Evaluating the Effects of Timed Practice on Reading Endurance: A Comparison of One-Minute and Three-Minute Practice Conditions

THESIS

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By

Joshua Garner

Graduate Program in Education and Human Ecology

The Ohio State University

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Master's Examination Committee:

Dr. Nancy Neef

Dr. Ralph Gardner
Abstract

An important component to reading may involve maintaining performance over long periods of time, especially when degradations in performance could otherwise negatively impact the outcome. This study used a counterbalanced multiple probe design to compare the effects of two reading practices on reading endurance of six second grade regular education students. The results indicated that the frequency of words read correctly increased in level and trend when a passage was practiced for 3-min, and little when the passage was practiced for 1-min three times (although one participant experienced substantial improvement during both conditions). The analysis of probe data across successive 10-s intervals indicated that large degradations in performance sometimes occurred within several minutes of reading. In addition, larger degradations occurred across the three, 1-min practice condition from the first minute to end of the timing. The implications of this finding for endurance are discussed along with limitations and suggestions for future research.
Dedication

This master’s thesis is dedicated to Dennis L. Edinger, Ph.D. Dennis is a man whom, in my eyes, is razor sharp in operant conditioning, measurement, and Standard Celeration Charting. Dennis is a friend whose time and precision has helped shape my character in every way. Without his council and wisdom I would truly be lost at sea without a compass. At this point, I would like to acknowledge my family as well. May God bless our journey together. I love you dearly.
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Vita

June 2003 ....................................................... Logan Elm High School

2007............................................................. B.A. Psychology, The Ohio State University

2010 to present ............................................ Graduate Research Associate, Applied

Behavior Analysis and Special Education,

The Ohio State University

2013 ............................................................. Expected M.A. Applied Behavior Analysis

and Special Education, The Ohio State

University

Fields of Study

Major Field: Education and Human Ecology
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Chapter 1: Introduction

Proficiency in reading is important because children must apply reading skills in a variety of contexts. Reading proficiency is a predictor of the success for other academic content areas (Carnine & Carnine, 2004). This may be because reading is frequently required across subjects. For example, a student may encounter material on fossilization in their science textbook; have to read a story problem in math, etc. Despite the high value and utility of reading, achievement in this area by children in the United States is lacking as evidenced by scores reported in the most recent Nation’s Report Card (a nationwide assessment of reading achievement). The National Center for Educational Statistics reported that during the year 2011, 67% of over 200,000 fourth-graders tested in reading scored below proficient (NCES, 2011). This report suggests that many children are not receiving the support they need to become proficient readers by the time they enter into the fourth grade. This is especially true in high poverty urban areas where many students are at risk for reading failure (Foorman & Moats, 2004).

Although these statistics are disheartening and problematic, there is a growing body of literature that points to effective practices for teaching students to read. This research was summarized by McCardle and Chhabra (2004) and the National Reading Panel (NRP, 2000). Information regarding phonemic awareness, phonics, vocabulary, comprehension, and fluency are found within these sources. The NRP report is a useful blueprint for both practitioners and researchers because these sources describe teaching
strategies that are best practices in reading instruction in addition the aspects of reading instruction that are in need of further empirical research. Promoting fluency (reading accurately at a high rate) was identified by the NRP as a key component of reading instruction.

Despite the importance placed on reading fluency by National Reading Panel, there is not a clear consensus on the best way to define fluency. The NRP defines fluency as reading that is accurate, at a reasonable rate, and prosodic (read with expression). According to this definition, fluency is conceptualized as a crucial component for effective reading instruction. The Dynamic Indicators of Basic Early Literacy Skills (DIBELS) use oral reading fluency as a central component of assessment (Good & Kaminski, 2007). In addition, DIBELS assessments are used to predict future reading problems, providing early and accurate identification of students in need of intervention (Riedel, 2007). The primary difference between DIBELS and NRP definitions of fluency is that DIBELS excludes prosody. In addition, the DIBELS defines more specifically what a reasonable rate is by recommending benchmarks, or the number of words read per minute, that students should meet throughout the year. These criterion-referenced benchmarks are used as a guide to compare performance with a preset standard for acceptable achievement. Although there are differences in definition, the most important commonality is that fluency contains elements of frequency and accuracy.

Another way to define fluency would be as an outcome that is characterized by the presence of several products. Lindsley (1995) describes in detail the products that are facilitated by fluent performance—retention, endurance, application, performance
standards, and stability (REAPS). Retention is the extent to which frequency remains unchanged following a period of time without practice. Endurance is the extent to which a performance can sustain in frequency over longer periods of time than the behavior is typically practiced. Application is the extent to which a performance is maintained when applied to real-world settings different from the practice setting. Performance standards refer to the frequency of a performance, or aim, which produces retention, endurance, application, and stability (this might be better conceptualized not as a product of fluency but a prerequisite to fluency). Last, stability is the absence of variability when fluency is reached. If one presumes that these outcomes are produced by achieving a sufficient frequency of performance, then fluency becomes something more meaningful to educators and students rather than just fast and accurate reading. However, there is limited research regarding fluency and REAPS. In particular, there is limited research demonstrating the procedures that best facilitate each of the fluency products and how to measure the emergence of the products.

Recently, researchers have investigated the relationship between fluency-building procedures, and the components of REAPS including retention (Kubina, Amato, Schwik, & Therrien, 2008), application (Lin & Kubina, 2005), and endurance (Brady & Kubina, 2010). These studies are the first experiments to isolate and measure the products of fluency.

Repeated reading is one procedure that has been shown to reliably build oral reading fluency (Chard, Vaughn, & Tyler, 2002; Hawkins, Hale, Sheeley, & Ling, 2011; Lo, Cooke, & Starling, 2011; Malanga, 2003; Vaday & Sanders, 2008). Repeated
reading entails a student reading a grade-level passage multiple times, starting from the beginning of the passage during each read. Once a frequency goal is reached, the student reads a new passage. The number of times the passage is read varies per session, and can range from three to five times (Kostewicz, 2012). In some instances, repeated reading is accompanied by other procedures. These may include various error correction and performance feedback procedures, probing the passage for difficult words, reviewing vocabulary, or instructing the student to read as much as he or she can in one minute (Lo, et al., 2011; Malanga, 2003).

