as the parent study for the present project. However, an additional measure (i.e., intervention adherence), not previously analyzed, was included in the present study, which reflects a novel examination of the role of student intervention adherence on students' writing outcomes. Thus, there were two primary aims associated with this study: (a) to assess participants' intervention adherence by administering a post-assessment intervention adherence measure, and (b) to explore the relationship between student intervention adherence and subsequent intervention outcomes. Descriptively examining students' intervention adherence permitted an initial examination of an additional treatment integrity construct. In addition, the present study examined whether there is a significant relationship between students' intervention adherence and their intervention outcomes. Because it has been argued that accurate intervention

implementation, as measured by treatment integrity, has significant implications for intervention outcomes (Moncher & Prinz, 1991), it was hypothesized that students' intervention adherence has a significant and positive relationship with intervention outcomes.

Method

Sample

Data for this study came from an individual randomized controlled trial collected with a single cohort within the Treatment Research in Academic lab at Syracuse University in 2013. Some of these data were previously published by Koenig and colleagues (2016). All data were collected from a public school in the Northeast United States. The parent study conducted by Koenig and colleagues (2016) contained 147 participants. Of the 147 participants, 6 did not provide consent or assent to participate, 24 did not meet the inclusion criteria, and 2 did not meet criteria during the intervention, resulting in 115 third-grade students who were randomly assigned to either a control condition (n = 39), a performance feedback condition (n = 39), or a combined performance feedback and goal setting condition (n = 38). For the purposes of the present study, only students who were assigned to combined performance feedback and goal setting condition (n = 38) were utilized for the present study because the post-intervention adherence measure directly assessed the intervention components (i.e., goal setting, self-graphing) that were administered (see Procedures section) to these students. However, due to eight student absences that occurred during the post-intervention assessment, the current study includes 30 of the 38 participants assigned to the performance feedback and goal setting condition. Of these participants, most identified as female (63.3%). Additionally, all students identified as either Black or African American (66.7%), White (26.6%), or Hispanic or Latino (6.7%). The average age of all participants was 8 years, 4 months (see Table 1). No participants

included received special education services (i.e., speech or language impairment, other health impairment) and met participation criteria.

For the purpose of the present study, third-grade students were targeted because the skill of composing extended connected text occurs in the third and fourth grades (Berninger et al., 2006), whereas students in the primary grades are still developing emerging handwriting skills. Additionally, due to local school constraints, fourth-grade students were not permitted to participate in research projects due to the extensive preparation for statewide testing. All human research protection guidelines were followed, including obtaining parental consent and student assent.

Research Assistants

Doctoral students in school psychology and advanced undergraduate psychology majors contributed to the intervention data collection process as research assistants. The research assistants received training on conducting procedural integrity observations, completing data entry, and administering and scoring measures. Research assistants were provided a manual detailing all procedures necessary for data collection, completed formal research ethics training, and were required to demonstrate 100% proficiency in scoring measures and conducting procedural integrity observations before collecting data.

For the purpose of the present study, doctoral students in school psychology served as research assistants. A coding manual (see Appendix A) was created, and research assistants were trained in coding procedures for the study outcome measures (i.e., student intervention adherence). Research assistants were provided a manual detailing all procedures necessary for data coding and were required to demonstrate 100% proficiency prior to coding.

Materials

Weekly writing packet

Students received a writing packet every week that contained the materials necessary for the combined intervention. The first page of the writing packet contained identifying information for the students, such as their names and classroom. The second page of the packet contained a large picture of a stop sign to ensure that the students would follow the verbal directions and not move to the next page. The third page of the packet contained the students' performance feedback sheet (see Appendix B), which indicated how well the students performed relative to the previous week and what goals were set for the current writing session. Two pages of the packet contained a Curriculum-Based Measurement in Written Expression probe (Appendix C). The final page of the packet contained the students' self-graphing sheet (Appendix D)

Curriculum-Based Measurement in Written Expression Probes

A total of seven Curriculum-Based Measurement in Written Expression (CBM-WE) probes were administered (Appendix C). Each probe presented the beginning of a story that students were tasked with completing (e.g., "I was talking to my friends when all of a sudden…). Each CBM-WE probe was previously evaluated for use with elementary-aged students (McMaster & Campbell, 2008). Curriculum-Based Measures in Written Expression are valid in relation to standardized writing tests and developmental scoring systems (r = .50 to .96).

Intervention Adherence Measure

The Measure of Intervention Adherence (MIA; Appendix E) was developed to assess students' fidelity of implementing the performance feedback and self-graphing intervention (i.e., counting the number of words contained in a story, plotting the number of self-counted words on a bar graph). The MIA consists of one page which contained a practice activity, and three separate pages that contained written stories of varying lengths (range, 4-43 words). Each story

was followed by a box for the students to record the number of words written in the story, and a bar graph for the students to graph the total number of words written.

Procedures

The combined performance feedback and goal-setting intervention was implemented over the course of 8 weeks, with one 20-minute session conducted each week. During each session, a writing packet was distributed to each student in the classroom as the research assistant provided instructions to the group of students using a procedural script (Appendix F). Specifically, once all students had received their writing packets, students were instructed to open their writing packets to the second page in their packet, which contained their individualized performance feedback (Appendix B). At the top of the page was a box that indicated the number of words the student had written during the previous session, as well as a symbol denoting whether they had written more, less, or the same. A second box was provided on the page that contained each student's individualized fluency goal, which indicated the number of words that each student was encouraged to write during that session. The fluency goal always reflected a three-word increase from the student's prior fluency goal. This standard goal was established based on prior research suggesting that students may gain up to three words per week upon receiving performance feedback in writing (Eckert et al., 2006), and research demonstrating that ambitious, yet attainable goals are the most effective at improving students' academic performance (Fuchs & Fuchs, 2002). After receiving performance feedback and reviewing the goal-setting information, students were instructed to complete a CBM-WE probe (Appendix C) following standardized procedures. Following the completion of the CBM-WE probe, students were instructed to count the number of words they had written as a form of immediate self-scored feedback and record this number on the top of the final page of their writing packet (Appendix D). Additionally,

students were instructed to plot their self-counted number of words written on the bottom of the final page of their writing packet), which contained a graph that included a goal-line reflecting each session's fluency goal. At the conclusion of the last intervention session, the students were administered the MIA Students practiced counting the number of words in a written story. Following the practice activity, students were instructed to count the number of words in each story and record that number in a box below the written passage. Students were instructed to graph the number of words written on a bar graph. During each session, a secondary research assistant monitored the session for procedural integrity.

Outcome Variables

Writing Fluency

Writing fluency was assessed by calculating the total number of words written (TTW) and the number of correct writing sequences (CWS) for each CBM-WE probe. Total words written was calculated by counting every grouping of letters separated by a space regardless of spelling or grammar. Correct writing sequences were calculated by analyzing each adjacent word for correct punctuation, capitalization, spelling, and syntax (Shapiro, 2011). Slopes of improvement for TWW and CWS over the course of the intervention were calculated by computing individual slopes of improvement for each participant using ordinary least squares.

Both TWW and CWS are measures of writing fluency and are two of the three most common metrics used to assess elementary-aged children's writing fluency skills (Espin et al., 2000). A meta-analysis conducted by Romig and colleagues (2016) examined 31 studies that assessed the criterion validity of TWW and CWS among other measures. Moderate criterion validity was demonstrated for both TWW (r = .44) and CWS (r = .51) in relation to the Test of Written Language – Third Edition (TOWL-3; Hammill & Larsen, 1996). Additionally, a

comprehensive review conducted by Powell-Smith and Shinn (2004) examined the reliability of TWW and CWS in 15 studies and found high reliability of interscorer agreement across both metrics (range, 96%-100%) as well as moderate to high reliability of parallel and alternate form reliability for both metrics (range, .42-.99) and high test-retest reliability (range, .81-.99).

Student Intervention Adherence

Student intervention adherence was assessed by measuring the completion and accuracy of the MIA using a coding sheet (Appendix G). To assess student completion of the MIA, the total words written box (i.e., the box that appears below each story) was coded as either: (a) complete (i.e., contains a number or numeral), or (b) incomplete (i.e., does not contain a number or numeral). Additionally, the total words written graph (i.e., the graph that appears to the right of each story) was coded as either (a) complete (i.e., contains any writing within the graph) or (b) incomplete (i.e., does not contain any writing within the graph). To assess student accuracy of the MIA, the total words written box was coded as (a) accurate (i.e., the correct number of words written in that story is written in the box indicated), or (b) inaccurate (i.e., the incorrect number of words written in that story is written in the box indicated). The accuracy of the total words written graph was coded as (a) accurate (i.e., the correct bar is plotted on the graph), or (b) inaccurate (i.e., an incorrect bar is plotted on the graph). The summed scores were computed for both student completion and student accuracy.

Procedural Integrity

Primary research assistants used a procedural script to conduct each session. Secondary research assistants observed 64% of the total intervention sessions (n = 32) to assess procedural integrity, which was calculated by dividing the number of instances when the secondary research assistant indicated the primary research assistant accurately implemented a step in the script by

the total number of possible procedural steps and multiplying by 100%. The mean procedural integrity was 98.71% with no reported deviations.

Interscorer Agreement

Interscorer agreement was calculated for completion and accuracy of the total words written box and total words written graph of all completed MIAs (n = 13). The mean interscorer agreement across all sections of the data scored by the research assistants was 100%, resulting in a mean Kappa coefficient of 1.00.

Results

Data Preparation

Data Input and Consistency Checks

The primary researcher entered all raw data into a Microsoft Excel file, which was used for initial data organization. All inputted data were double-checked to reduce errors and ensure the accuracy of data entry. Data in Excel were transferred to R (R Core Team, 2014) to compute descriptive statistics, generate graphs for data inspection, and compute an ordinary least squares function to measure students' writing fluency progress over time (i.e., the slope of improvement in students' writing over the course of the intervention).

Data Inspection

Data were inspected for violations of assumptions of normality and homogeneity of variance. The assumption of normality was evaluated by calculating skewness and kurtosis. Data were considered normal due to both skewness (-0.26) and kurtosis (0.55) falling within the acceptable range of -1 and 1. Homogeneity of variance was assessed using the Shapiro-Wilk's test and data were further considered normal due to non-significant results (p = 0.08). Linearity was assessed by visually inspecting the data for total words written slope (Figure 1), correct

writing sequences slope (Figure 2), completion (Figure 3), accuracy (Figure 4), and adherence (Figure 5). Additional graphs included a line of best fit (Figure 6) to further visualize the linearity of these data. Visual inspection suggested that the assumption of linearity was met due to the fact that no curvature was present.

Exploratory Analyses

Exploratory analyses were conducted to assess the frequency and type of inaccuracies within student permanent products. Participants who had inaccuracies were found to have (a) counted the total number of words within a passage incorrectly (56%, $n = 9$), (b) made mistakes in graphing the number of words counted (37.5%, $n = 6$), or (c) copied the answer of a peer (6.5%, $n = 2$) as the number of words they recorded was not accurate for their passage but would be accurate for peers who received a different passage (Table 2). With respect to the most frequent inaccuracies committed by students, those who incorrectly counted the total number of words within a passage were incorrect by an average of 1.16 words. Students who incorrectly graphed the number of words were incorrect by an average of 3.46 ticks on the graph.

Descriptive Analyses

Descriptive analyses were conducted to assess student intervention completion and student intervention accuracy. Results indicated that student intervention completion was 100% for the total words written box portion of the intervention, and 97% for the total words written graph portion of the intervention. Results also indicated that student intervention accuracy was high ($M = 85.5\%$, range 50% to 100%) across the intervention. Specifically, students performed similarly across measures within the MIA averaging high accuracy ($M = 88\%$, range 33% to 100%) for the Total Words Written Box and high accuracy ($M = 83\%$, range 0% to 100%) for the Total Words Written Graph (see Table 3).

