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Enhancing Self-Monitoring with Differential Negative Reinforcement of Alternative Behavior for Increasing Students' Writing Production

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Abstract

Many students find writing aversive and behave in ways to escape the task. Self-monitoring and differential negative reinforcement of alternative behavior (DNRA) are two approaches that have been shown to improve the quantity of writing performance but have never been combined to determine whether they are more effective in combination than in isolation. The purpose of the present study was to evaluate the differential effectiveness of self-monitoring versus self-monitoring plus DNRA for an increasing the number of words and sentences written using a multiple probe design across three participants during two 10-minute sessions. For each baseline session, participants were given a story starter prompt to write as much as they could, received a short break, and then the second 10-minute session would begin. Self-monitoring indicated an increase in a number of words written and an unstable but slightly higher trend in a number of sentences written for one participant. The other two participants showed decreasing trends in both the number of words and sentences written during self-monitoring. Results of self-monitoring plus DNRA indicated an increase in a number of words and sentences written for one participant, while the other two participants showed little to no improvement. Areas for future research, limitations, and implications for practice are discussed.

Keywords: Self-monitoring; Multiple probe design; Differential negative reinforcement of alternative behavior; Writing productivity; Data stability.

1. Introduction

Writing is an important skill for success in school and beyond (National Commission on Writing, 2004, 2005). Yet, it is an area in which students struggle (Achieve, 2014; ACT, 2014). Many reviews found writing to be a difficult task for students (Achieve, 2014; ACT, 2014; National Commission on Writing, 2003;2004). According to the 2011National Center for Education Statistics (2012), 73% of high school students wrote at or below basic levels. Achieve (2014) and ACT (2014) found that 36% of students who took the ACT were not prepared for college-level writing courses and that 34% of high school graduates in the workforce displayed gaps in their writing education and quality of writing expected on the job.

One reason it is difficult to improve writing outcomes is because many students view writing to be a difficult and especially unpleasant task (Boscolo and Gelati, 2019; Bruning and Kaufmann, 2016). For example, Wray (1993) found that children expressed negative perceptions about writing, primarily because it was viewed to be very tedious. Villalón *et al.* (2015), found that not only can beliefs about writing result in escape behaviors, but also predict future writing performance. Specifically, students with negative beliefs about writing displayed poorer performance (Sanders-Reio *et al.*, 2014; White and Bruning, 2005). Consequently, writing tasks may result in students displaying more escape behaviors than activities in other academic content.

It is important to find strategies to motivate students to engage in writing tasks and increase their production using the skills they possess. One motivational strategy that has been researched for many years is self-monitoring (Wolfe *et al.*, 2000). Differential Negative Reinforcement of Alternative Behavior (DNRA) may be another strategy that increases motivation for students who find writing unpleasant because it permits a student to escape the second half of a writing task by increasing production on the first part (Holtz and Daly, 2019).

1.1. Self-Monitoring

Self-monitoring consists of three components: self-observation, self-recording, and self-graphing (Goddard and Sendi, 2008). There have been two systematic reviews that concluded self-monitoring was highly effective in improving reading for students from kindergarten to twelfth grade (Guzman *et al.*, 2018; Joseph and Eveleigh,

2011). Self-monitoring has also been used to improve math fluency (Maccini and Hughes, 1997). Much research has been conducted on the effectiveness of self-monitoring to improve on-task and decrease off-task behaviors (Bruhn *et al.*, 2015). However, one area that has received far less attention is writing. In fact, there have only been four studies that examined the effectiveness of self-monitoring on writing (Ballard and Glynn, 1975; Goddard and Sendi, 2008; Rumsey and Ballard, 1985; Wolfe *et al.*, 2000).

Ballard and Glynn (1975) used self-monitoring with a self-assessment component to improve several aspects of writing, including number of sentences, describing words, and on task behavior for students between eight and nine years of age. Goddard and Sendi (2008) built on Ballard and Glynn (1975) study by including a checklist for participants, with learning disabilities. Rumsey and Ballard (1985) used self-monitoring to successfully increase the number of words written while also investigating the impact of self-monitoring for on-task and off-task behavior of participants who displayed disruptive behaviors during writing tasks. Finally, Wolfe *et al.* (2000) used self-monitoring both for on-task and number of words written for participants with learning disabilities.

1.2. Differential Negative Reinforcement of Alternative Behavior (DNRA)

An intervention that may be effective to improve writing is DNRA (Holtz and Daly, 2019). For example, for students who want to escape an academic task, DNRA would consist of letting that student know that if he or she can complete a certain amount of work at a predetermined criterion level, then they would not have to do the remainder of the work—hence being able to escape the task by demonstrating higher performance on the first part of the task. MacArthur *et al.* (2018), found that longer essays and writing have been determined as having higher writing quality and scores. Therefore, potential increases in writing productivity may also produce improvements in writing quality. Several researchers have conducted studies using DNRA to decrease problem behaviors associated with escaping an aversive task (Golonka *et al.*, 2000; Marcus and Vollmer, 1995; Piazza *et al.*, 1996; Vaz *et al.*, 2011; Vollmer *et al.*, 1999). However, only one study examined DNRA with writing productivity and quality (Holtz and Daly, 2019).