In general, research on repeated readings has investigated the procedure only in regards to increases in words read per minute. For example, Lo et al. (2011) used a multiple probe design across participants to investigate whether a repeated readings procedure would build increased performance on grade-level DIBELS Oral Reading Fluency (DORF) passages. The authors found that a repeated readings procedure did increase performances on DORF. Although these results do provide support for repeated reading as a procedure to build fluency, it is not certain if the increase in performance also led to all of the desired products of fluency (i.e., REAPS). Investigating the relationship between specific levels of reading fluency and the products of fluency may be an important direction for reading research. If the number of words a student reads per minute increases, but the student does not demonstrate the other components of REAPS, then this would not technically qualify as a fluent outcome according to the definitions laid out in the Precision Teaching literature (e.g., Lindsley, 1995; Binder, 1996).
A study by Brady and Kubina (2010) investigated fluency and the products of fluency using procedures that resembled repeated readings. They used an alternating treatments design to compare multiple shorter duration practices to a single longer duration practice to see which teaching practice best facilitated endurance. Fourth and fifth grade students with attention deficit hyperactivity disorder (ADHD) were asked to complete see-write multiplication facts. The authors compared the frequency with which students completed problems correctly following exposure to one of two practice conditions, one involving three 20-s timings, and another involving a 1-min timing. More facts were completed during the three 20-s timings, (added together), than during the one minute timings. This study represented one of the first attempts to isolate and manipulate endurance. However, assessing the total number of problems completed during practice may not be the best way to measure endurance. As Lindsley (1995) states, endurance is the sustained frequency of the skill when performed under longer periods of time. Brady and Kubina measured fluency only in the 1 min and 20 s timings, and not over longer timings; thus endurance was never truly assessed.

A study by Sroka (1990) illustrates an additional problem with the design and measurement system used by Brady and Kubina (2010). Sroka investigated the extent to which multiple shorter intervals could be added together to predict performance during a longer interval of time, as when adding three 20-s timings to compare to a 1-min timing. Sroka compared rates of reading by second to sixth grade students using either shorter (30- s) or longer (1-min) intervals. When the first 30 s of a 1-min timing was compared to a 30-s timing, rates of reading were approximately identical. However, when the second
half of a 1-min timing was compared to a 30-s timing, there was a reliable difference, with students performing better on the 30-s timing than they did on the second half of the 1-min timing. When two independent 30-s timings were added together, and compared to a 1-min timing, the shorter intervals inflated frequencies by a factor of 1.1 to 1.3. Often in education, children are categorized into reading groups that receive specific types of instruction based on the number of words read per minute (following the benchmarks set by DIBELS, for example). If the placement and instructional method are based on an inflated rate (as can be produced by a timing that is too short), then it can potentially jeopardize the student’s learning. A student may be placed at the wrong instructional level, or teachers may fail to recognize that he or she is in need of additional support.

Thus, it appears to be problematic to combine multiple, shorter intervals for comparison with a single longer time interval, as was done by Brady and Kubina (2010). The poorer performance under the longer timing described in that study may have been an artifact of the method by which frequency was being measured, rather than the practice procedure being used per se. Additionally, if endurance is the ability to maintain performance over time, then recording and measurement procedures need to be sensitive to degradations of performance over time (e.g., within a given practice interval).

Deeney (2010) described some potential problems posed by fluency assessments that rely on 1-min timings. She examined the reading performance of second and third graders who attended an after school literacy support program. She compared the number of words read correctly when students were asked to read for 1-min versus when asked to read the whole passage. The results indicated that when assessed during a 1-min timing
all eight participants met benchmark, referring to the recommended words read correctly per minute goal on curriculum-based measures. Yet when given a longer time to perform, all students experienced some degradation in both frequency and accuracy. During the longer reading four of the participants fell below benchmark. This indicates a serious limitation of assessments that look only at reading fluency during a one minute window. It also indicates a need to measure degradations in performance. A measurement system that is sensitive to degradations in frequency could be a useful tool for assessing endurance.

Although Deeney (2010) acknowledged the reliability of 1-min assessments for predicting future reading problems, 1-min timings do not help the teacher determine the extent to which reading frequency remains consistent within the assessment period or beyond. One minute is a relatively short duration of reading compared to what students are typically asked to do in the classroom. In many cases, students must read a fixed amount of printed text from beginning to end, which may take several minutes or longer depending on the length of the passage. If teachers are concerned with student performance as it applies to in-class experiences, then a one minute assessment may not be a representative indicator of reading performance.

In summary, endurance has not been investigated within the context of reading. Additionally, research on endurance has not included procedures that involve practice or measurement intervals longer than a minute. Research that utilizes longer duration practice trials may be more representative of the duration of reading students engage in. Furthermore, the research on endurance has not investigated how the timed practice
affects performance on a time interval longer than the practice interval. This procedure is important because comparing total math facts completed during relatively short practice periods, as done by Brady and Kubina (2010) will not necessarily indicate how a student will do when performing for longer durations. Last, studies have not utilized a measurement system sensitive enough to evaluate degradations of performance. This type of measurement system would be advantageous to the study of endurance because knowing how long a performance can last before it decays and to what extent the performance decays would be critical information for programming instruction for endurance.
Purpose of the Study

The purpose of this study was to investigate which procedure, reading for 3-min or three 1-min timings, would best facilitate endurance. A counterbalanced multiple probe design was used to evaluate which of these two practice conditions facilitated greater rates of reading during a longer (5-min) probe. The probes were analyzed by assessing the frequency at which a student was reading during every successive 10-s interval, to evaluate changes in rate over time.

Research Questions

- Which method of reading practice, three 1-min timings or one 3-min timing, better maintains a level of performance (rate of reading words) over time?
- When a student is given a passage to read, how will the frequency at which he or she reads the passage change across 10-s intervals of a 5-min timing?
Chapter 2: Method

Participants and Setting

The participants were four female and two male second-grade general education students enrolled in an urban elementary school. The students’ ages ranged from 7 to 8 years. Each participant had an established repertoire of phonemic awareness and alphabetic principles. During the initial probe, the participants were given a paper that contained grade-level DIBELS passages. Five participants were able to read the passages with 95% accuracy. One participant, Ray, read the passages with 90% accuracy. Ray’s accuracy quickly improved after repeated exposure to the reading passage and error correction procedure.