Descriptive analyses were also conducted to examine students' pre- and post-intervention outcomes (see Table 4). Prior to the start of the intervention, students averaged 22.8 total words written and 19.6 correct writing sequences. At the end of the intervention students averaged 39.4 total words written and 34.7 correct writing sequences. Additionally, students averaged an increase of 2.36 total words written per intervention session (*M* slope of improvement = 0.15), as well as an averaged increase of 2.15 total correct writing sequences per intervention session (*M* slope of improvement = .154) over the course of the study (see Figure 7).

Major Analyses

To examine the relationship between students' intervention adherence and students' writing performance, a series of correlations were computed (see Table 5). Pearson correlation coefficients were computed to assess the relationships between the students' writing outcomes at the conclusion of the intervention and student intervention completion, accuracy, and total intervention adherence. Small and statistically non-significant relationships were found between students' intervention adherence and their CWS slope of improvement, $r(28) = .207$, $p = .273$, as well as their TWW slope of improvement, $r(28) = .213$, $p = .258$.

Discussion

It is widely accepted that treatment integrity is an important component in evaluating the validity of an intervention (Collier-Meek et al., 2013), and empirical research has demonstrated a positive relationship between high treatment integrity and intervention outcomes (Hengeller et al., 1997; Huey et al., 2000; Noell et al., 2002; Scott et al., 2019; Wilder et al., 2006). Participant adherence, a foundational dimension of treatment integrity (Sanetti et al., 2021), should also be examined in order to make valid conclusions regarding intervention effectiveness. To date, no studies have been conducted that examine the relationship between student intervention

adherence and intervention outcomes. The present study sought to add to the existing literature on intervention implementation and to expand our conceptual understanding of treatment integrity by assessing participants' intervention adherence. In the context of the present study, a post-assessment intervention adherence measure was administered, and I explored the relationship between student intervention adherence and subsequent intervention outcomes.

Student Intervention Adherence

This study found that students were very likely to complete the intervention presented to them (*M* = 98.5%) and were very likely to complete the intervention accurately (*M* = 85.5%). These data suggest that students were adhering to the core aspects of the intervention being administered and provide preliminary evidence regarding student intervention adherence within the context of a performance feedback, goal setting, and self-graphing intervention. As previously discussed, a number of studies (Alitto, 2008; Koenig et al., 2015; Moxley et al., 1995) have examined the effectiveness of combining performance feedback, goal setting, and self-graphing to improve students' written expression skills, yet no studies have reported whether students adhered to the intervention components. This study reflects the first examination of student intervention adherence being measured in the context of academic interventions and the findings suggest that the overwhelming majority of students were adhering to the intervention.

There are currently no studies that have conceptualized or empirically investigated means to assess student intervention adherence. Although initial definitions of intervention adherence were initially defined as the extent to which the participant implements essential intervention strategies as planned (Jones et al., 2008), measurement of the construct may vary as a function of the type of intervention that is being implemented. As a result, there is not one singular way to measure this construct. Although the present study focused on examining the permanent products

of specific components of the intervention in a cross-sectional approach, it is possible that very different results could be obtained if different methodologies were incorporated. For example, a longitudinal assessment of student intervention adherence over the course of the study could have been conducted that included direct observation measures as well as an examination of direct permanent products. In addition, structured or semi-structured student interviews regarding intervention adherence could be conducted to obtain an assessment of students' perceptions of adherence.

Intervention Outcomes

It was hypothesized that student intervention adherence would have a significant and positive relationship with student intervention outcomes as previous research (Hengeller et al., 1997; Huey et al., 2000; Noell et al., 2002; Scott et al., 2019; Wilder et al., 2006) demonstrated this relationship and conceptual models of treatment integrity (Moncher & Prinz, 1991) highlight the significant role that treatment integrity plays on treatment outcomes. However, contrary to the initial hypothesis, there was no statistically significant relationship between student intervention adherence and intervention outcomes. In the present study, an insignificant and weak positive association was observed. This finding may have been due to the limited variability in student intervention adherence, with the majority of accuracy scores falling in the high range (M = 85.5%, range 50% to 100%). Additionally, it is possible that this finding may be a product of adherence being measured via a proxy. The MIA assessed two aspects of the intervention (e.g., filling in the box and graphing that number), which was conceptualized as measuring adherence to the intervention. It is possible that using the MIA as a proxy for intervention adherence may not fully assess student adherence to the intervention. To remedy this, a direct examination of student permanent products or dynamic administration of the MIA

across intervention sessions may be beneficial. Additionally, the measure of intervention adherence only assessed student adherence to the goal-setting (e.g., writing how many words you would like to write) and self-graphing (e.g., graphing how many words you have written) components of the intervention that were implemented. As a result, there was no examination of students' adherence to the performance feedback intervention. It is possible that students' adherence or understanding of the performance feedback component of the combined intervention had the most significant relationship with the intervention outcomes. In addition, accuracy was measured dichotomously as either accurate or inaccurate, which did not take into account minor inaccuracies in student responses. For example, an exploratory examination of the inaccurate permanent products indicated that almost all students who made errors in counting the number of words in a passage were incorrect by one word. Additionally, of the students who graphed incorrectly, more than half of the mistakes made were within two tick boxes of the correct graphing location. As a result, intervention accuracy in the present study did not take into account nuances in student responses. Further, given the dichotomous scaling of intervention accuracy, there was less variability observed in student responses. Incorporating alternative scaling options (e.g., percentage) would result in more variability in responses and potentially increase measurement sensitivity.

Limitations

The current study contained several limitations. First, the study design was correlational and as a result, no causal relationship between student intervention adherence and intervention outcomes can be inferred. Second, this study contained a very small sample size. A larger sample size would likely result in more variability in the outcomes assessed. Third, the MIA served as a proxy measure for student adherence, meaning that only adherence to the MIA was directly

assessed and adherence to the intervention was assumed based on that measure. Fourth, the timing of the administration of the MIA (i.e., at the conclusion of the intervention) may have resulted in an interaction between the intervention and the MIA. Specifically, students may have increased scores on the MIA due to familiarity with the concepts and procedures associated with intervention because it had been administered over an eight-week period. Fifth, the sample for this study was selected from a larger group of students and was determined based on the availability of MIA data. As a result, the sample was restricted and no assumptions regarding the randomness of this selection can be made. Sixth, accuracy was measured dichotomously as either accurate or inaccurate, resulting in a potential lack of variability. A more nuanced measure of accuracy might produce more information regarding student adherence. Finally, students participating in this study were all third-grade students in an urban school district, limiting the generalizability of these results.

Future Research Directions

Although past research (Gresham, 1989; Perepletchikova & Kazdin, 2005) presented evidence to conceptually suggest a positive and strong relationship between intervention adherence and intervention outcomes, this relationship was not observed in the present study. This may have been due to a number of reasons that provide directions for future research. In this study, high levels of student intervention adherence were observed as determined through a proxy measure amongst a very small sample size. Future research may wish to conduct similar studies including a larger sample size, which may increase the variability of student intervention adherence and further inform our understanding of this relationship. Additionally, it may be important for future research studies to assess intervention adherence through a dynamic examination of permanent products as interventions are administered throughout the

implementation of the intervention. Exploring whether variations in students' intervention adherence occur may inform intervention development as well as our conceptualization of treatment integrity. Future research examining student intervention adherence, and specifically the relationship between student intervention adherence and intervention outcomes, is warranted to contribute to our understanding of how treatment integrity impacts academic interventions administered in school settings.

Conclusion

It is widely accepted that treatment integrity is an important component in evaluating the validity of an intervention (Collier-Meek et al., 2013), and empirical research has demonstrated a positive relationship between high treatment integrity and intervention outcomes (Hengeller et al., 1997; Huey et al., 2000; Noell et al., 2002; Scott et al., 2019; Wilder et al., 2006). Participant adherence, a foundational dimension of treatment integrity (Sanetti et al., 2021), should also be examined in order to make valid conclusions regarding intervention effectiveness. The current study sought to examine the relationship between student intervention adherence and intervention outcomes and found that students typically adhered to the intervention examined in the context of the present study with very high levels of intervention completion and accuracy. The current study did not find a statistically significant or strong relationship between student intervention adherence and intervention outcomes. However, given design considerations, these results are preliminary and further research is required to better understand this relationship. Future research should consider examining student intervention adherence when implementing academic interventions and assess its relationship with intervention outcomes.

Table 1

***Student Demographic Information* (*n* = 30)**

Characteristics	%	(*n*)
Gender		
Female	63.3%	(19)
Male	36.7%	(11)
Ethnicity or Race		
Black or African American	66.7%	(20)
White	26.6%	(8)
Hispanic or Latino	6.7%	(2)
Special Education Eligibility	0%	(0)
	M	(*SD*)
Age	8.04	(0.04)

Table 2

Frequency and Type of Inaccuracy in Student Permanent Products (n = 16)

	Copied Peer Response	Graphed Incorrectly	Counted Incorrectly
(*n*)	(2)	(9)	(6)
%	6.50%	56%	37.5%

Table 3

Student Intervention Completion and Accuracy (n = 30)

Measure	Accuracy							Completion						
	Story 1		Story 2		Story 3		Total	Story 1		Story 2		Story 3		Total
	%	(*n*)	%	(*n*)	%	(*n*)	%	%	(*n*)	%	(*n*)	%	(*n*)	%
Total Words Written Box	93	(30)	93	(30)	80	(30)	88	100	(30)	100	(30)	100	(30)	100
Total Words Written Graph	83	(29)	90	(29)	76	(29)	83	97	(29)	97	(29)	97	(29)	97
Combined							85.5							98.5

Table 4

Student Pre- and Post-Intervention Writing Outcomes (n = 30)

	Pre-Intervention	AIMSweb National Norms	Post-Intervention	AIMSweb National Norms
TWW	22.8	35th percentile	39.4	64th percentile
CWS	19.6	52nd percentile	34.7	73rd percentile

Table 5

Descriptive Statistics and Intercorrelations for Study Variables

Variable	*M*	(*SD*)	1	2	3	4	5
1. Total Words Written Slope	.157	(0.14)	-				
2. Correct Writing Sequences Slope	.154	(0.12)	.849***	-			
3. Student Intervention Completion	5.9	(0)	.112	.107	-		
4. Student Intervention Accuracy	5.16	(0.83)	.224	.218	.431**	-	
5. Student Intervention Adherence	11.06	(1.28)	.213	.207	.745***	.923***	-

*$p < .05$. **$p < .01$. ***$p < .001$.