The purpose of the current study was to examine the effectiveness of two motivational strategies—self-monitoring and DNRA—to increase the number of words and sentences for participants who were given story starters and told to write an essay about the topics. A multiple probe design across participants was used to assess the effectiveness of self-monitoring in isolation after baseline was established, and then the third phase would add DNRA to self-monitoring. There were three questions of interest in conducting this study. First, does self-monitoring the number of words written increase participants' productivity? Second, does adding DNRA to self-monitoring further improve the quantity of writing? Third, does self-monitoring words written also increase number of sentences written?

2. Method

A multiple probe across participants design was used because it does not require as many data points during baseline as compared to a multiple baseline design which, otherwise, could result in a practice effect for participants in the second and third tiers. Moreover, a multiple probe design does not require treatment withdrawal to establish experimental control. This design allows for gradual application of the intervention(s) to observe continuous improvement rather than only terminal improvement. Finally, by staggering participants entering intervention can serve as a way to establish experimental control. Further control is established when performance changes in terms of level and/or trend with the introduction of intervention for one participant while the other participants' baseline remains stable.

2.1. Participants

Three third and fourth grade participants were selected from children who attended an after school reading clinic of a large midwestern university that served approximately 45 children at the time. Participants were nominated by their tutors or parents because of their aversion to engaging in writing tasks and lacked motivation to complete them—especially those that required writing a story or essay. Stephen was a 10-year old fourth-grade African American male, Alex, a 10-year-old fourth grade Caucasian male, and Henry, also a third-grade Caucasian male. The primary language for all participants was English.

2.2. Setting

All sessions were conducted by the primary researcher in a reserved conference room at a large midwestern public university. The room consisted of one rectangular table with six chairs, two chairs at each long side of the table and one at each short side of the table. The walls were blank except for a white board on the south wall. All materials needed to conduct the experiment were set up in the room prior to escorting participants from the reading clinic to the conference room during the study. Participants met with the experimenter following their tutoring session.

2.3. Materials

There were three sets of materials used in the current study: (1) pencil and lined paper with writing prompts at the top, (2) self-monitoring sheet to record the number of words written, and (3) a bar graph for participants to shade in based on the number of words written.

2.4. Pencil and Prompts

A pencil and four writing prompts, each on a different piece of lined paper, were provided to participants every session. For each probe, participants were given two prompts to choose from, as well as a blank sheet of paper for planning and an extra sheet of lined paper. The writing prompts appeared at the top of 8" x 10" lined paper. A typical writing prompt would be "Write about your favorite sport. Include at least three reasons why you like it." Each prompt was selected and confirmed as grade-level covered content by linking them with state standards and conversing with a third-grade teacher and professor whose major area of research is writing.

2.5. Self-Monitoring Sheets

Self-monitoring sheets were identical to the lined piece of paper with each story starter. The only difference was that at the bottom lower left side of each sheet there was, "Number of words written." A box appeared below that statement in which participants wrote that number.

2.6. Self-Graphing Sheets

Graphing sheets were made to record the number of words written for each writing task. Each sheet contained a bar graph with five columns. Each column was divided into individual squares. For example, if a participant wrote 20 words, then he would shade in up to the number 20 on that particular column. Each column was made to look like a rocket ship to enhance the appearance of the graph.

2.7. Dependent Variables

There were two dependent variables collected in the present study: (1) number of words written and (2) number of sentences written. Number of words written was defined as a letter or group of letters separated by a space. Spelling and grammar were not considered as part of the definition. Number of sentences were counted if it contained a noun and a verb. Capitalization and punctuation were not considered as part of the definition.

2.8. Procedures

After obtaining approval from the university's Institutional Review Board (IRB), the primary investigator (PI) contacted parents of potential participants who attended the reading center and explained the purpose and structure of the study. Parents who were interested in the study met with the PI and her supervisor. Parents signed a consent letter while participants signed the assent form. There were three different conditions to the study. First, baseline date were collected. Second, the self-monitoring procedure was implemented. The third condition added DNRA to self-monitoring. The PI collected and recorded number of words and sentences written for each of the three conditions or phases of the study. All sessions for each condition were approximately 25 min. long. The 25-min. sessions were broken down into two 10-min individual recording sessions, with a 5-min break between individual recording sessions. Participants received directions from a script that the PI read aloud. If a participant did not write any words, the PI recorded a zero for both number of words and sentences for that prompt.

2.9. Baseline

During baseline, the PI prepared four lined sheets of paper with story starters on each. She randomly gave participants two writing prompts, read them aloud along with scripted directions (e.g., "try to write as much as you can about the topic"), and told them to select which one they wanted to write about first. The unselected story starter was placed aside for future sessions selected at random by a random number generator. After the first 10-min writing task ended, participants received a 5-min break that consisted of taking a walk around inside the three story building that housed the reading clinic. After the break, the second 10-min writing task began. The second session mirrored the first except the two writing prompts from which participants chose were different. After the two writing tasks were completed, the session ended. During baseline, participants did not come in contact with any planned, contingent motivational (i.e., reinforcement) consequences, nor did they receive any feedback as to how well they performed. Data were graphed only from the first prompt because in the third phase of the study participants could potentially escape the second writing probe.