The recruitment process involved obtaining consent to conduct research from the principal of the school. After consent was given the experimenter identified the teachers in the school who taught second grade. The experimenter handed out consent forms to each student (see Appendix A). If a student brought back a consent form signed by his or her legal guardian, then he or she was eligible for participation in the study. Before the experiment began, verbal assent was received from the student by following a script (see Appendix B).

The daily sessions were conducted in two different locations within the elementary school. The majority of sessions took place in a small multi-purpose room containing a circular table fitted with several wood chairs. Filing cabinets lined the walls
adjacent to the windows. Participants sat at the circular table in the center of the room. Some sessions took place in the school’s computer lab. The perimeter of this room was lined with tables and computers with several empty tables and chairs in the center of the room, where the students sat during these sessions.

Each session lasted from 8 to 10 min. Sessions were conducted five days a week during regular school hours. Fewer sessions were conducted during some weeks, however, because of absences, special school events, spring break, and other circumstances. The study was conducted over the course of 10 to 14 weeks.

Materials

The materials included a laptop computer (used for audio recording each session), digital timers, pens and pencils, and two 8.5 in x 11 in printed documents containing the reading passages. Reading passages A and B were documents containing several second-grade stories taken from the DIBELS Oral Reading Fluency (Good & Kaminski, 2007). The stories from the DIBELS Oral Reading Fluency were selected because they were relatively consistent in story length and vocabulary. The stories for each passage were typed in Times New Roman 11 point font, with 1.5 in paragraph spacing, and 1 in margins. Passage A contained a total of 1219 words over two sheets of paper (see Appendix C). Passage B contained 1206 words over two sheets of paper (see Appendix D). There were no indentions or additional spacing for new paragraphs in either passage. Once a story was complete, the next story began with a new sentence on the same line.
**Dependent Variables**

There were two dependent variables measured in this experiment: the overall frequency (cycles per minute) of words read correctly during a 5-min timing (probe) and the number of words read correctly within each successive 10-s interval during the 5-min probes.

**Data Collection**

Each session was recorded using a built-in audio recording function on a laptop computer. The audio recording was done using a Microsoft media application that saved the audio as Windows media files. The recordings were used to calculate the number of words read correctly, inter-observer agreement, and treatment integrity. Once recorded, the audio files were played using Audacity 2.0.0 (a free audio editing program). This allowed the experimenter to precisely pinpoint times during playback, within hundredths of a second. The audio files for the probes were augmented so that the computer displayed lines of demarcation across the 5-min timing indicating each 10-s interval.

**Interobserver Agreement**

A second observer scored 30% of the probes across both phases and all participants. The probes were separated into successive 10-s intervals using the computer program mentioned. Agreement on the total number of words read correctly was calculated for each 10-s interval by dividing the smaller total by the larger total. Then the average agreement per interval was calculated, which was 95% for Buttercup, 96% for Cody, 94% for Ray, 95% for Rose, 98% for Shadow, and 96% for Tiffany.
**Independent Variable**

Prior to each session, a script was read to the participant. The script is as follows: “You are going to be given a sheet of paper. On this paper are several stories. Read the stories aloud for ____ amount of time [1 min three times, 3 min, or 5 min]. Do not stop reading. If you get lost or stuck trying to read a word that you do not know then I will briefly provide help to redirect you to read.” The purpose of the script was to avoid influencing the reader by suggesting that he or she read in a certain way (read fast, or do your best) and was used to avoid accidental differences in the way instructions were given.

Two different practice conditions constituted the independent variables. In one practice condition students read the passage for one 3-min interval. In the other practice condition students read the passage for 1-min three times, each time starting from the beginning of the passage.

Throughout the study participants selected an incentive for their participation. The selection was made after the session ended. Participants could choose one item from a variety of stickers, water-based tattoos, and pencils.

**1x3-min timing.** During this condition the participants practiced reading the passage for 3 min. After the script was read and the participant was given a passage, a timer was set for 3 min and the student was cued to begin reading. Once the student began to read the experimenter started the digital timer, which beeped when the interval expired. Following the timing, an error correction procedure was implemented for any words that had been read incorrectly. Although other types of errors may have occurred
(e.g., inserting words, skipping words, or skipping lines of the passage) the error correction procedures were not applied to these types of errors. At the end of each practice timing in which a word had been read incorrectly, the experimenter told the participant that one or more errors had been made while reading and that they would now review those errors. A timer was set for 1-min. Regardless of the number of errors that occurred, the procedure ended after exactly 1-min. During the procedure, the experimenter pointed to the word that was read incorrectly, said the word, and asked the student to read the word in isolation and in the sentence. This procedure applied to each word read incorrectly in isolation starting with the first error made. If each error was reviewed using the correction procedures before 1-min had expired, then the procedure was repeated.

**3x1-min timings.** During this condition the participants practiced reading the passage for one minute three separate times. After the script was read and the participant was given a passage, a timer was set for 1 min and the student was cued to begin reading. When the timer beeped, the student was asked to stop reading. After the initial and second timings, the student was instructed to read the passage again from the beginning. A pause of 10 s or more occurred between each repeated read. At times, the inter-timing pause occurred up to 1 min. However, the delay between each reading was not controlled to a precise and consistent duration. After the completion of the third timing an error correction procedure was implemented if any errors had occurred. The errors were corrected in the order in which they occurred. An error made during the first read was
corrected before errors made during the next two reads. The same correction procedures were followed as in the 1x3 condition.

**Probe**

The probe was a 5-min timing administered after an average of every 3 practice sessions. The probes and practice sessions occurred on separate days. During a probe the participant was given the same passage that he or she had been practicing. The timer was set and the participant was cued to begin reading. No error correction procedure was used after the probe, regardless of whether or not any errors occurred.

**Experimental Design**

This experiment utilized a counterbalanced multiple probe design. Typically, in a multiple probe design, behavior is probed intermittently throughout the baseline phase of an experiment. The probes provide the basis for determining whether behavior has changed or remained stable prior to the intervention (Cooper, Heron, & Heward, 2007). The probes are an alternative to continuously monitoring a behavior. An advantage of the discontinuous probe schedule in the present study was the attenuation of potential practice effects. By limiting the participants’ exposure to the 5-min timings, it was hoped their impact on performance would be minimized.