Figure 1

Scatterplot of Total Words Written Slopes

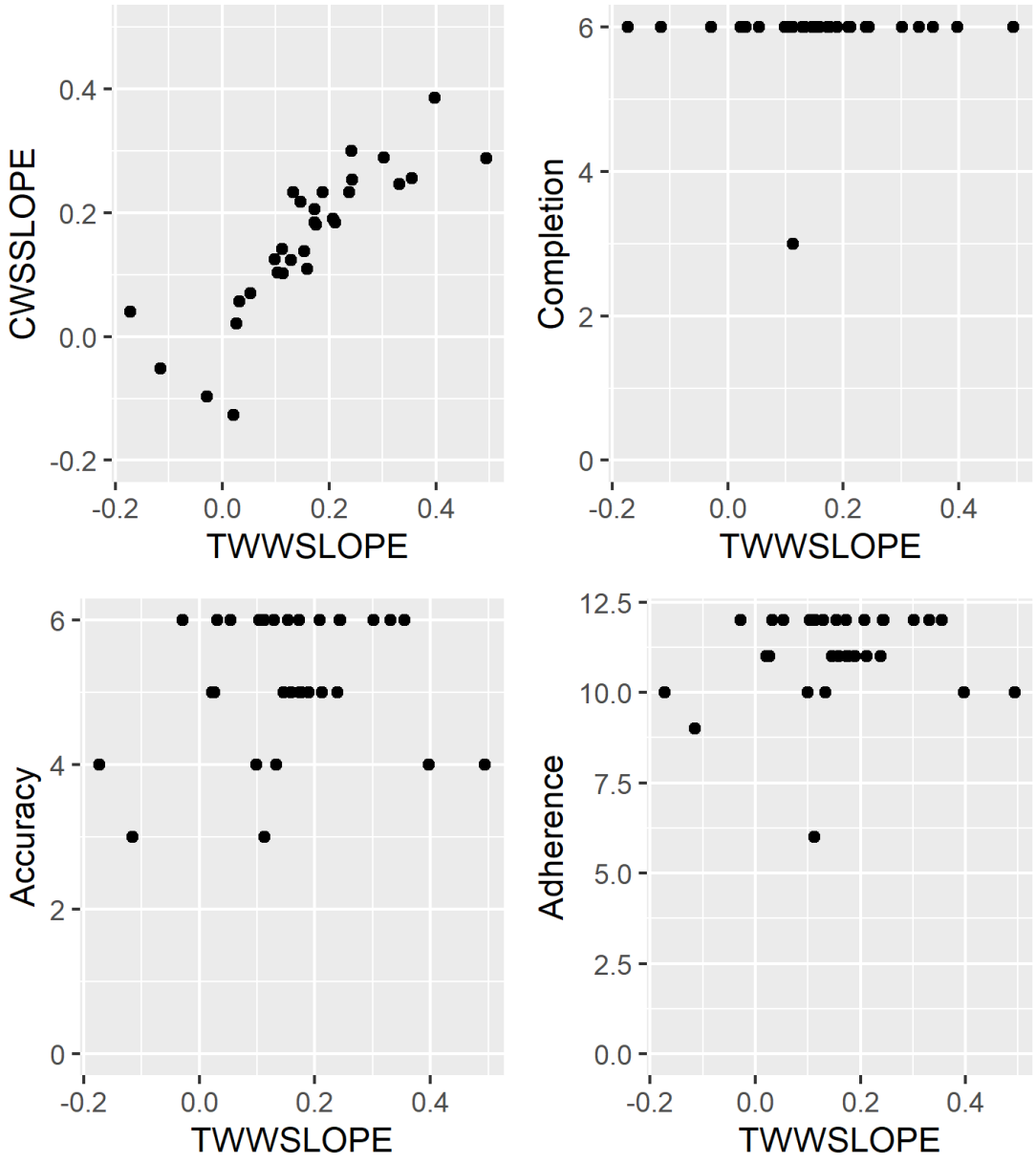


Figure 2

Scatterplot of Correct Writing Sequences Slopes

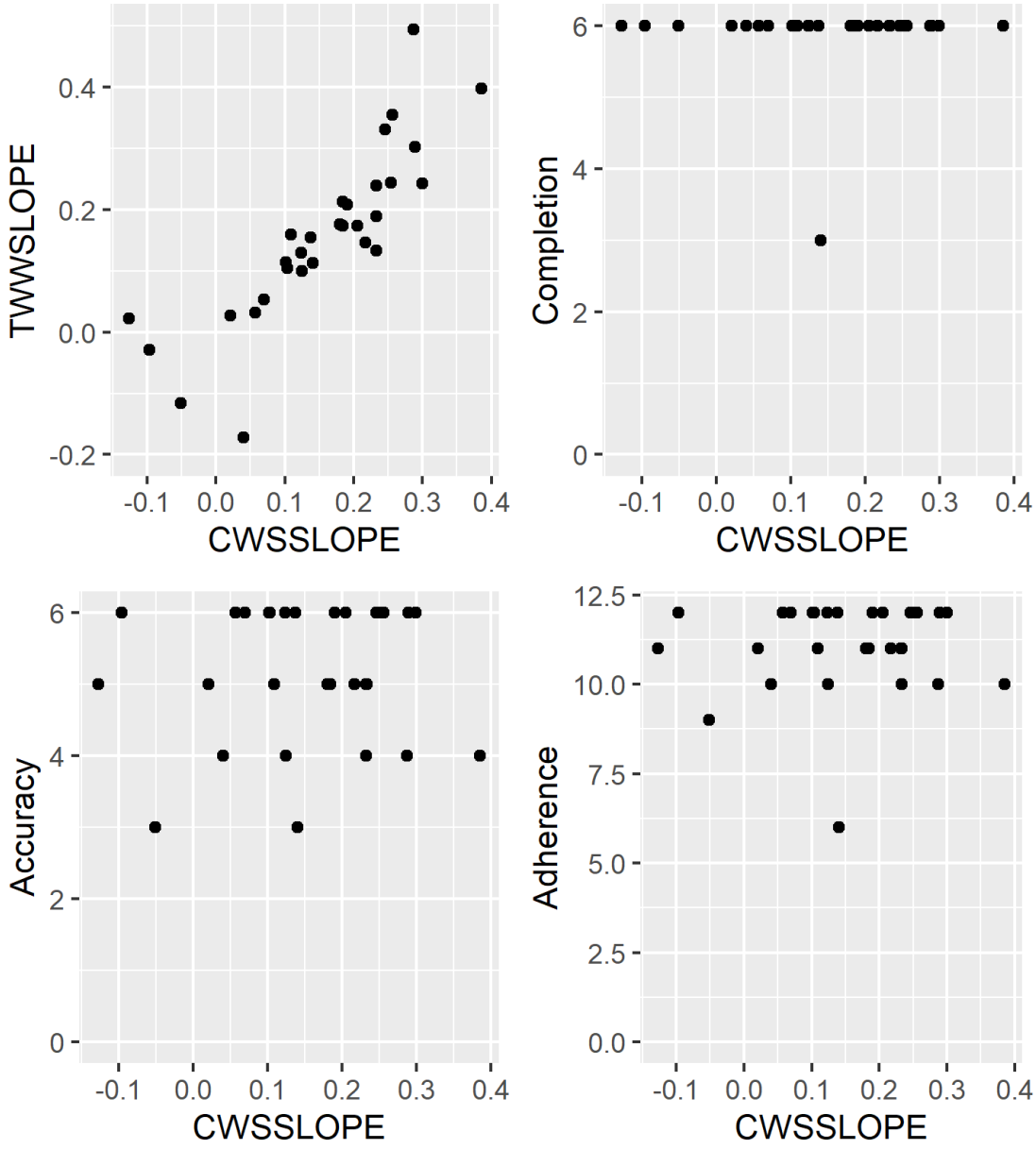


Figure 3

Scatterplot of Completion Scores

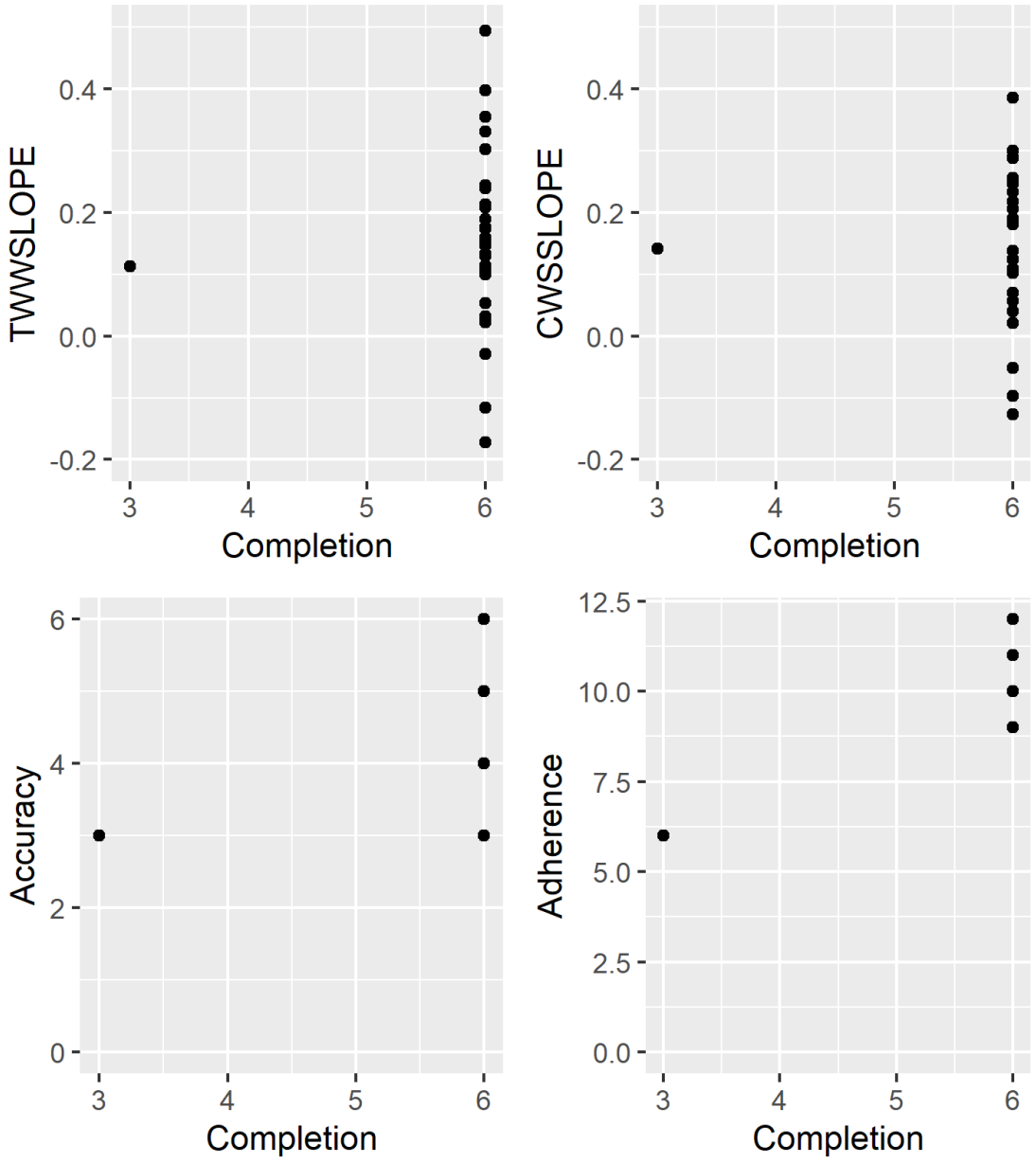


Figure 4