2.10. Self-Monitoring

This phase followed the same procedure as that for baseline except the PI told and showed participants that the story starter paper had a direction at the bottom that said, "number of words written." Participants received directions from a script that the PI read aloud. The PI then pointed to a box directly below that direction and, after participants finished the writing task, instructed them to count up the number of words they wrote and write that number in the box. Following writing the number in the box, participants were shown a piece of paper placed next to the story starter that contained a bar graph with five columns. They noted that each column was divided into individual squares and the direction written at the top of the paper, "Shade in the amount of squares for the number of words you wrote on your writing sheet." Participants counted, recorded, and graphed the number of words written at the end of each session. During self-monitoring, participants did not come in contact with any planned, contingent motivational (i.e., reinforcement) consequences.

2.11. Self-Monitoring + DNRA

The third phase was conducted exactly as in the self-monitoring only phase, but with the DNRA contingency introduced at the beginning of the first writing sample using a prepared script. Each participant was showed a paper bag and told there were slips of paper with different numbers written on them. After they counted, recorded, and graphed the number of words written, the PI also counted the number of words written. Participants were then told that the PI would pull a slip of paper from the bag and if the number of words written was the same or greater than the number on the slip of paper, they did not have to complete the second writing task, the session was concluded, and they were permitted to leave.

The number of words on each slip of paper was determined in the following way. First, the highest data point from the baseline or self-monitoring phase was selected. The reason for collecting the highest data point from either phase depended on the addition of DNRA. For example, from baseline to self-monitoring, baseline was used and when NDRA was implemented, the self-monitoring only phase was used because it was adjacent to phase three. Second, 50% of the highest data point was added to that number. For example, if the highest number of words written during baseline was 26, then 13 (half of 26) was added to 26 (26 + 13 = 39). Third, the numbers 27 through 39 were written on individual slips of paper and each placed the bag. To ensure non-overlapping contingencies with baseline or self-monitoring points, the lowest number placed in the paper bag was one number more than the highest baseline or self-monitoring data point. The purpose was to ensure non-discriminable contingencies for participants so that they would not simply stop writing if the predetermined criterion was known prior to beginning the first writing task. The motivational aspect of this phase was that participants were negatively reinforced by being able to escape the second writing task by reaching the predetermined but previously unknown criterion. During the self-monitoring plus DNRA phase, participants did not come in contact with any planned, contingent positive reinforcement.

2.12. Inter-observer Agreement (IOA)

Inter-observer agreement (IOA) was scored for approximately 33% of the probes. The PI scored all writing samples for both number of words and sentences written with a second trained impartial graduate student also separately counting the number of words and sentences written. The researcher calculated IOA by dividing the smaller frequency of trial agreements by the larger number of trial agreements, and multiplying the result by 100 to obtain an average of 94% for number of words and 72% for number of sentences.

2.13. Treatment Fidelity

Treatment fidelity was conducted by having the PI train an impartial graduate student how to implement each of the intervention phases using the preexisting instructions and script. The PI then provided the graduate student a checklist containing the steps involved with the implementation of self-monitoring and self-monitoring plus DNRA phases as a basis for determining fidelity. The graduate student marked each step of the intervention process as met or not met and provide that feedback to address treatment integrity. Fidelity checks occurred across each phase and all participants for 47% of probes with 100% for every probe.

2.14. Data Analysis

From the previous information regarding the self-monitoring plus DNRA phase only data from the first writing task were graphed and analyzed. Data were primarily analyzed through visual inspection in order to identify changes in level, trend, variability, and compare means across phases (Kazdin, 2011). In addition, two types of effect sizes were calculated. First, Tau-*U* values were computed because it controls for monotonic trend (i.e., increasing trends during baseline). Second, improvement rate difference (IRD) was also computed because it provides an effect size similar to the *risk difference* used in medical treatment research, which has a proven track record in hundreds of studies (Parker *et al.*, 2009). The Tau-*U* and IRD effect sizes were calculated using the www.singlecaseresearch.org/calculators.

3. Results

Results of the current study will be presented in two ways. First data were subjected to visual analysis as described above. Figures 1 and 2 display the graphs for number of word and number of sentences written, respectively. Table 1 presents the means, ranges, and standard deviations for all three participants across baseline and intervention conditions for both number of words written and number of sentences written. Table 2 presents the results of IRD and Tau-*U* effect sizes for both number of words written and number of sentences written.