All participants were given an initial 5-min timing, or probe. Then, the students were assigned to an initial practice condition of either the 3x1 min or the 1x3 min timings. Three students were assigned to each condition. Students were assigned based on baseline rates of reading, to ensure a relatively even distribution of students with high and
low reading skills across the two groups. Participants were assigned at random to receive passage A or passage B, which was then used for that student throughout the experiment.

Each participant contacted both conditions of the experiment in a counterbalanced format. Participants who started with the 1x3-min practice condition were subsequently exposed to the 3x1-min practice (1x3 to 3x1 group), and participants who started with the 3x1 min practice condition were subsequently exposed to the 1x3 min condition (3x1 to 1x3 group). The change from one experimental condition to the next was staggered across participants. This was done to demonstrate experimental control by showing that a change in behavior occurred only after the change in experimental conditions. However, the design was constructed a priori; the experimenter was not certain which procedure would facilitate endurance the best.

The first participant in the first tier of the multiple probe experienced three probes in the first condition and five probes in the second condition. The participant in the second tier experienced four probes in the first condition and four probes in the second condition. The participant in the last tier experienced five probes in the first condition and three probes during the second condition.

**Treatment Integrity**

Treatment integrity was assessed on 30% of the practice sessions. The audio recordings were scored using a checklist (see Appendix E). The session was conducted with integrity if the appropriate practice condition was applied, the appropriate reading passage was given, and the error correction procedure was implemented when appropriate, as described in the procedures above. If all of these items were met during a
session, then integrity was 100%. However, if any one of the items was missing, then integrity was scored as 0%. This method was selected to ensure a conservative estimate of treatment integrity. Eighty-two percent of the sessions assessed were conducted with 100% integrity. No more than one disagreement occurred during each of the remaining sessions, and consisted of not implementing the error correction procedure when an error occurred.

Social Validity

Social validity was assessed in two ways. First, an oral questionnaire was given to the participants to determine consumer satisfaction with the procedures. Then a normative sample of reading endurance was obtained to address social validity of goals and outcomes.

The experimenter gave the participants an oral questionnaire at the conclusion of the study. The questionnaire assessed consumer satisfaction with the procedures. The questions pertained to the duration of reading the participants most preferred, and if the practice they experienced during this study helped them become better readers. Their answers to the questions were transcribed by the experimenter. Appendix F contains an example of the data sheet used for social validity. Five participants preferred reading for 3-min and one participant preferred reading for 1-min three times. Five participants indicated that they preferred longer duration reading and one participant preferred reading for shorter durations. All six participants indicated that they felt like better readers after participating in the study and that they could read for longer periods of time.
One method for assessing the social validity of outcomes and goals includes comparing participants’ performance to the performance of a normative sample (Cooper, Heron, & Heward, 2007). Performance obtained from a normative sample can serve as a standard to evaluate the outcome of an intervention (Van Houten, 1979). A normative sample was retroactively obtained after the investigation. Three second-grade female students participated. The participants were identified by their teacher as students who had no deficits in phonemic awareness or alphabetic principles and who could read the passages without struggling. The same script explaining the procedures was read to each participant. The student was asked to begin reading, using the same passage read by the study participants. Then each student read the passage for 5 min.
Chapter 3: Results

**Across Probes Analysis**

In both Figures 1 and 2 the passage that the participants read during the experiment is labeled next to their name. Along the y-axis are the correct words per minute (CWPM) read by the participants. Across the x-axis are the probes administered throughout the investigation.

**1x3 to 3x1 Group.** The results for Buttercup, Tiffany, and Ray are displayed in Figure 1. During the 1x3 condition CWPM increased for Buttercup ($M = 98$; range, 72 to 112), Tiffany ($M = 170$; range, 136 to 196), and Ray ($M = 78$; range, 59 to 90). When the 3x1 condition was introduced, the CWPM remained relatively stable for Buttercup ($M = 116$; range, 107 to 123), but increased slightly for Tiffany ($M = 198$; range, 191 to 209), and Ray ($M = 82$; range, 75 to 90).
Figure 1. The CWPM on each probe for Buttercup, Tiffany, and Ray.
**3x1 to 1x3 Group.** The results for Rose, Shadow, and Cody are displayed in Figure 2. During the 3x1 condition CWPM increased steadily for Rose ($M = 100$; range, 79 to 120), but was fairly stable for Shadow ($M = 110$; range, 100 to 126) and Cody ($M = 99$; range, 91 to 113). When the 1x3 practice condition was introduced CWPM increased for Rose ($M = 158$; range, 132 to 192), Shadow ($M = 150$; range 137 to 163), and Cody ($M = 144$; range, 134 to 150).
Figure 2. The CWPM on each probe for Rose, Shadow, and Cody.
**Standard Celeration Charts**

The Standard Celeration Chart (SCC) is based on standard units of time, which can be expressed as successive calendar days, weeks, months or years. Additionally, each SCC has a six-cycle, base 10, logarithmic scale along the y-axis (Pennypacker, Gutierrez, & Lindsley, 2003). The chart utilized for analysis in this study was a Microsoft Excel approximation of the Daily per minute Chart™ (Dpmin-12EC) developed by Scott Born and Stu Harder. This Excel version allows multiple frequencies from a given day to be stacked.

Displayed on each SCC are the counting time floors represented by an underscore and the CWPM which is represented by a black dot. During the 3x1 condition there are stacked dots. The three 1-min timings are represented by a 1-min counting time floor and three dots above; two frequencies are grey, and one frequency is black. The black frequency corresponds to the median CWPM obtained during the session and the two grey frequencies correspond to the upper and lower CWPM obtained during the same session.

The acceleration of the probes during both conditions was calculated for each participant. The formula for calculating acceleration is cycles per time unit per time unit (Johnston & Pennypacker, 1980). In this case, acceleration pertains to the words read correctly per minute per week. Calculating the acceleration of the probes was selected to discover if the practice conditions facilitated change in the longer timings.