Scatterplot of Accuracy Scores

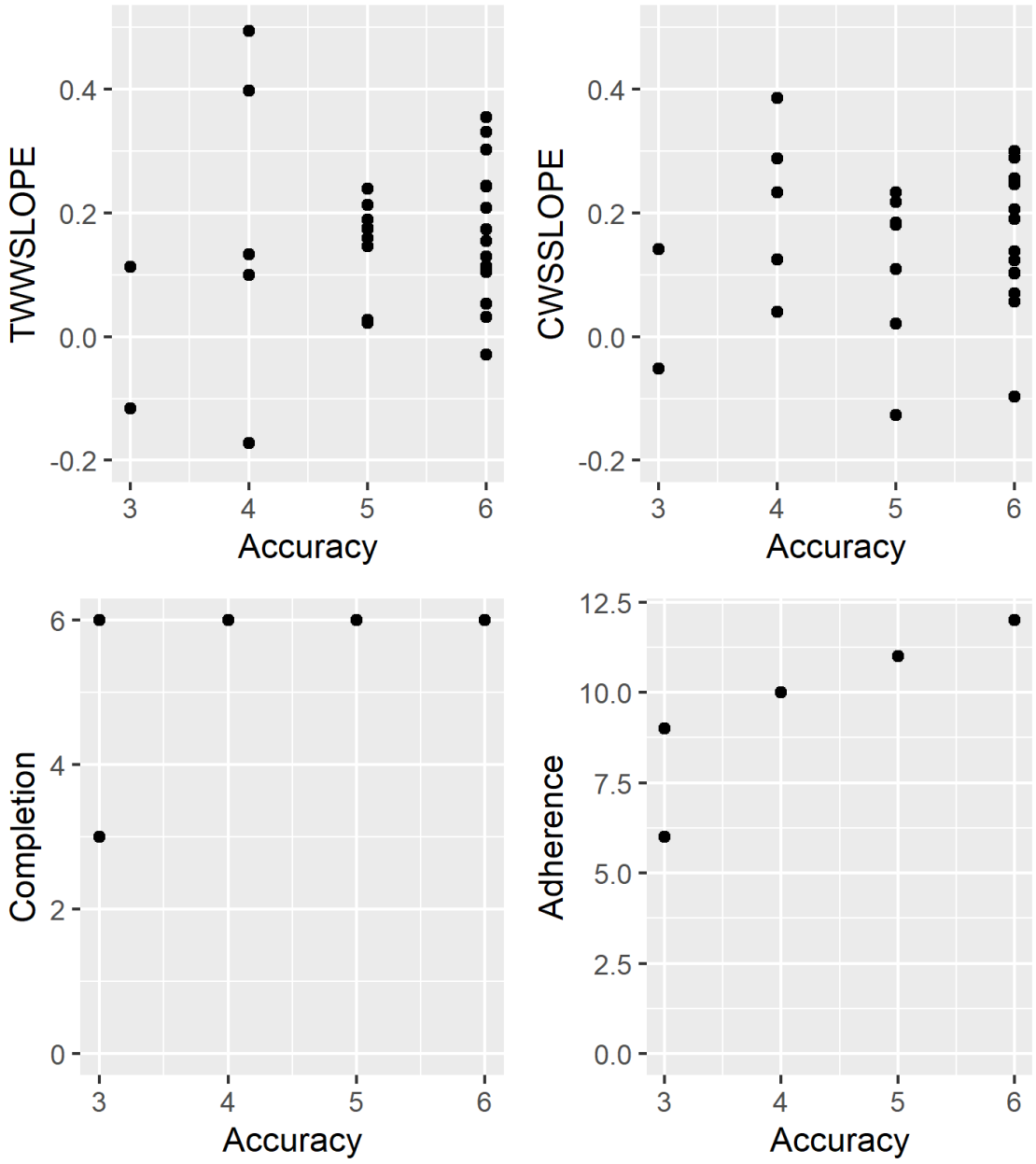


Figure 5

Scatterplot of Adherence Scores

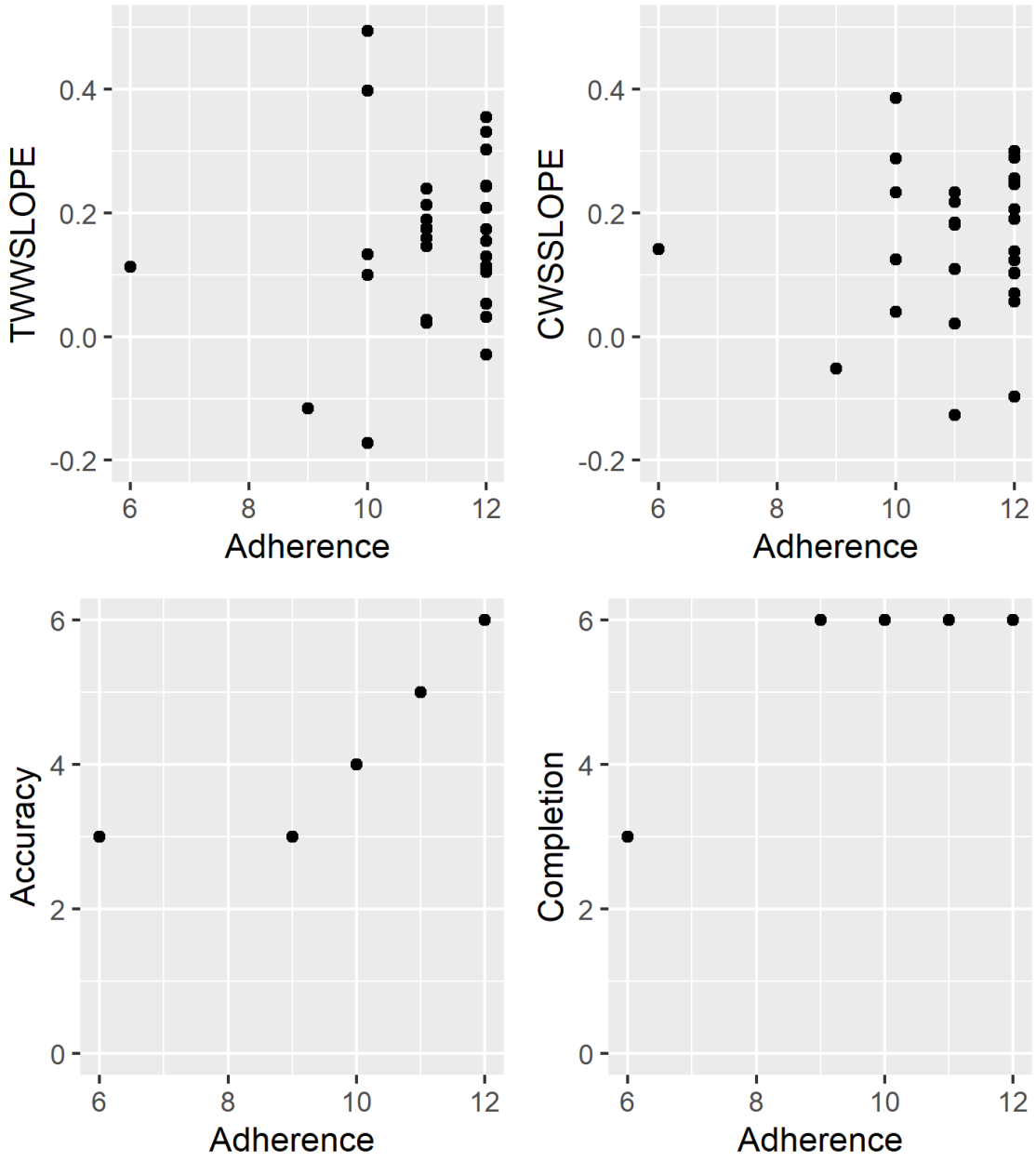


Figure 6

Scatterplots with Line of Best Fit

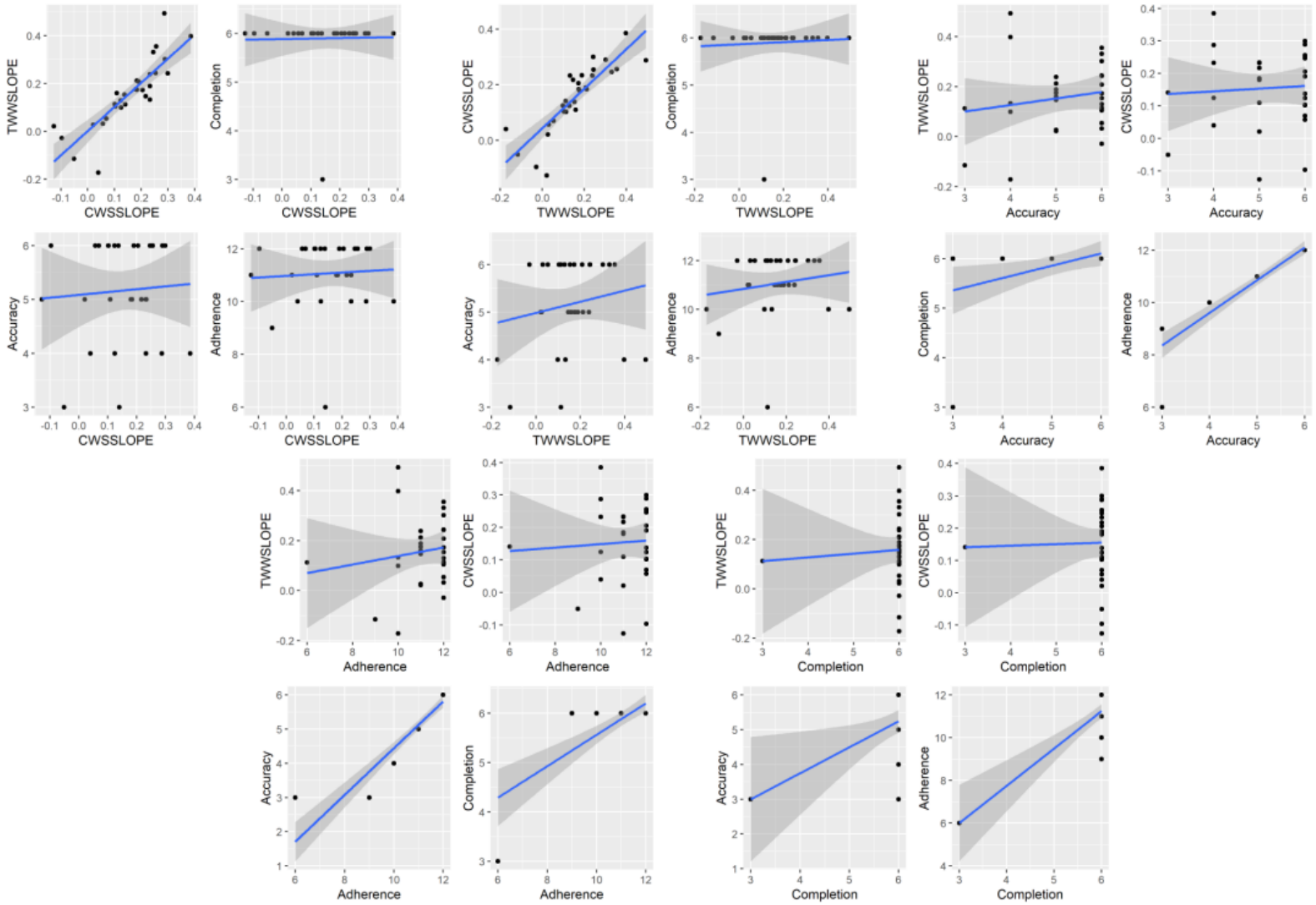
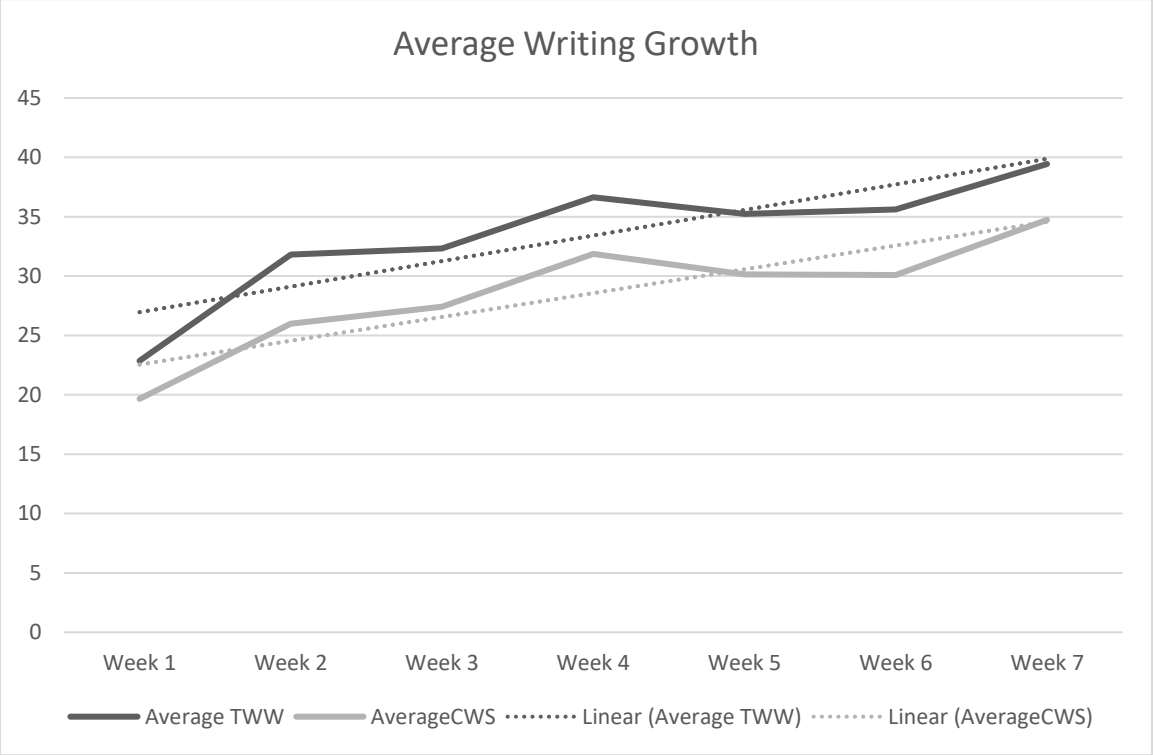