Table-1. Number of Words and Sentences Written

Participants	Baseline	Self-Monitoring	Self-Monitoring+ DNRA
Number of Words Written			
Stephen	Mean = 104 Range: 91-120 SD = 16.40	Mean = 142 Range: 126 – 158 SD = 15.03	Mean = 180 Range: 168 – 195 SD = 11.32
Alex	Mean = 15 Range: 12 – 53 SD = 2.98	Mean = 14 Range: 12 – 14 SD = 1.66	Mean = 23 Range: 17 – 33 SD = 7.32
Henry	Mean = 41 Range: 29 – 53 SD = 7.30	Mean = 34 Range: 20 – 49 SD = 10.98	Mean = 42 Range: 28 – 50 SD = 10.14
Number of Sentences Written			
Stephen	Mean = 9 Range: 6 – 13 SD = 0.878	Mean = 12 Range: 8 – 15 SD = 2.50	Mean = 13 Range: 11 – 17 SD = 2.65
Alex	Mean = 3 Range: SD = 0	Mean = 3 Range: 2 – 4 SD = 0.71	Mean = 7 Range: 4 – 11 SD = 3.09
Henry	Mean = 4 Range: 2 – 5 SD = 0.87	Mean – 3 Range: 1 – 4 SD = 1.22	Mean = 5 Range: 4 – 5 SD = 0.47

Table-2. Effect Sizes for Number of Words and Sentences Written

Participants	Baseline to Self-Monitoring		Baseline to Self-Monitoring + DNRA		Self-Monitoring to Self-Monitoring + DNRA	
Effect Sizes for Number of Words Written						
	IRD	Tau-U	IRD	Tau-U	IRD	Tau-U
Steven	1.00	1.00 (.33 – 1.00)[a]	.60	1.00 (.37 – 1.00)[b]	1.00	.50 (-.17 – 1.00)
Alex	.46	-.32 (-.94 – 30)	1.00	.77 (.19 – 1.00)[a]	.86	1.00 (33 – 1 .00)[a]
Henry	.50	-.33 (-.93 – .26)	.50	.26 (-.26 – .78)	.56	.42 (-23, 1.00)
Effect Sizes for Numbers of Sentences Written						
Steven	.25	.45 (-.22 – 1.00)	.55	.89 (.17 – 100)	.60	.55 (-.12 – 1.00)
Alex	.25	.00 (-.62 – .62)	.75	1.00 (.421 – 1.00)[a]	1.00	.85 (.18 – 1.00)
Henry	.25	-.56 (-1.00 – .40)	.67	.30 (-.22 – .81)	.17	.63 (-.02 – 1.00)

Note: P= [a] < 0.05, [b] < 0.01

Figure-1. Multiple probe across participants graph showing effects of self-monitoring and self-monitoring plus DNRA on number of words written.

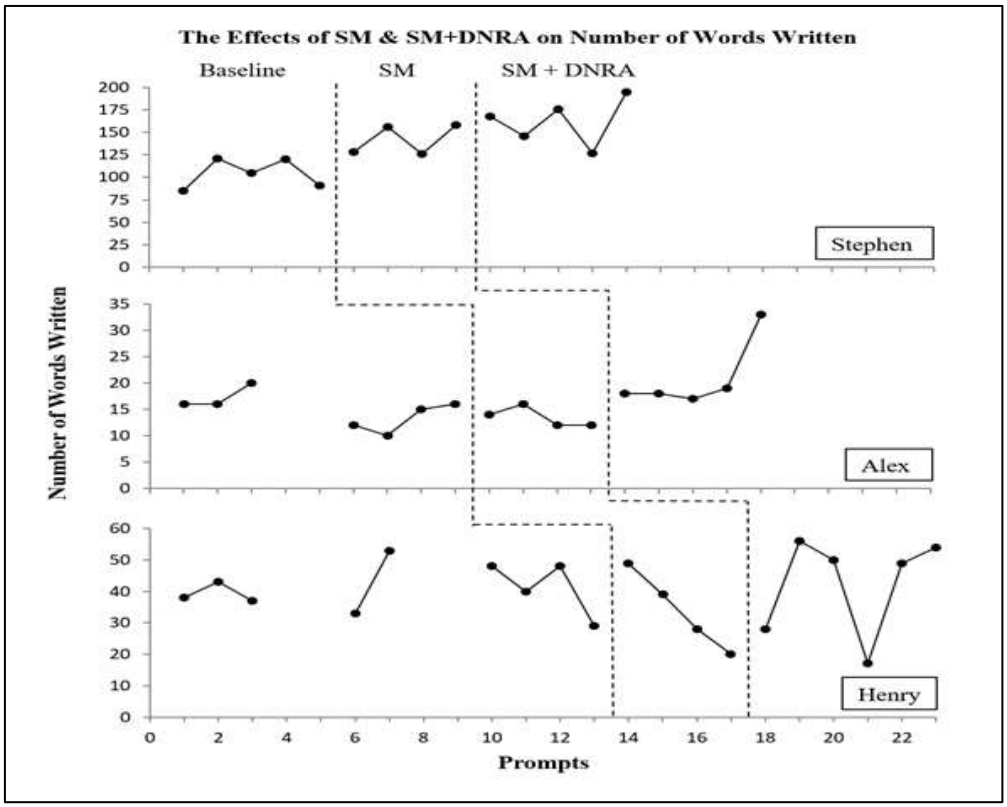
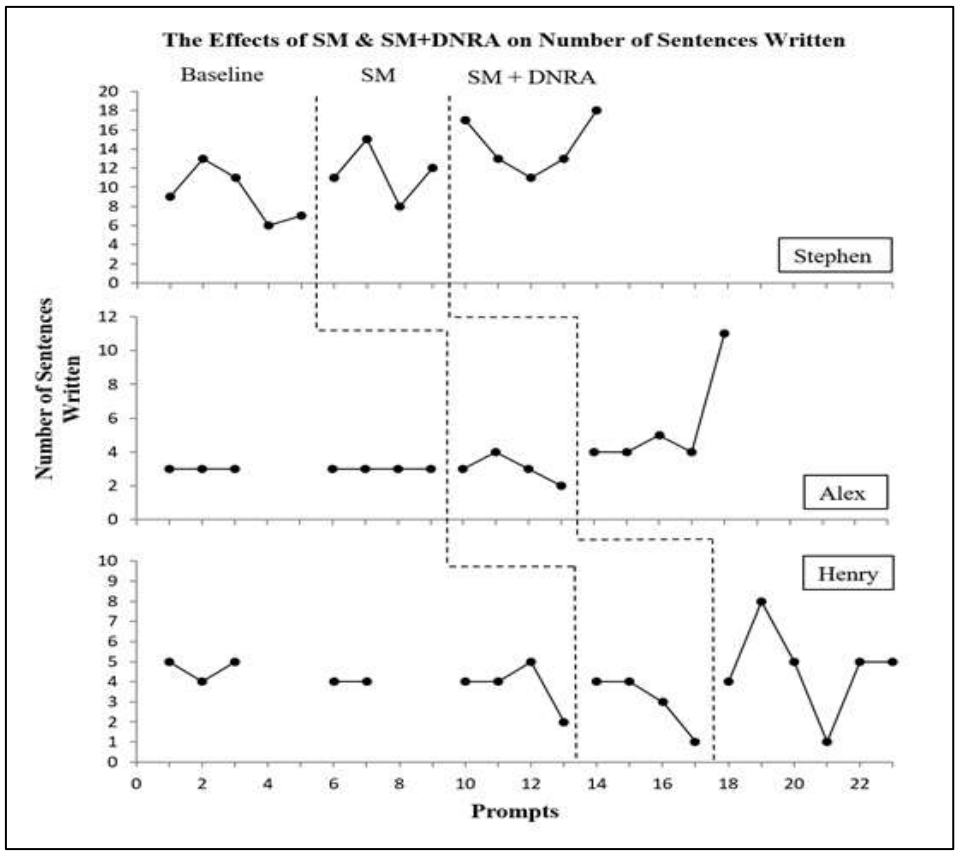