Lindsley (1995) stated that endurance is maintaining a performance frequency over a time period longer than the behavior is typically practiced. This definition pertains
to the amount of variability imposed when the behavior is performed for longer durations. Therefore, the bounce (variability) was calculated for each participant across both conditions. Calculating bounce shows the drop, or lack of drop, from the CWPM performed during practice to the CWPM performed during the probe.

**Buttercup.** The results of Buttercup are displayed in Appendix H. During the 1x3 condition the acceleration of the probes was 1.16 cycles/min/week and the bounce of the practice and probe performances was x1.39. During the 3x1 condition the acceleration of the probes was 1.01 cycles/min/week and the bounce of the practice and probe performances was x1.95.

**Tiffany.** The results of Tiffany are displayed in Appendix I. During the 1x3 condition the acceleration of the probes was 1.07 cycles/min/week and the bounce of the practice and probe performances was x1.39. During the 3x1 condition the acceleration of the probes was 1.02 cycles/min/week and the bounce of the practice and probe performances was x2.03.

**Ray.** The results of Ray are displayed in Appendix J. During the 1x3 condition the acceleration of the probes was 1.08 cycles/min/week and the bounce of the practice and probe performances was x1.65. During the 3x1 condition the acceleration of the probes was 1.09 cycles/min/week and the bounce of the practice and probe performances was x2.31.

**Rose.** The results of Rose are displayed in Appendix K. During the 3x1 condition the acceleration of the probes was 1.15 cycles/min/week and the bounce of the practice and probe performances was x2.02. During the 1x3 condition the acceleration of the
probes was 1.05 cycles/min/week and the bounce of the practice and probe performances was x1.40.

**Shadow.** The results of Shadow are displayed in Appendix L. During the 3x1 condition the acceleration of the probes was 1.05 cycles/min/week and the bounce of the practice and probe performances was x2.10. During the 1x3 condition the acceleration of the probes was 1.02 cycles/min/week and the bounce of the practice and probe performances was x1.41.

**Cody.** The results of Cody are displayed in Appendix M. During the 3x1 condition the acceleration of the probes was 1.02 cycles/min/week and the bounce of the practice and probe performances was x2.51. During the 1x3 condition the acceleration of the probes was 1.05 cycles/min/week and the bounce of the practice and probe performances was x1.35.

**Analysis of Successive 10-s Intervals**

The probes were analyzed to evaluate the extent to which performance decreased over time. Each probe was evaluated using successive 10-s intervals and was measured in two ways. The two measures are described below.

The first measurement method, labeled continuous, was calculated by dividing the cumulative number of words read correctly by the total time. For example, if Cody read 25 words within the first 10-s interval, then read 15 more words during the next 10-s interval, then 25 would be divided by 0.166 min (10 s) and 40 (25 + 15) would be divided by 0.333 min (20 s) to yield frequencies of 150 CWPM and 120 CWPM for the 10 s and 20 s intervals, respectively. If 17 more words were read after the next 10-s interval, then
57 (40 + 17) would be divided by 0.5 min (30 s) for a frequency of 114 CWPM. This calculation procedure was carried out through the 5-min timing, thereby providing a continuous sample of frequency.

With the second measurement method, labeled per interval, frequency was calculated independently for each 10-s interval. For example, if Cody read 25 words within the first 10-s interval and read 15 words during the second 10-s interval, then 25 would be divided by 0.166 min (150 CWPM) and 15 would also be divided by 0.166 min (90 CWPM). This method shows the moment to moment variability across the probe, as well as changes in frequency from the start of the timing to the end. Both continuous and per interval measures are labeled on Figures 3 through 10.

Cody’s performance was selected as representative of the outcomes found across participants. Each graph displays the CWPM along the ordinate and successive 10-s intervals along the abscissa.

**Probe One.** Cody’s performance during probe one was quite stable. For the continuous measure the CWPM decreased slightly and then stabilized for the remainder of the interval ($M = 100$; range, 91 to 145). For the per interval measure, apart from a drop in frequency during the fifth interval, the CWPM was stable ($M = 80$; range, 35 to 145). The results for probe 1 are shown in Figure 3.
Probe Two. After initial contact with the 3x1-min practice condition, Cody’s performance based on the continuous measure was noticeably different. The level of performance within the first minute increased compared to probe 1. However, CWPM decreased more substantially across the first two minutes before reaching an asymptote ($M = 130$; range, 100 to 201). Cody’s performance based on the per interval measure varied from moment to moment ($M = 100$; range; 6 to 204). The results for probe 2 are shown in Figure 4.
Probes Three through Five. After continuous contact with the 3x1-min practice condition, a clear pattern emerged within each probe. Cody’s performance within the first 10-s was high; he read over 300 CWPM. Within the first minute, however, his performance decreased by 100 CWPM. This pattern may have emerged due to a practice effect. Exposure to the same passage repeatedly could account for the high frequency within the first minute. For the continuous measure the mean CWPM was 130 on probe 3 (range, 96 to 343), 150 on probe 4 (range, 113 to 307), and 120 on probe 5 (range, 96 to 343). For the per interval measure the mean CWPM was 115 on probe 3 (range, 24 to 343), 120 on probe 4 (range, 36 to 307), and 100 on probe 5 (range, 36 to 343). The results of probes 3 through 5 are displayed in Figures 5 through 7.
Figure 5. The CWPM on probe 3 during the 3x1 practice condition for Cody using continuous and per interval measures.

Figure 6. The CWPM on probe 4 during the 3x1 practice condition for Cody using continuous and per interval measures.
Probes Six through Eight. During probes 6 through 8 Cody switched to the 1x3 practice condition. The CWPM decreased over time in probes 6 through 8, however, the slopes are not as steep compared to the slopes in Figure 7. For the continuous measure the mean CWPM was 180 on probe 6 (range, 134 to 321), 190 on probe 7 (range, 148 to 307), and 200 on probe 8 (range, 150 to 301). For the per interval measure the mean CWPM was 150 for probe 6 (range, 66 to 337), 160 on probe 7 (range, 66 to 307), and 170 on probe 8 (range, 72 to 301). The results of probes 6 through 8 are displayed in Figures 8 through 10, respectively.
Figure 8. The CWPM on probe 6 during the 1x3 practice condition for Cody using continuous and per interval measures.