Figure 7

Average Writing Growth



List of Appendices

Appendix A

A Closer Look into Treatment Integrity: Examining the Effects of Student Intervention Adherence on Intervention outcomes

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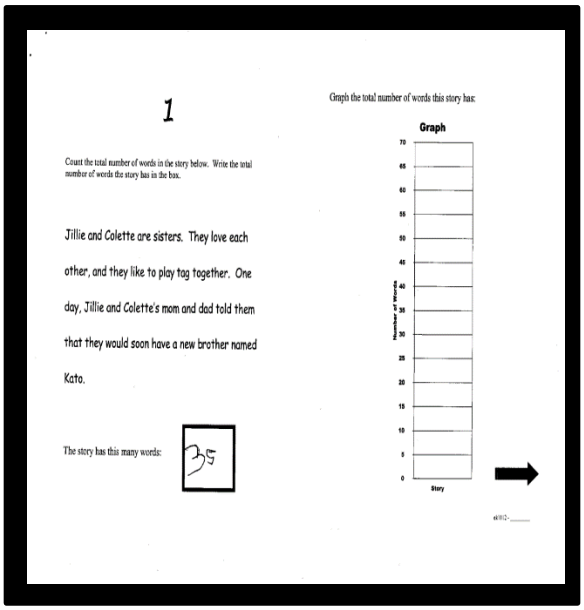
Coding Manual 2021

You will need to obtain the student's coding packet, which contains the following:



1

Count the total number of words in the story below. Write the total number of words the story has in the box.

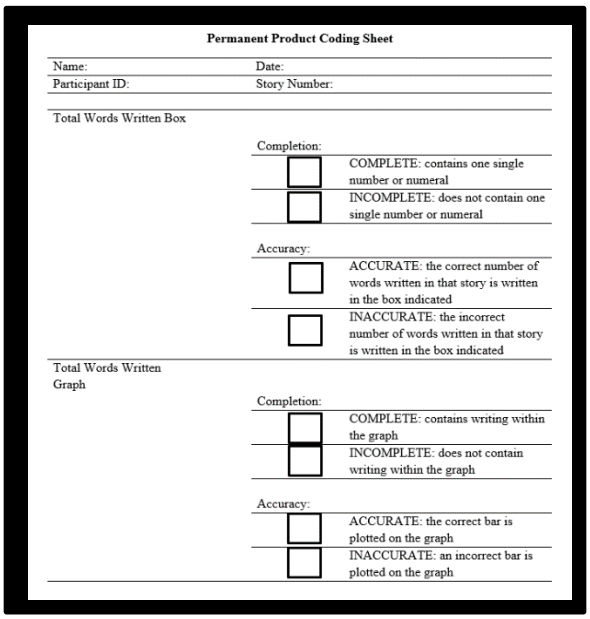
Jillie and Colette are sisters. They love each other, and they like to play tag together. One day, Jillie and Colette's mom and dad told them that they would soon have a new brother named Kato.

The story has this many words: 35

Graph the total number of words this story has:

Graph

Measure of Intervention Adherence



Permanent Product Coding Sheet

Name:	Date:
Participant ID:	Story Number:

Total Words Written Box

Completion:

- ☐ COMPLETE: contains one single number or numeral
- ☐ INCOMPLETE: does not contain one single number or numeral

Accuracy:

- ☐ ACCURATE: the correct number of words written in that story is written in the box indicated
- ☐ INACCURATE: the incorrect number of words written in that story is written in the box indicated

Total Words Written Graph

Completion:

- ☐ COMPLETE: contains writing within the graph
- ☐ INCOMPLETE: does not contain writing within the graph

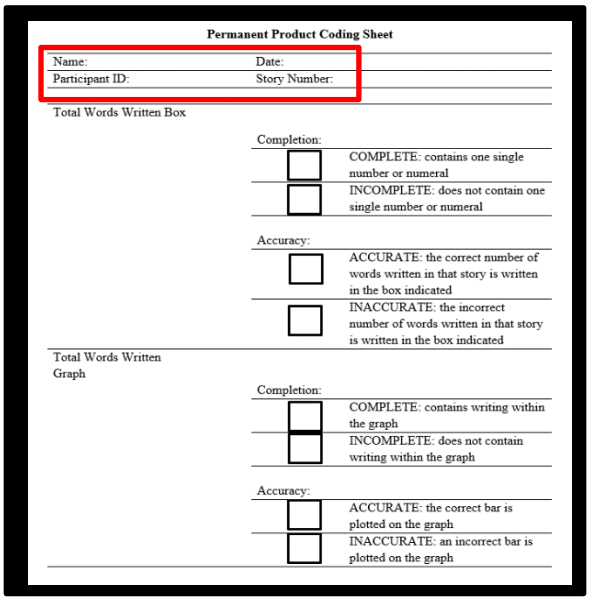
Accuracy:

- ☐ ACCURATE: the correct bar is plotted on the graph
- ☐ INACCURATE: an incorrect bar is plotted on the graph

Measure of Intervention Adherence Coding Sheet

Coding Steps:

1. Obtain the Measure of Intervention Adherence Coding Sheet:



Permanent Product Coding Sheet

Name: Date:
Participant ID: Story Number:

Total Words Written Box

Completion:
- ☐ COMPLETE: contains one single number or numeral
- ☐ INCOMPLETE: does not contain one single number or numeral

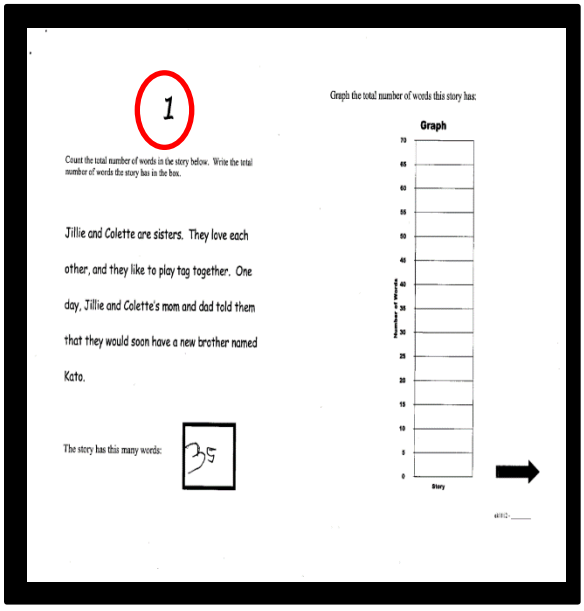
Accuracy:
- ☐ ACCURATE: the correct number of words written in that story is written in the box indicated
- ☐ INACCURATE: the incorrect number of words written in that story is written in the box indicated

Total Words Written Graph

Completion:
- ☐ COMPLETE: contains writing within the graph
- ☐ INCOMPLETE: does not contain writing within the graph

Accuracy:
- ☐ ACCURATE: the correct bar is plotted on the graph
- ☐ INACCURATE: an incorrect bar is plotted on the graph

2. Insert your name and date on the top line.
3. Review the student's packet and on the second line, copy the "Participant ID"
4. Obtain the Measure of Intervention Adherence:



1

Count the total number of words in the story below. Write the total number of words the story has in the box.

Jillie and Colette are sisters. They love each other, and they like to play tag together. One day, Jillie and Colette's mom and dad told them that they would soon have a new brother named Kato.

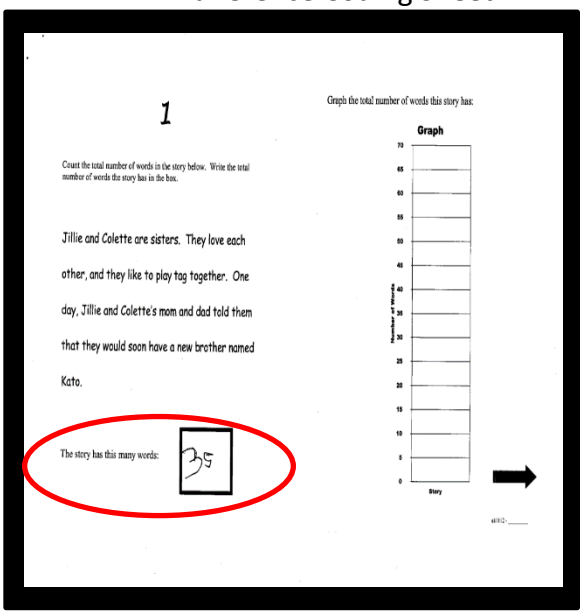
The story has this many words: 35

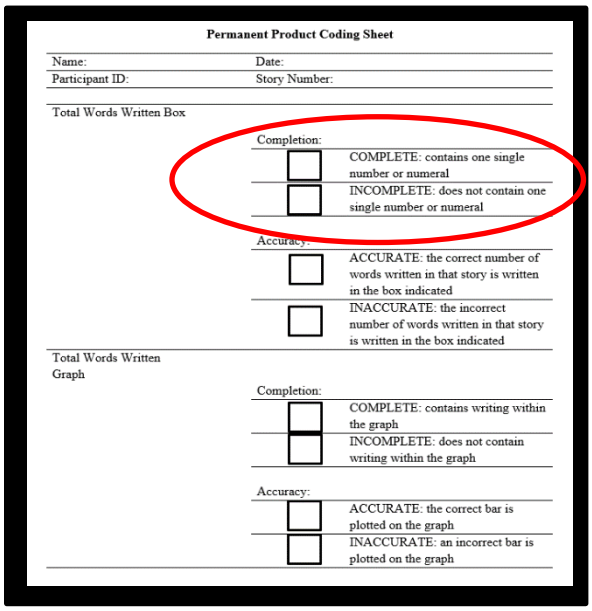
Graph the total number of words this story has:

Graph

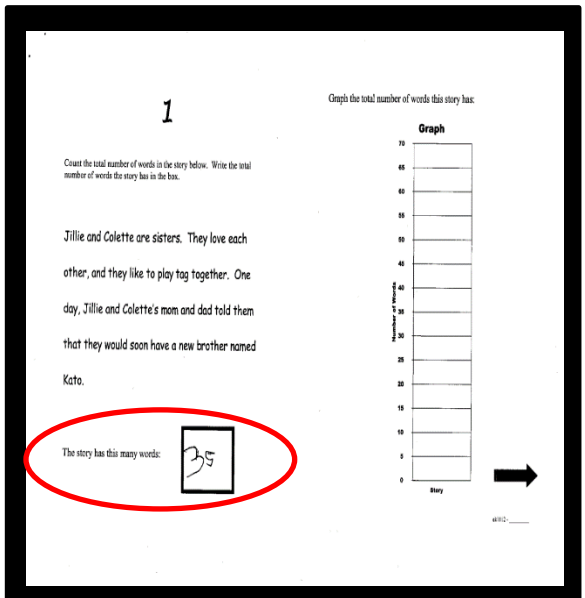
5. Identify which story number you are coding (as indicated as the bold number above the story) and record the "Story Number" on the second line of the Measure of Intervention Adherence Coding Sheet