Figure-2. Multiple probe across participants graph showing effects of self-monitoring and self-monitoring plus DNRA on number of sentences written



3.1. Visual Analysis

3.1.1. Number of Words Written

Stephen's baseline was stable (mean = 104, range = 91-120, SD = 16.40). During self-monitoring, the number of words written increased with a fairly stable trend and no data overlap between baseline and this phase (mean = 142, range = 126-158, SD = 15.03). Number of words written continued to increase with a but increasing trend during self-monitoring plus DNRA phase (mean = 162, range = 127-195, SD = 23.67). However, there was more variability and two data points overlapping with the self-monitoring only condition.

Alex's baseline was relatively stable (mean = 15, range = 12-20, SD = 2.98). During self-monitoring, the number of words written decreased with a very stable slightly decreasing trend (mean = 14, range = 12-14, SD = 1.66). Number of words written increased slightly with a very stable trend until a substantially high data point during self-monitoring plus DNRA phase (mean = 21, range = 17-33, SD = 6.03). There were no overlapping data points with the self-monitoring only condition. There was a slight increase in the number of words written over the self-monitoring plus DNRA phase, but there was only one non-overlapping data point with the highest baseline data point.

Henry's baseline was relatively stable (mean = 41, range = 29-53, SD = 7.30). During self-monitoring, the number of words written initially increased from baseline and continued with a stable but decreasing trend (mean = 34, range = 20-49, SD = 10.98). Number of words written increased slightly with a relatively stable trend with a substantially low data point during self-monitoring plus DNRA phase (mean = 42, range = 17-54, SD = 14.57). There was a slight increase in the number of words written over the self-monitoring plus DNRA phase, but there were only three of six non-overlapping data points.

3.1.2. Number of Sentences Written

Stephen's baseline for number of sentences written showed more variability than for number of words written (mean = 9, range = 6-13, SD = 2.86). The trend initially ascended but then descended for three data points before leveling off. An unstable, but slightly higher trend can be seen during self-monitoring (mean = 12, range = 8-15, SD = 2.50). There were also three overlapping data points with baseline. Data during self-monitoring plus DNRA phase were unstable with an ascending trend for the first three data points and descending trend for the next two data points (mean = 14, range = 11-18, SD = 2.65). There was an increase in the number of sentences written during the self-monitoring only phase, with only two non-overlapping data points.