Figure 9. The CWPM on probe 7 during the 1x3 practice condition for Cody using continuous and per interval measures
Figure 10. The CWPM on probe 8 during the 1x3 practice condition for Cody using continuous and per interval measures.

Performance Degradation

Tables 1 through 6 summarize each participant’s performance on each probe. The main body of data corresponds to the CWPM at each minute throughout a 5-min timing. For example, in Table 1 Buttercup’s CWPM during the first probe after reading for 1 min was 89 CWPM. The CWPM on the first probe after 2 min was 85 (170 correct words read divided by 2 min). This continues up to the 5 min row, which indicates the frequency for the entire 5-min timing.

**Buttercup.** The CWPM at each minute of a 5-min timing across probes for Buttercup are shown in Table 1. Although, CWPM decreased during both practice conditions, these data indicate that a greater change in frequency (represented as Δf on
each table) occurred during the 3x1 practice condition ($M = 1.41$; range, 1.27 to 1.53) compared to the 1x3 condition ($M = 1.27$; range, 1.24 to 1.30).

Table 1. The CWPM for Buttercup at Each Minute During Each Probe

<table>
<thead>
<tr>
<th>Minutes</th>
<th>1x3</th>
<th>3x1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 min</td>
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<td>2 min</td>
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<td>76</td>
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<tr>
<td>5 min</td>
<td>72</td>
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</tr>
<tr>
<td>Δf **</td>
<td>1.24</td>
<td>1.37</td>
</tr>
</tbody>
</table>

*Note: This probe occurred prior to any exposure to the experimental condition
** Note: Δf refers to the change in frequency, calculated by dividing the CWPM read after 1-min by the CWPM read after 5-min

**Tiffany.** The CWPM at each minute of a 5-min timing across probes for Tiffany are shown in Table 2. These data indicate that a greater change in frequency occurred during the 3x1 practice condition ($M = 1.27$; range, 1.24 to 1.31) compared to the 1x3 condition ($M = 1.14$; range, 1.10 to 1.18). Probe three was excluded from the analysis because the change in frequency was an increase.
Table 2. The CWPM for Tiffany at Each Minute During Each Probe

<table>
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</tr>
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<td>1.01</td>
<td>1.16</td>
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<td></td>
</tr>
</tbody>
</table>

*Note: This probe occurred prior to any exposure to the experimental condition
** Note: Δf refers to the change in frequency, calculated by dividing the CWPM read after 1-min by the CWPM read after 5-min

** Ray.** The CWPM at each minute of a 5-min timing across probes for Ray are shown in Table 3. These data indicate that a greater change in frequency occurred during the 3x1 practice condition ($M = 1.82$; range, 1.44 to 2.13) compared to the 1x3 condition ($M = 1.48$; range, 1.10 to 1.86).
Table 3. The CWPM for Ray at Each Minute During Each Probe

<table>
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<th>Probes</th>
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<tbody>
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<td></td>
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<td>1.86</td>
<td>2.13</td>
<td>1.44</td>
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</tr>
</tbody>
</table>

*Note: This probe occurred prior to any exposure to the experimental condition
** Note: Δf refers to the change in frequency, calculated by dividing the CWPM read after 1-min by the CWPM read after 5-min

**Rose.** The CWPM at each minute of a 5-min timing across probes for Rose are shown in Table 4. A different pattern emerged with exposure to the 3x1 to 1x3. During the 3x1 condition the change in frequency increased from probe one to probe three ($M = 1.32$; range, 1.03 to 1.56). In the 1x3 condition the change in frequency decreased from probe four to eight ($M = 1.40$; range, 1.14 to 1.60).
Table 4. The CWPM for Rose at Each Minute During Each Probe

<table>
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<td>Δf **</td>
<td>1.03</td>
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</tr>
</tbody>
</table>

*Note: This probe occurred prior to any exposure to the experimental condition
** Note: Δf refers to the change in frequency, calculated by dividing the CWPM read after 1-min by the CWPM read after 5-min

Shadow. The CWPM at each minute of a 5-min timing across probes for Shadow are shown in Table 5. The change in frequency for Shadow is similar to that found with Rose. During the 3x1 condition the change in frequency increased across probes one through four (M = 1.39; range, 1.14 to 1.54). In the 1x3 condition the change in frequency decreased across probes four through eight (M = 1.37; range, 1.28 to 1.54).
Table 5. The CWPM for Shadow at Each Minute During Each Probe

<table>
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</tr>
<tr>
<td>2 min</td>
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<td>Δf**</td>
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<td>1.54</td>
</tr>
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</table>

*Note: This probe occurred prior to any exposure to the experimental condition
** Note: Δf refers to the change in frequency, calculated by dividing the CWPM read after 1-min by the CWPM read after 5-min

**Cody.** The CWPM at each minute of a 5-min timing across probes for Cody are shown in Table 6. During the 3x1 condition the change in frequency increased on probes one through five (M = 1.61; range, 1.08 to 1.92). In the 1x3 condition the change in frequency decreased on probes six through eight (M = 1.68; range, 1.57 to 1.73).
Table 6. The CWPM for Cody at Each Minute During Each Probe

<table>
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<td>1.71</td>
<td>1.78</td>
<td>1.73</td>
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</table>

*Note: This probe occurred prior to any exposure to the experimental condition
** Note: Δf refers to the change in frequency, calculated by dividing the CWPM read after 1-min by the CWPM read after 5-min

Social Validity of Goals

Table 7 displays the CWPM of the study participants and the CWPM of the normative sample. The CWPM for all six study participants was higher during the first minute compared to the last minute ($M = 1.13$; range, 1.03 to 1.24). Likewise, the CWPM for the normative sample was higher during the first minute compared to the last minute ($M = 1.11$; range, 1.04 to 1.17).
Table 7. The CWPM of the Study Participants’ Initial Probes and the CWPM of the Normative Sample.