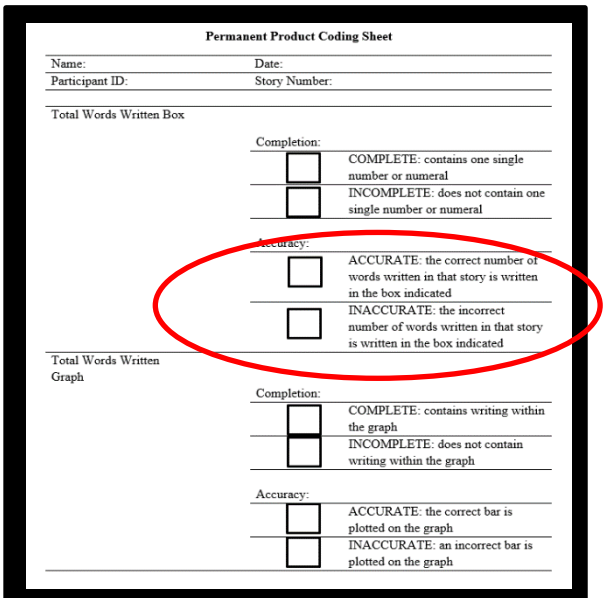
6. Locate the “This story has this many words” box on the Measure of Intervention Adherence and the “Completion” section for Total Words Written Box on the Measure of Intervention Adherence Coding Sheet
    a. If there is one number or numeral written in the box, check the box “complete” on the Measure of Intervention Adherence Coding Sheet
    b. If the box does not contain a number or numeral, or contains more than one number or numeral, check the box “Incomplete” on the Measure of Intervention Adherence Coding Sheet



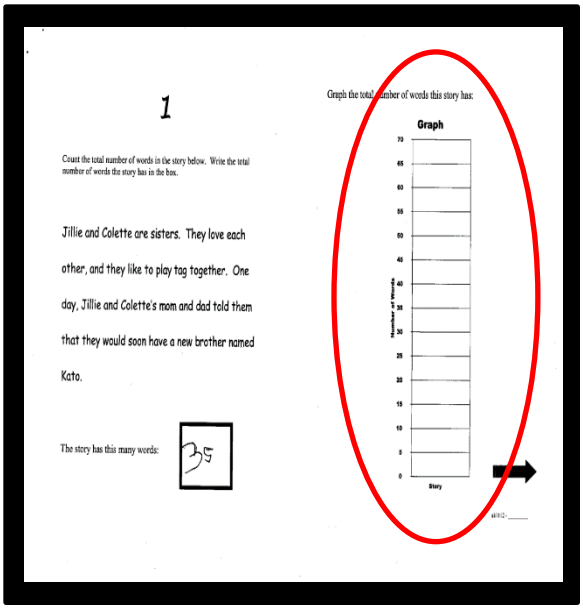


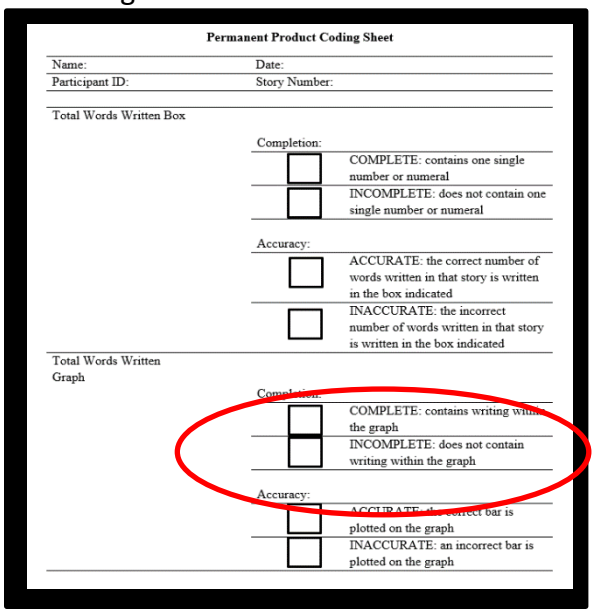
7. Locate the “This story has this many words” box on the Measure of Intervention Adherence and the “Accuracy” section for Total Words Written Box on the Measure of Intervention Adherence Coding Sheet
    a. If the number written in the box is the correct number of words written in that story, check the box “accurate” on the Measure of Intervention Adherence Coding Sheet
    b. If the number written in the box is not the correct number of words written in that story, check the box “accurate” on the Measure of Intervention Adherence Coding Sheet



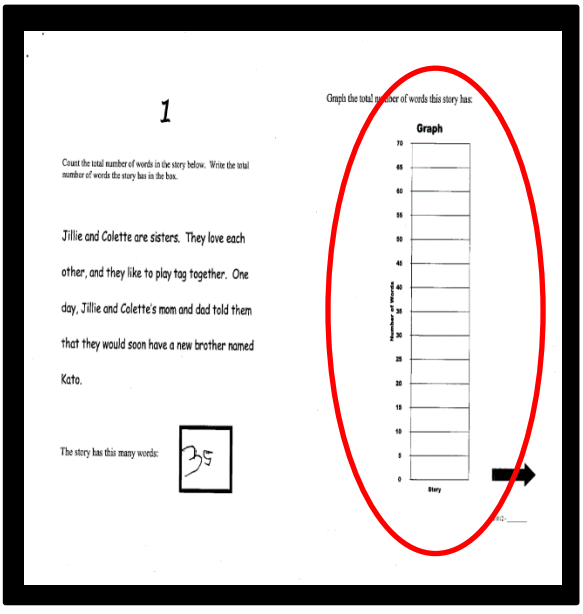


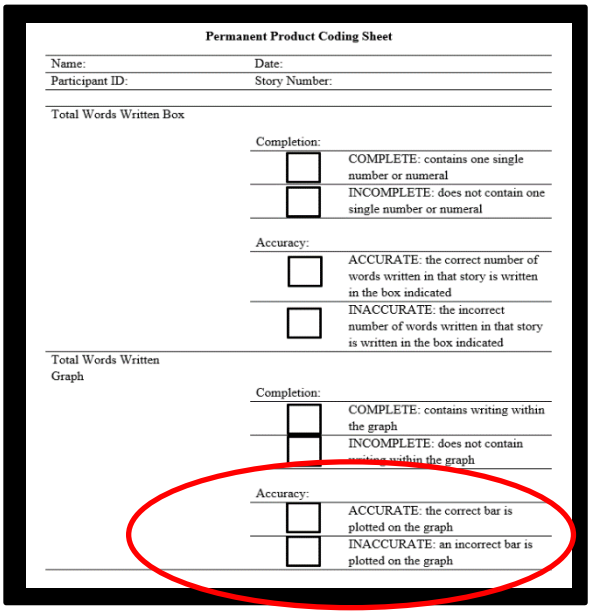
8. Locate the “Graph” on the Measure of Intervention Adherence and the “Completion” section for Total Words Written Graph on the Measure of Intervention Adherence Coding Sheet
    a. If there is any writing within the graph, check the box “complete” on the Measure of Intervention Adherence Coding Sheet
    b. If there is not any writing within the graph, check the box “incomplete” on the Measure of Intervention Adherence Coding Sheet





9. Locate the “Graph” on the Measure of Intervention Adherence and the “Accuracy” section for Total Words Written Graph on the Measure of Intervention Adherence Coding Sheet
    a. If the correct bar is plotted on the graph, check the box “accurate” on the Measure of Intervention Adherence Coding Sheet
    b. If the correct bar is not plotted on the graph, check the box “inaccurate” on the Measure of Intervention Adherence Coding Sheet





Appendix B

Student Performance Feedback and Goal Setting Page

Last week, you wrote this many words:

Today, please try to write at least this many words:

Appendix C

Curriculum-Based Measurement in Written-Expression Probe

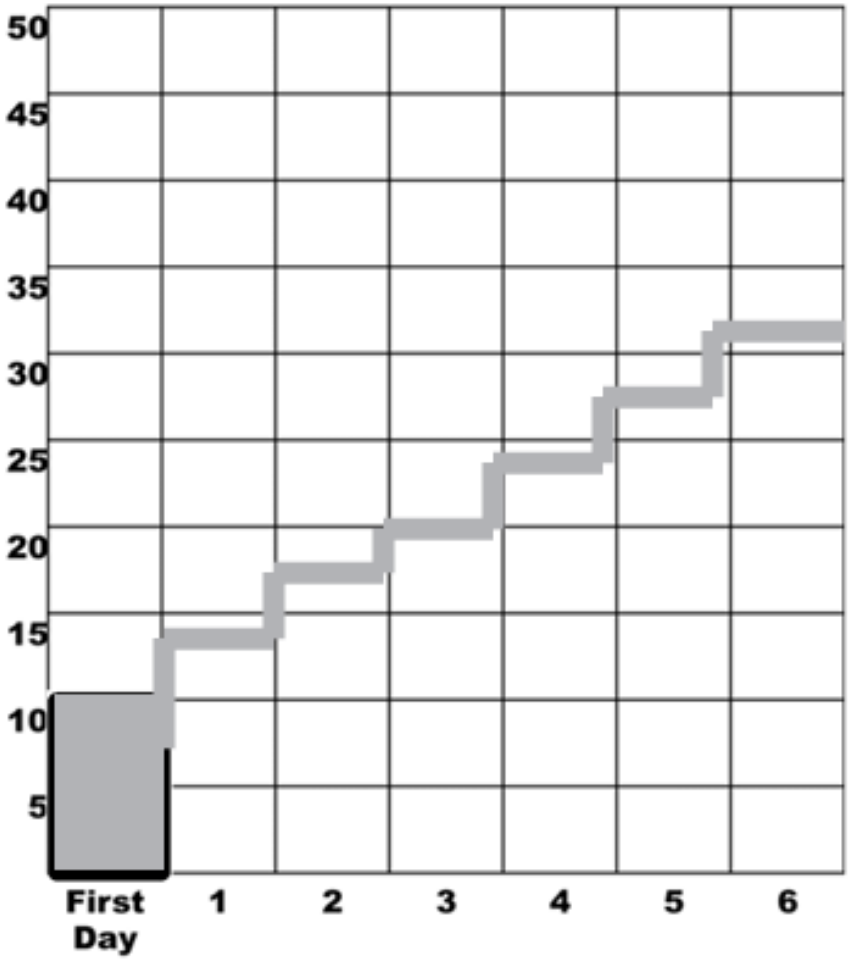
I was talking to my friends when all of a sudden _____