Alex's baseline showed a very stable trend (mean = 3, range = N/A, SD = 0.00). A relatively stable decreasing trend can be seen during self-monitoring (mean = 3, range = 2-4, SD = 0.71). There were also three overlapping data points with baseline. Data during self-monitoring plus DNRA phase showed a stable trend with a substantially high data point (mean = 6, range = 4-11, SD = 2.73). Nevertheless, there was an increase in the number of sentences written over the self-monitoring plus DNRA phase, but only two non-overlapping data points.

Henry's baseline showed a stable trend (mean = 4, range = 2-5, SD = 0.87). A relatively stable but decreasing trend can be seen during self-monitoring (mean = 3, range = 1-4, SD = 1.22). Data during self-monitoring plus DNRA phase showed a fairly stable trend with a substantially low data point (mean = 5, range = 1-8, SD = 2.05). There was a slight increase in the number of sentences written over the self-monitoring plus DNRA phase, but there were only two non-overlapping data points with the baseline phase.

3.2. Effect Size Calculations

Effect sizes were calculated to determine if there were any more nuanced differences between phase improvements. Data for most baselines were stable, but were visually characterized as mostly unstable with much trend variability during subsequent phases. Consequently, effect sizes may cast some additional light on the differential effectiveness of self-monitoring only compared to self-monitoring plus DNRA. Effect size ranges for Tau-*U* have been classified as follows: < 0.20 = small; 0.21 - 0.60 = moderate; 0.61 - 0.80 = large; > 0.80 = very large. Effect size ranges for IRD are similar: < .367 = ineffective; .368 - .478 = small to questionable; .479 - .717 = moderate; .719 - .897 = large; > .898 = very large. Table 2 contains the effect sizes, standard deviations, and ranges for all three participants across all conditions for both number of words written and number of sentences written. Effect sizes were calculated from baseline to self-monitoring phases, baseline to self-monitoring plus DNRA, and self-monitoring to self-monitoring to self-monitoring plus DNRA.

3.2.1. Number of Words Written

Effect sizes across all participants showed very different results. From baseline to self-monitoring, IRD ranged from 0.46 to 1.00, indicating that self-monitoring ranged from small to questionable effects to having a very large effect on number of words written. Tau-*U* ranged from -0.33 to 1.00, indicating there was small to very large improvement from baseline to self-monitoring. Effect sizes from baseline to self-monitoring were much larger for Stephen than for Alex and Henry. Self-monitoring effect sizes were greater for Alex than Henry for number of words written.

Although not common practice and, consequently effect sizes must be interpreted cautiously, they were calculated between baseline and self-monitoring plus DNRA even though these two phases were not adjacent. From the baseline to the self-monitoring plus DNRA phase, IRD ranged from 0.50 to 1.00, indicating that there was large to very large effects on number of words written. Effect sizes for Alex were largest for self-monitoring plus DNRA. Effect sizes showed that self-monitoring was more effective for Stephen than for Alex and Henry. Tau-*U* ranged from 0.26 to 1.00, indicating small to very large improvement. Effect sizes were largest for Stephen. Alex's effect sizes were larger than those calculated for Henry.

From the self-monitoring to the self-monitoring plus DNRA phase, IRD ranged from 0.56 to 1.00, indicating that self-monitoring ranged from moderate effects to having a very large effect on number of words written. Tau-*U* ranged from 0.42 to 1.00, indicating there was moderate to very large improvement from baseline to self-monitoring. Effect sizes from baseline to self-monitoring were much larger for Stephen than the other participants. Effect sizes showed that self-monitoring was more effective for Alex than Henry for number of words written.

3.2.2. Number of Sentences Written

Effect sizes for number of sentences written were of similar magnitude as those for number of words written. IRD ranged from 0.55 to 0.75, indicating there was moderate to large effects on number of sentences written. Effect sizes obtained for Alex were largest. Henry had larger effect sizes than Stephen for number of sentences written. Tau-*U* ranged from 0.30 to 1.00, indicating there were moderate to very large amounts of improvement, with Alex's effect sizes largest.. Stephen had larger effect sizes than Henry.

Effect sizes of self-monitoring for number of sentences written showed similar effects with IRD ranging from 0.17 to 1.00, indicating that self-monitoring was ineffective to having very large effects for increasing number of sentences. Tau-*U* ranged from 0.55 to 0.85, indicating moderate to very large improvement. Effect sizes for self-monitoring were larger for Alex than then for Stephen and Henry. There were larger effects for Alex than those calculated for Henry. However, effect sizes for Henry were larger than those obtained for Stephen. Overall, across all phases, effect sizes for Stephen were generally larger than participants two and three.

3.3. Summary of Results

Based on visual inspection, and some of the obtained effect sizes, data do not support that experimental control was established for two of the three participants. Alex's data from baseline to self-monitoring and also from baseline to self-monitoring + DNRA, except for the last data point, were very similar. Henry's data during self-monitoring showed a decreasing trend compared to baseline levels, and also between his baseline and self-monitoring + DNRA phases. Some experimental control was achieved for Stephen—especially between his baseline and self-monitoring + DNRA phases.