<table>
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<th>Minutes</th>
<th>Study Participants</th>
<th></th>
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</tr>
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<td></td>
<td>1.17</td>
<td>1.13</td>
<td>1.04</td>
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</table>

* Note: Δf refers to the change in frequency, calculated by dividing the CWPM read after 1-min by the CWPM read after 5-min
Chapter 4: Discussion

This study investigated two practice conditions, a 3-min timing and three, 1-min timings, to determine which practice best facilitated reading endurance with 6 second-grade students. Five participants had larger gains in performance during the 1x3 condition. In addition, greater decrements in frequency throughout the 5-min timing occurred during the 3x1 condition. The findings suggest that longer duration practice facilitates endurance better than multiple shorter timings. Longer practice may be a more efficient way of using the same amount of time. The total reading time was the same in the 1x3 and 3x1 conditions. However, the 1x3 condition exposed the student to more material, instead of the same material repeatedly.

The analysis of performance within probes showed a higher level of performance during the first minute of a 5-min timing for all participants. However, degradations in CWPM occurred thereafter. These data are consistent with those reported by Deeney (2010) who found that decreases in frequency occurred when students were asked to read a whole passage compared to a 1-min timing. Given the widespread use of 1-min assessments this could be problematic.

The problem with 1-min assessments is the assumption that performance will remain stable over time, which does not address the decrease in performance that occurs within time (e.g. the decrease of CWPM within a 1-min interval). To illustrate the point further, consider test-retest reliability, which can be defined as the administration of the
same test under two occasions to the same individual (Sapp, 2002). The two scores are then correlated to produce a reliability coefficient for stability. The range of test-retest reliability on the DIBELS is .92 to .97 (Good & Kaminski, 2002). This reliability score means that students CWPM obtained on the DIBELS from time one were very similar to those at time two. Test-retest reliability is only an appropriate measure when evaluating phenomena that remain relatively stable over time (Cohen, Swerdlik, & Sturman, 2013). Assessments of 1-min fail to address the unsustainability in performance, especially given the decreases in CWPM that occur over time. In the current study, during probes three through eight, Ray’s reading frequency after 1-min was above benchmark as established by the DIBELS (Good & Kaminski, 2002). In comparison, his reading frequency by the end of the 5-min timing would indicate that he was at some risk for encountering problems on subsequent reading goals. Ray’s performance after 1-min of reading scored on an assessment could be interpreted as a true positive (i.e. a positive test result that accurately reflects his reading skills). By the end of the probe, his performance decayed by as much as 85 CWPM. In Ray’s case it is uncertain if a 1-min timing was the best indicator of performance, especially considering that his performance moved across DIBELS descriptors. (The descriptors include at risk, some risk, and low risk and are ranked based on a frequency range of CWPM.)

Therefore, assessments of oral reading fluency may not provide reliable results that hold true beyond 1 min. The unsustainability of CWPM after a minute of reading is important for educators to consider, especially if reading for periods longer than a minute is a typical component of instruction as well as a common expectation of the class.
Nonetheless, longer timings may not be appropriate for all readers. Durations of a minute could constitute sufficient practice for early readers and for readers who are in need of more intensive instruction. However, in order to continuously build performance as the student becomes more skilled, the practice time should be systematically increased.

**Social Validity of Goals and Outcomes**

**Goals.** Obtaining a normative sample is important for determining the optimal range within which behavior is most adaptive (Van Houten, 1979). The data obtained from the normative sample can serve as a standard to determine the success of interventions targeting reading endurance with readers who are at risk for reading failure. Given the decrease in performance that occurs in reading, the standard for reading endurance may be best determined by the change in frequency. The decrements in frequency within the 5 min reading period with normative sample participants ranged from 1.04 to 1.17. A decrement in frequency greater than this range may indicate poor reading endurance.

**Outcomes.** The post-intervention CWPM for the study participants were higher in both conditions compared to the data from the normative sample, indicating that the intervention was successful. Even though greater decreases occurred between the practice performance and probes during the 3x1 condition, the endurance acquired from exposure to both practice conditions benefitted the readers. The benefit obtained was efficiency. For example, before endurance training an individual could complete a task (e.g., read a chapter) within 30 min. After endurance training the individual could complete the same task or similar tasks within 20 min. The decrease in time is directly related to the
performance occurring at a higher frequency and maintaining at a higher frequency across time. In education, efficiency is advantageous. If the same, or even greater, amount of work is completed within a fraction of the time, then more time is available for additional practice within the classroom.

**Limitations**

This study did not clearly demonstrate a functional relationship between the independent variables and changes in the dependent variable. Reliable patterns of performance within both conditions were demonstrated across participants. However, this alone does not establish a functional relationship. Each participant experienced the practice conditions once. Exposing the participants to another experimental condition, for example a reversal (e.g., 1x3, 3x1, 1x3), would have reproduced the patterns of responding, thus providing a more convincing demonstration of control.

The fact that Rose’s data showed an increasing trend in CWPM across both conditions was problematic with respect to demonstrating a clear effect of the intervention. Contact with the practice and error correction could account for the increased performance throughout both conditions. This is best conceptualized as a practice effect, and could account for the accelerated reading performance for each participant.

The objective of this investigation was to see how practice facilitates endurance, therefore some practice effects were intentional (e.g., practice effects from exposure to the treatment conditions). The limitation stems from the same passage used repeatedly during both practice conditions and during the probes. In the 3x1 condition the practice
effect may have been more pronounced because participants read the same passage repeatedly. This may have been why students in the 3x1 condition read faster during the first minute of the probes.

The practice effect could be eliminated if each probe utilized a different reading passage. If the passages are from the same source then there is no reason to assume that each passage differs greatly in length and difficulty. This may also be a more natural way of investigating reading because students are unlikely to read a passage over and over again. Also, using different passages may increase generality, especially if the effects are shown across multiple passages.

Because the first probe was administered prior to the student’s exposure to the intervention, there would be only two data points in the first condition for Buttercup and Rose. The effect of the intervention is difficult to ascertain because two data points are an insufficient number to determine a trend. However, administering a probe prior to implementing the practice procedures was done for the purpose of assigning participants to the practice conditions based on their initial reading frequency. This avoided a confound derived from the potential uneven distribution the students across the conditions.

**Suggestions for Future Research**

Reading endurance should be investigated using designs better suited for comparing two treatment conditions. The multiple probe design was not the best arrangement to compare two treatment conditions that produced increasing trends. A
multi-element design would be more appropriate for this purpose. Experimental control would be determined by degree of separation between the two treatment conditions.