Appendix D

Student Self-Graphing Page

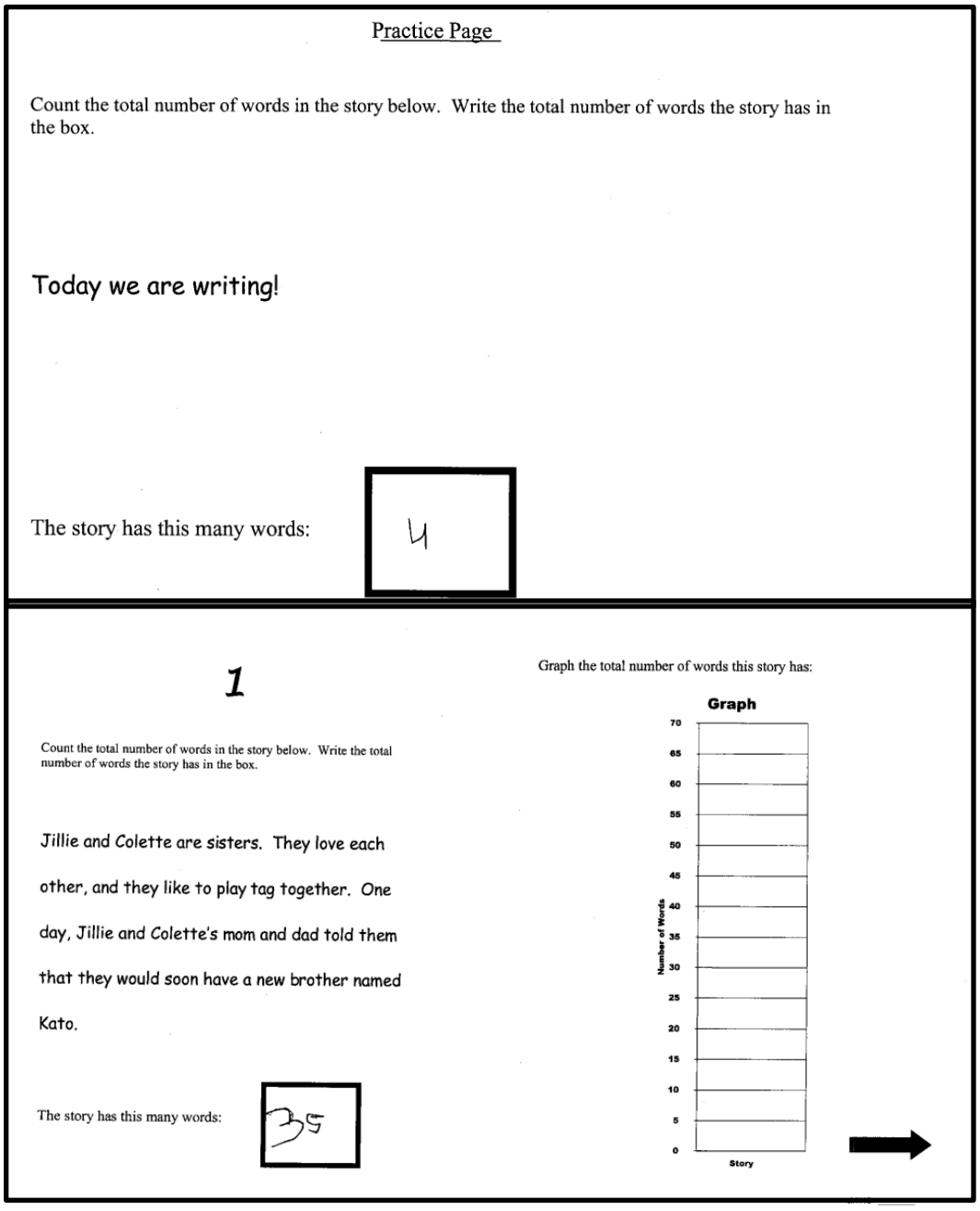
Today I wrote this many words:

My Writing Graph



Appendix E

Measure of Intervention Adherence



Practice Page

Count the total number of words in the story below. Write the total number of words the story has in the box.

Today we are writing!

The story has this many words: 4

1

Count the total number of words in the story below. Write the total number of words the story has in the box.

Jillie and Colette are sisters. They love each other, and they like to play tag together. One day, Jillie and Colette's mom and dad told them that they would soon have a new brother named Kato.

The story has this many words: 35

Graph the total number of words this story has:

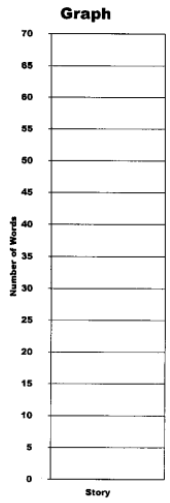
2

Count the total number of words in the story below. Write the total number of words the story has in the box.

Titus the dog likes to bark and play fetch. At night, Titus sleeps under the covers in bed because he gets cold. His favorite activity is eating!

The story has this many words: 67

Graph the total number of words this story has:



ek1112 - _____

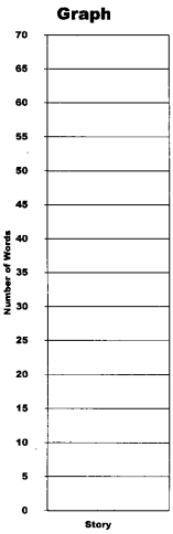
3

Count the total number of words in the story below. Write the total number of words the story has in the box.

Rigby was so excited for her first day of school! When she arrived, the other kids made up nicknames for her. One girl said, "Hi, Big Rig!" The other said, "Do you eat rigatoni?" Rigby was so popular because of her cool name!

The story has this many words: 43

Graph the total number of words this story has:



ek1112 - _____

Appendix F

Procedural Script for Performance Feedback Plus Goal Setting Intervention

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

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

	desks fill up, place any remaining students at tables in the room. The other research assistant should be standing outside the classroom holding up the blue sheet of paper that says Blue Group. The research assistant should assist students with quickly getting to the appropriate classroom.	
5.	Once you have confirmed that all the students from the other classrooms have arrived, state to the students: "*Welcome to the Blue Group. We are going to be practicing writing today, because we want you to become better writers. Please turn to the first page of your packet that has stop sign in the middle of the page.* *Today I want you to write a story. Before we do that I want to tell you how you are doing with your writing skills. Last week you each counted the number of words you wrote in your stories, and then we took all your stories back with us and we counted all of the words, too. Please turn to the next page of your packet. This page has a pencil writing a story at the top of the page.*"	
6.	The research assistant should scan the room to make sure all the students are on the correct page.	
7	State to the students: *"The box in the middle of the page* [The research assistant should point to the box] *tells you how many words you wrote last week. Every week when I work with you, I will tell you how you are doing with your writing. Our goal is to have you write more and more words over the next six weeks.*	
8	The research assistant should monitor the students for questions.	
9.	State to the students: *"Now look at the box below. This box has a number in it. I want you to try to write this many words or more in your story today. Try to write a story that has at least this number of words in it."* The research assistant should monitor the students for questions.	
10.	State to the students: "*Now I want you to write another story. I am going to read a sentence to you first, and then I want you to write a story about what happens next. You will have some time to think about the story you will write and then you will have some time to write it.*"	
11.	State to the students: "*Please turn to the next page of your packet. This page has a cloud at the top of the page.*"	

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

	your packet."	
21.	State to the students: *"Look at the first box on this page. It says, 'Today I wrote this many words.' When I say 'begin,' turn back to the story you just wrote and count the number of words you wrote, like this:* [experimenter points to writing sample]. *If I wrote the words, 'I walked to school,' that would be 1, 2, 3, 4 words* [experimenter points to each word while counting]. *Make sure you count all your words as best as you can, because we will be taking your stories back with us and counting them, too.* *"When you are done counting, write the number of words you wrote today in this box at the top of the page* [experimenter points to the box]. *Begin counting."*	
22.	Monitor the students, answer questions, and help them count if necessary.	
23.	When students are finished counting, state to the students, *"Now look at the graph on the bottom of the page. This is your writing graph. Last week when we worked with you, we counted your words and graphed them for you on the column that says "First day." We also put your goal on the graph by coloring it in blue. See where the blue line is?* [Experimenter points to blue line on graph.] *That's how many words your goal was for today.* *I want you to graph the number of words you wrote today on the column above the number one,* [experimenter points to the column labeled 'one'] *by coloring in these boxes, and only color up to the number of words you wrote today, like this. For example, if I wrote five words, I would color up to here* [experimenter demonstrates]. *Go ahead and color in those boxes in the column above the number one because today is the first time you've counted your words. You will be graphing the number of words you write every week when I come to work with you.*	
24.	Monitor the students, answer questions, and help them graph if necessary.	
25.	When students have finished graphing, state: *"Please stop working, put your pencils back in the air, and closer your packet."*	
26.	The research assistant should monitor the students to ensure they have stopped writing and have closed their packets.	
31.	State to the students, *"That is all of the writing that we are going to do today. All of you did a very nice*	

	job following my directions. Thank you for working with us today."	
32.	The research assistant should collect all of the packets.	
33.	State to the students: *All of the students in _____'s classroom, please pick up your pencil and line up at the door.* *All of the students in _____'s classroom, please pick up your pencil and line up at the door.* *All of the students in _____'s classroom, please pick up your pencil and line up at the door.*	
34.	The research assistants should then assist the students in getting back to their classrooms quickly and quietly.	
Total number of steps completed:		

Appendix G

Measure of Intervention Adherence Coding Sheet

Name:	Date:
Participant ID:	Story Number:

Total Words Written Box		
	Completion:	
	☐	COMPLETE: contains one single number or numeral
	☐	INCOMPLETE: does not contain one single number or numeral
	Accuracy:	
	☐	ACCURATE: the correct number of words written in that story is written in the box indicated
	☐	INACCURATE: the incorrect number of words written in that story is written in the box indicated
Total Words Written Graph		
	Completion:	
	☐	COMPLETE: contains writing within the graph
	☐	INCOMPLETE: does not contain writing within the graph
	Accuracy:	
	☐	ACCURATE: the correct bar is plotted on the graph
	☐	INACCURATE: an incorrect bar is plotted on the graph

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Alec Goldstein

426 Ostrom Ave., Syracuse, NY 13210 | Agolds07@syr.edu | (516) 425-4801

EDUCATION

Syracuse University, Syracuse, NY
August 2019- Present
Ph.D. student in School Psychology (*APA and NASP Accredited*)
Expected Graduation 2025

State University of New York, College at New Paltz, New Paltz, NY
August 2016- May 2019
B.A. in Psychology | *Minors*: Evolutionary Studies and Music
Cumulative GPA in Major: 3.95
Cumulative GPA: 3.78

RESEARCH EXPERIENCE

Treatment Research in Academic Competence Lab (TRAC), Syracuse, NY
August 2019- Present
Graduate Assistant | Faculty Mentor: Dr. Tanya Eckert

- Conduct independent research for milestone projects
- Co-author current lab research manuscripts and presentations
- Manage data collection and analysis, and review literature on school-based interventions to improve student's academic skills
- Mentor and train undergraduate research assistants in the foundations of school psychology research

Research in Interventions Targeting Educational Success Lab (RITES), Syracuse, NY
August 2019- May 2022
Graduate Assistant | Faculty Mentor: Dr. Bridget Hier

- Locate and code scientific research articles using an established coding manual for a systematic review on writing quality
- Attend weekly meetings to assess project progress

Evolutionary Psychology Lab, New Paltz, NY
August 2017- June 2019
Research Assistant | Faculty Mentor: Dr. Glenn Geher

- Create surveys and assess for validity
- Collect, input, and analyze data from online surveys
- Contribute sections to manuscript writing and engage in peer editing
- Meet weekly to discuss current manuscripts and research projects

Development in Language Lab, New Paltz, NY
August 2017- June 2019
Lab Manager| Faculty Mentor: Dr. Elizabeth Hirshorn

- Facilitate weekly meetings between the graduate and research assistants
- Code programs using E Prime to collect appropriate EEG data
- Contribute to manuscript writing

PUBLICATIONS

Eckert, T., Maguire, S., Nelson, K., Amidon, S., **Goldstein, A.**, Antoine, M. (in progress). Student acceptability and dosage

Eckert, T., Circe, J., **Goldstein, A.**, Amidon, S., Nelson, K., Maguire, S. (in progress) Comparison of paragraph and sentence writing prompts

Goldstein, A., Hirshorn, E (in progress) Move Over! Learned vs Innate Processing: Examining the Relationship Between Visual Word and Face Processing.