4. Discussion

The purpose of this study was to evaluate the effectiveness of DNRA to enhance self-monitoring for increasing writing productivity (words and sentences) for three children. Another purpose was to see if self-monitoring words also increased the number of sentences written. The main results for each participant were as follows: Stephen showed improvement during the self-monitoring only and increased performance during the self-monitoring plus

DNRA phase. The effects of self-monitoring could not be replicated across the other participants. These results are inconsistent with other research using writing and self-monitoring techniques similar to the current study (Ballard and Glynn, 1975; Goddard and Sendi, 2008; Rumsey and Ballard, 1985; Wolfe *et al.*, 2000). The other two participants showed no improvement during self-monitoring but during the self-monitoring plus DNRA phase, Alex's performance improved. The third participant's performance decreased during self-monitoring and showed no change during the self-monitoring plus DNRA condition. The results showed that the interventions were effective for Stephen, but little improvement was displayed with Alex and Henry. Results on number of sentences written were proportionally similar to those obtained from number of words written. Results for each participant will be discussed and potential variables that impacted the effectiveness of both conditions including participant performance levels prior to beginning the study, participant disabilities, and diverse emotional reactions.

4.1. Factors Contributing to the Lack of Establishing Experimental Control

4.1.1. Stephen's Performance

Stephen's performance was consistent with results of previous studies with similar self-monitoring interventions and measures (Ballard and Glynn, 1975; Goddard and Sendi, 2008; Rumsey and Ballard, 1985; Wolfe *et al.*, 2000). His number of words written increased in both the self-monitoring and self-monitoring plus DNRA phases. The two decreasing data points for number of words written during the self-monitoring plus DNRA phase may have occurred because he demonstrated a negative emotional reaction (i.e., began crying) because he could not escape the second task due to not meeting the performance criterion for the first task. A student's failure to meet a goal and experience a negative emotional reaction could negatively impact their subsequent motivation (Deci and Cascio, 1972). Specifically, researchers have found that individuals who were exposed to certain amounts of failure were less intrinsically motivated and persisted in tasks for shorter amounts of time following the failed task than those who did not experience initial failure (Deci and Cascio, 1972; McCaughan and McKinlay, 1981; Weinberg and Ragan, 1979). These negative emotions may result in a student feeling frustrated which, in turn, can negatively impact academic performance (Pekrun *et al.*, 2017).

4.1.2. Alex's Performance

Alex's results of a decrease in performance in the self-monitoring condition and a small increase in the self-monitoring plus DNRA phase do not align with previous research. Specifically, self-monitoring has been found to improve the writing productivity of children (Ballard and Glynn, 1975; Goddard and Sendi, 2008; Rumsey and Ballard, 1985; Wolfe *et al.*, 2000). Previous research with DNRA has also shown more substantial positive effects to improve performance on a variety of tasks, including one study examining the effects of DNRA on writing (Holtz and Daly, 2019). Other studies have also found DNRA to be an extremely effective intervention not only for improving writing productivity but also for decreasing disruptive and destructive behaviors (Golonka *et al.*, 2000; Marcus and Vollmer, 1995; Piazza *et al.*, 1996; Vaz *et al.*, 2011; Vollmer *et al.*, 1999).

Although Alex's results did not show large amounts of improvement, his behaviors during the self-monitoring plus DNRA phase showed that it may have been slightly motivating for him. For instance, for each prompt, Alex would count some words multiple times and would argue with the PI that he wrote more than she counted. He may have made these errors in an attempt to escape the second task. Further, his motivation to complete all writing tasks was very low. For example, his handwriting was difficult to read because each letter was sloppily written and was so large it overlapped up to eight lines of the paper on the writing prompts. Further, he ended each writing prompt early, with his longest work time being just over four minutes out of a 10-minute session. A typical writing sample would consist of such words, phrases, or sentences such as "I like it." "I love it." "I hate it." He would often write "turd" at the end of his prompt. Notably, he ended every break early, potentially because he found it more negatively reinforcing to finish both writing tasks quickly and leave rather than taking more time to complete the first task with higher productivity and escape the second task.

Short, the repetitive nature of his writing was consistent with his dual diagnosis of Autism and attention-deficit/hyperactivity disorder (Reid *et al.*, 2014). Whitby and Mancil (2009), found in their review of the literature that a majority of students with high functioning autism showed weakness in the areas of written expression and graphomotor skills. Children diagnosed with ADHD also often struggle academically in many areas, including writing (Barry *et al.*, 2002; Reid R., 2012). Research also indicates that writing may be one of the most common academic subjects that cause difficulty for children with ADHD and or a learning disability (Mayes and Calhoun, 2006;2007). Students with ADHD write less, do not include important writing elements (e.g., topic sentence), and have a lower overall quality than those without ADHD (De La Paz, 2001; Jacobson and Reid, 2010; Lienemann and Reid, 2008).

4.1.3. Henry's Performance

Both intervention conditions were ineffective for increasing writing productivity for Henry. Henry's data shows an almost perfectly linear descending trend from baseline to self-monitoring. This linear trend indicated that self-monitoring may have been unpleasant for him or he may have simply been disinterested in the task itself and the types of writing prompts he received—an assumption other researchers have concluded (Boscolo and Gelati, 2019; Bruning and Kaufmann, 2016; Sanders-Reio *et al.*, 2014; Villalón *et al.*, 2015; White and Bruning, 2005). For example, he would frequently say things like "Hopefully I can write enough, sometimes it depends on the prompt" and "50?! But that's such a big number!" and "I think all numbers are over 50, that's not even fair." Hidi and

McLaren (1991) specifically found that topic interestingness can positively or negatively impact children's writing. Consequently, and like Alex, Henry's attitude may have inhibited better writing productivity.

5. Limitations

The present study cannot be properly interpreted without including a discussion of its limitations. The first, and major, limitation was that experimental control could not be obtained. The lack of experimental control was most likely due to characteristics of the participants in leu of adequate screening procedures—a factor beyond control given certain procedures limitations ascribed by the reading clinic. Nevertheless, all three participants were at very different academic levels—some with and without disabilities that may have affected the outcome of the interventions.

Second, although results for each participant varied, the session times (i.e., 10 min) for the study posed several problems for different participants. For example, the time limit expired while Stephen was still writing. As he already wrote between 80 and 120 words prior to intervention, he then needed to write faster to increase the number of words written. Although, writing sessions were 10 minutes in length, it was not mandatory that participants wrote for the entire 10 minutes. Another limitation due to time was the range of numbers to escape the second writing task during the self-monitoring plus DNRA phase.To determine the range of numbers placed in the bag for each participant, the researcher took 50% of the highest data point from the baseline or self-monitoring phase, whichever phase had the highest data point for each participant and added that to the highest baseline or self-monitoring point. To ensure non-overlapping contingencies with baseline or self-monitoring points, the lowest number placed in the paper bag was one number more than the highest baseline or self-monitoring point. Stephen's highest self-monitoring data point was 158 words, which left the range of numbers for DNRA between 159 to 237 words. Like Stephen, Henry also wrote for the entire 10 minutes but did not generate as many words or sentences because he seemed to have struggled with idea generation. Consequently, a time period longer than 10 minutes may have reflected more accurately the number of words and sentences that he wanted to write but was unable because of the time expiring.

Third, although during the self-monitoring phase students were instructed to count the number of words written, and graphs were in direct view of each participant, the PI did not specifically draw participant attention to the graphs before writing. Therefore, they did not see progress on the graph from previous writing prompts unless they looked at them without the instruction to do so. Additionally, there was no goal-setting component during the self-monitoring phase. This omission may have altered the success of self-monitoring, as goal setting has shown to increase in self-monitoring effectiveness (Maag, 2018).

Fourth, prompt selections may have impacted the amount participants wrote. The PI re-used prompts that were not chosen from previous sessions. Although participants were given two prompt options for each probe, the re-used prompts were sometimes two initially rejected by participants the first time. This practice may be a limitation because the prompts were sometimes two options that the participants may not have any contextual knowledge of or did not find interesting. Hidi and McLaren (1991) specifically found that topic interestingness can positively or negatively impact children's writing.

6. Future Research

The present study examined the effects of self-monitoring and self-monitoring plus DNRA on writing quantity. In addition to writing quantity, using the two techniques of self-monitoring plus DNRA, future research should also focus on the quality of writing. This addition may determine whether self-monitoring plus DNRA is more effective for increasing quantity or quality..

For the present study, self-monitoring was paired with DNRA. However, there was no individual DNRA condition. Consequently, future research should examine the effects of DNRA alone on the quality and/or quantity of writing. Additionally, the order in which the interventions were given could be counterbalanced (e.g. introduce DNRA prior to self-monitoring) to determine the effectiveness of self-monitoring plus DNRA or DNRA alone prior to a self-monitoring phase. Also researchers may want to examine the impact longer sessions may have on children's performance. Future research should examine how DNRA can effect writing with longer periods of time to write. Additionally, adding more attainable ranges of number of words written for participants (less than 50% more of the highest baseline score) may be beneficial.

The topics that students write about are extremely important. If students have a topic they do not find of interest or do not know about, they may not be motivated to write (Hidi and McLaren, 1991). In the future, researchers should include more prompt options and not reuse prompts. Researchers should also survey participants and their parents to determine what topics they enjoy doing or talking about. Then each topic could be ranked ordered by participants.

Although the present study allowed participants to plan before the 10-minute probe began, future research should also add specific planning time and include direct instruction and/or feedback to increase writing productivity and quality. Interventions should be designed to meet the specific needs of each participant. Writing is a cognitively complex process, and it requires use of many strategies, including planning. Therefore, the addition of direct instruction in planning strategies may be beneficial in future research.

7. Conclusion

The purpose of the present study was to evaluate the effectiveness of using DNRA to enhance self-monitoring for increasing writing productivity using a multiple probe across three participants design. Results demonstrated that some participants responded with increases in number of words and sentences written, while others did not. This study expanded the research on self-monitoring and DNRA in writing by combining two motivational strategies, indicating that together, they may be more effective for some students than when used in isolation. Results of this study show a great potential for DRNA to be used to motivate students in the classroom for writing and other subjects. Yet, future research is still required to examine other factors such as those listed above to clarify and variables and factors that either enhance or detract from students increasing their writing production.

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