Goldstein, A., & Planke, J. (in progress) Differences in Reactions to Infidelity Based on Sex and Sexuality

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Hier, B., MacKenzie, C., Ash, T., Maguire, S., Nelson, K., Helminen, E., Watts, E., Matsuba, E., Masters, E., Finelli, C., Circe, J., Hitchings, T., **Goldstein, A.**, & Sullivan, W. (revise and resubmit). Effects of the good behavior game on students' academic engagement in remote classrooms during the COVID-19 pandemic. *Journal of Positive Behavior Interventions.*

Ruel, M., De Jesus, A., Cristo, M., Nolan, K., Stewart-Hill, S., DeBonis, A., **Goldstein, A**., Frederick, M. Geher, G., Alijaj, N., Elyukin, N., Huppert, S., Kruchowy, D., Maurerm, E., Santos, A., Spackman, B., Villegas, A., Widrick, K., Wojszynski, C., & Zezula, V. (2022). Why should I help you? A study of betrayal and helping. *Current Psychology.*

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PRESENTATIONS

Eckert, T. L., Circe, J. J., **Goldstein, A.**, Maguire, S. C., Nelson, K. A., Amidon, S. Y. M. (2022). *Impact of Reading Comprehension on Elementary-Age Students' Writing Performance.* Poster presented at the National Association of School Psychologists, Boston, MA

Hier, B. O., Datchuk, S. M., Eckert, T., L., Watts, E. A., Circe, J. J., Hitchings, T. J., **Goldstein, A.**, Finelli, C. C., Maguire, S. C., Nelson, K. A. (2021). *Validity and Classification Accuracy of Curriculum-Based Measurement of Sentence Construction*. Poster presented at the National Association of School Psychologists, Virtual Convention

Eckert, T. L., Hier, B. O., Circe, J. J., **Goldstein, A.**, Eggleston, B. N., Maguire, S. C., & Nelson, K. A. (2021). *Association between writing productivity, writing apprehension, and grit.* Poster presented at the National Association of School Psychologists, Virtual Convention.

Hier, B. O., Hitchings, T. J., Ardoin, S. P., **Goldstein, A.**, Watts, E. A. (2020) *The Effect of Topic Choice on Second-Grade Student's Writing Performance*. Poster presented at National Association of School Psychologists, Baltimore, MD

Goldstein, A. (2019) *Move Over! Learned vs Innate Processing: Examining the Relationship Between Visual Word and Face Processing*. Paper presented at the 13th NEEPS Conference, Boston, MA.

Goldstein, A. (2019) *Cheating: The Darwinian Perspective*. Paper presented at the annual celebration of "Darwin Day" sponsored by the National Humanist Society, New Paltz, NY.

Goldstein, A., Newhook, K. (2018) *The Evolution of Beauty*. Paper presented at the annual celebration of "Darwin Day" sponsored by the National Humanist Society, New Paltz, NY.

Goldstein, A. (2018) *The Evolution of Beauty: How Darwin's Forgotten Theory of Mate Choice Shapes the Animal World-and Us. A recap and literature review*. Paper presented at the Evolutionary Studies Speaker Series at SUNY New Paltz

Goldstein, A. (2018) *Differences in Reactions to Infidelity Based on Sex and Sexuality*. Poster presented at the SUNY Undergrad Research Conference 2018, Oneonta, NY.

Goldstein, A. (2018) *Differences in Reactions to Infidelity Based on Sex and Sexuality*. Poster presented at the SUNY New Paltz Student Research Symposium 2018, New Paltz, NY.

Goldstein, A. (2018) *Differences in Reactions to Infidelity Based on Sex and Sexuality*. Poster presented at the the 12th NEEPS Conference, New Paltz, NY.

Goldstein, A. (2018) *Move Over! Learned vs Innate Processing: Examining the Relationship Between Visual Word and Face Processing*. Paper presented at the Evolutionary Psychology Independent Conference, New Paltz, NY.

Goldstein, A. (2018) *Move Over! Learned vs Innate Processing: Examining the Relationship Between Visual Word and Face Processing*. Poser presented at the SUNY New Paltz Student Research Symposium 2018, New Paltz, NY.

Goldstein, A. (2018) *Move Over! Learned vs Innate Processing: Examining the Relationship Between Visual Word and Face Processing*. Poster presented at the SUNY Undergraduate Research Symposium, Oneonta, NY.

Goldstein, A. (2017) *The Evolution of Murder.* Paper presented at the Evolutionary Studies Symposium, New Paltz, NY.

PROFESSIONAL EXPERIENCE

Elmcrest Children's Center; Crisis Respite Facility, Syracuse, NY
August 2022 - Present
Graduate Clinician

- Conduct intake risk assessment and resource management
- Provide acute psychological support during crises
- Provide twice-weekly individual therapy and weekly DBT groups
- Provide individual supervision to cottage clinicians and facilitate weekly group supervision to the residential clinician team

Elmcrest Children's Center; Residential Treatment Center, Syracuse, NY
July 2021 - August 2022
Graduate Clinician/ Behavioral Consultant

- Conduct individual therapy with children in residential homes
- Observe, assess, and create appropriate behavioral and non-behavioral interventions for children both at home and in school
- Maintain communication and appropriate support of state regulatory bodies and legal counsel of clients in care

Elmcrest Children's Center; Early Intervention, Syracuse, NY
August 2020 - July 2021
Early Intervention Behavioral Specialist

- Conduct cognitive and behavioral assessments, functional behavior assessments, and classroom consultations
- Maintain communication with the multidisciplinary team of therapists and teachers regarding referrals, evaluations, recommendations, and CPSE meetings
- Conduct behavioral consultations and develop appropriate classroom-based behavioral interventions for teachers

Syracuse University, Syracuse, NY
May 2020 - June 2020, May 2021 - June 2021
Instructor of Record

- Taught weekly classes as the sole instructor, created syllabus and all teaching material, held weekly office hours and guided study sessions, constructed assignments quizzes, and tests, and graded all exams/assignments for "PSY 335: Psychology of Childhood"

Syracuse University, Syracuse, NY
September 2019- May 2020
Teaching Assistant (TA)

- Taught weekly recitation sections on core content, held weekly office hours and guided study sessions, constructed assignments and quizzes, and graded all exams/assignments for "PSY205: Introduction to Human Behavior"

Social Skills Training Group, Syracuse, NY
September 2019- September 2021
Intervention Leader

- Meet once a week with families with children diagnosed with ADHD and ASD where we teach social skills to the children and work with the parents on strategies in order to improve functioning and quality of life for all members of the family

State University of New York, College at New Paltz, **Department of Psychology**, New Paltz, NY August 2017- June 2019
Teaching Assistant (TA)

- Held weekly office hours and guided study sessions, contributed content to exam drafting, and graded exams/assignments for a course in 'PSY307: Evolutionary Psychology'

Undergraduate Tutor

- Tutored students in various psychology courses including 'Introduction to Psychology', 'Research Methods in Psychology', 'Psychology of Memory and Thinking', 'Psychology of Language', 'Psychology of Infancy and Childhood', 'Positive Psychology', and 'Psychological Statistics'

State University of New York, College at New Paltz, Department of Evolutionary Studies, New Paltz, NY August 2018- June 2019
Course Assistant

- Held bi-weekly office hours, coordinated guest lecturers, and assisted in class budgeting for a seminar in 'EVO301:Evolutionary Studies Seminar'

DOCA Inclusive Summer Program, Oceanside, NY
June 2017- August 2017, June 2018- August 2018
Group Leader

- Structured curricula, coordinated schedules and managed a multi-functional team of 5+ other leaders to provide a safe and cultivating environment for 40+ children age 11-12
- Identified and coordinated responses to student behavioral issues, making determinations of how to engage in conflict mediation and/or parental intervention

One on one aide for High-risk Children
June 2013- August 2013, June 2014- August 2014, June 2015- August 2015, June 2016- August 2016

- Developed and oversaw scheduling for a group of 20+ children age 9-10 in activities and coordinated this scheduling with leaders of different groups

- Identified and provided additional support through structured modeling and consistent mentorship meetings for children at high-risk for problematic behaviors, to assist them in participating fully in group activities and prosocial group dynamics

CO-CURRICULAR EXPERIENCE

Applied Evolutionary Psychology Society
August 2020 - Present
ByLaws Officer

- Organize agenda and maintain decorum within the executive board
- Monitor and moderate society run forums

Journal of Evolutionary Studies Consortium
April 2018 – September 2019
Member of the Editorial Review Board

- Read manuscripts from multiple disciplines and deemed them ready for publication or not
- Made content-based edit recommendations for editorial manuscripts deemed not ready for publication and reviewed grammar and syntax for editorial manuscripts deemed ready for publication
- Monitored editorial submissions to the journal and served as a means of communication between the journal and researchers

Applied Evolutionary Psychology Society
June 2018 - August 2020
Communications Officer

- Facilitate minute-taking at semi-monthly meetings, organized all meeting agendas, and executed communication between the executive board and the 200+ general society members via regular email and newsletter

Jewish Advocacy Academy
June 2017 - Present
Student Delegate

- Organized events to inform other students of the relevancies of Jewish teachings to modern society and student life
- Lobbied and offered campaign assistance to Jewish student leaders running for office in student government organizations

Sinai Scholars
January 2018 - May 2018
Student Representative

- Wrote monthly papers on select Torah portions, analyzed biblical stories from psychological perspectives, and provided these analyses to members of the Rabbinical community

New Paltz Volleyball Club
August 2016 - June 2019
Club President, Team Captain

- Oversaw the maintenance of a university-sanctioned budget, organized fundraising, synchronized practice schedules between the university athletics department and club members, and ran bi-weekly practices

Miami Theatre Players
January 2017 - June 2019
Musical Director, Pit Musician

- Arranged all symphonic instrumentation, directed it's teaching to all vocalists and pit musicians, and conducted the orchestra for 2+ musicals per semester for this student-led theater company

SUNY New Paltz Jazz Ensemble
January 2016 - January 2018
Section Leader

- Arranged musical selections, determined part distribution, and organized sectional rehearsals for the percussion section of this student-led jazz ensemble

Other Involvements: New Paltz Racquetball Club, New Paltz Cooking Club, New Paltz Outing and Hiking Club, Syracuse Men's Volleyball Club

COMMUNITY SERVICE EXPERIENCE

IDD-inclusive Drum Lessons
September 2012 - Present
Founder, Drum Instructor

- Provided free drum lessons to elementary-aged students with Intellectual and Developmental Disabilities (IDDs), to improve motor skills, foster co-curricular interests, and provide a form of music therapy

American Jewish Committee (AJC PAC)
July 2016 - August 2018
Senior Delegate

- Volunteered time to engage in phone-banking and in face to face meetings with members of Congress to discuss Jewish students' perspectives on national legislature and policies

Best Buddies International
September 2012 - June 2016
Music Coordinator, Member

- Volunteered time to meet weekly with a local chapter of this international nonprofit focused on fostering one-on-one friendships between high school students with and without Intellectual and Developmental Disabilities (IDDs)
- Coordinated bi-weekly musically oriented activities for chapter members

Relevant Coursework: Cognitive and Affective Bases of Behavior, Social Cognition, Statistics and Research Design, Cognitive and Intellectual Assessment, Theories and Methods of Assessment, Direct Academic Assessment, Principles of Behavior and Behavior Modification, Child and Family Interventions, Introductory Seminar in School Psychology, Socioemotional Assessment, Psychology of Childhood and Infancy, Psychology of Motivation, Psychology of Memory and Thinking, Abnormal Psychology, Positive Psychology, Disaster Psychology, Research Methods in Psychology, Psychology of Personality, Psychology of Learning and Behavior