In addition, research on repeated readings could investigate an alternative procedure in which a student starts reading where he or she ended after the previous timing, instead of reading the passage from the beginning during each timing. This procedure might combine the benefit of a repeated reading procedure with the benefit of exposing students to more of the material.

Researchers using the procedure mentioned above should carefully consider the inter-timing interval. The experimenter would need to carefully select a pause long enough so that it is discriminable from a continuous read. If the inter-timing interval selected is too short, the procedure may yield results similar to a continuous read.

Further research on endurance should answer the following questions: What constitutes endurance? How much decay is acceptable when analyzing performance? Generally, some decrease in frequency should be expected across any amount of time. However, what level of sustained frequency is optimal for classroom application? As mentioned earlier, different durations may be more suitable for certain performers under certain conditions. Even though discovering the optimal practice time and sustained frequency across this time may be challenging, doing so may provide teachers with better methods of assessment.

Previous research has indicated that reading fluency is positively correlated with reading comprehension (Hawkins, Hale, Sheeley, & Ling, 2011; Klauda & Guthrie, 2008). This suggests that if CWPM decreases over time, comprehension may also
Programming for endurance could therefore be a valuable component of reading instruction, in that it may promote comprehension when students read longer passages, or for longer periods of time. However, the relationship between endurance and comprehension has not been established, and could be a fruitful research endeavor for investigators interested in fluency and the products of fluency. If reading endurance does relate to comprehension, confirming this relationship will provide further support for the importance of endurance as a meaningful variable that contributes to positive educational outcomes.
References


*Journal of Precision Teaching, 7*, 8–11.


APPENDIX A: PARENTAL PERMISSION FORM
The Ohio State University Parental Permission
For Child’s Participation in Research

Study Title: The Comparison of Long versus Short Practice Trials on the Facilitation of Endurance

Researcher: Nancy Neef

Sponsor: This is a parental permission form for research participation. It contains important information about this study and what to expect if you permit your child to participate.

Your child’s participation is voluntary.
Please consider the information carefully. Feel free to discuss the study with your friends and family and to ask questions before making your decision whether or not to permit your child to participate. If you permit your child to participate, you will be asked to sign this form and will receive a copy of the form.

Purpose:
The purpose of this study is to investigate how reading practice leads to the development of endurance, or the ability to maintain the reading for longer durations of time.

Procedures/Tasks:
Your child will be asked to read a passage either one time for three minutes or three times for one minute. Sometimes they will be asked to read for five minutes. While each student reads, an audio recorder will be used. This will help provide a precise account of the number of words your student will read.

Duration:
Each session will last no longer than ten minutes. Your child will be asked to read each day during school hours, 5 days a week, for a minimum of one month. The entire study should not last longer than a couple months.

Your child may leave the study at any time. If you or your child decides to stop participation in the study, there will be no penalty and neither you nor your child will lose any benefits to which you are otherwise entitled. Your decision will not affect your future relationship with The Ohio State University.
Risks and Benefits:
There are no risks to your child since reading is a typical activity within a school day. However, this study may provide your child with a benefit for participating which includes improvement in their reading abilities.

Confidentiality:

Efforts will be made to keep your child’s study-related information confidential. However, there may be circumstances where this information must be released. For example, personal information regarding your child’s participation in this study may be disclosed if required by state law. Also, your child’s records may be reviewed by the following groups (as applicable to the research):

- Office for Human Research Protections or other federal, state, or international regulatory agencies;
- The Ohio State University Institutional Review Board or Office of Responsible Research Practices;
- The sponsor, if any, or agency (including the Food and Drug Administration for FDA-regulated research) supporting the study.

Incentives:
After each session your child can select from a variety of stickers, pencils, or water based tattoos.

Participant Rights:

You or your child may refuse to participate in this study without penalty or loss of benefits to which you are otherwise entitled. If you or your child is a student or employee at Ohio State, your decision will not affect your grades or employment status.

If you and your child choose to participate in the study, you may discontinue participation at any time without penalty or loss of benefits. By signing this form, you do not give up any personal legal rights your child may have as a participant in this study.

An Institutional Review Board responsible for human subjects research at The Ohio State University reviewed this research project and found it to be acceptable, according to applicable state and federal regulations and University policies designed to protect the rights and welfare of participants in research.

Contacts and Questions:

For questions, concerns, or complaints about the study you may contact Joshua Garner at garner.112@buckeyemail.osu.edu
For questions about your child’s rights as a participant in this study or to discuss other study-related concerns or complaints with someone who is not part of the research team, you may contact Ms. Sandra Meadows in the Office of Responsible Research Practices at 1-800-678-6251.

If your child is injured as a result of participating in this study or for questions about a study-related injury, you may contact Joshua Garner at garner.112@buckeyemail.osu.edu.

**Signing the parental permission form**

I have read (or someone has read to me) this form and I am aware that I am being asked to provide permission for my child to participate in a research study. I have had the opportunity to ask questions and have had them answered to my satisfaction. I voluntarily agree to permit my child to participate in this study.

I am not giving up any legal rights by signing this form. I will be given a copy of this form.

---

**Investigator/Research Staff**

I have explained the research to the participant or his/her representative before requesting the signature(s) above. There are no blanks in this document. A copy of this form has been given to the participant or his/her representative.

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APPENDIX B: VERBAL ASSENT FORM
The Ohio State University Assent to Participate in Research

Study Title:
The Comparison of Long versus Short Practice Trials on the
Facilitation of Endurance

Researcher:
Nancy Neef

Sponsor:

- You are being asked to be in a research study. Studies are done to find better ways to treat people or to understand things better.
- This form will tell you about the study to help you decide whether or not you want to participate.
- You should ask any questions you have before making up your mind. You can think about it and discuss it with your family or friends before you decide.
- It is okay to say “No” if you don’t want to be in the study. If you say “Yes” you can change your mind and quit being in the study at any time without getting in trouble.
- If you decide you want to be in the study, an adult (usually a parent) will also need to give permission for you to be in the study.

1. What is this study about?

This study is looking at how long students can read and how do different ways of reading effect their reading skills.

2. What will I need to do if I am in this study?

If you are in this study you will read a passage either for three minutes or for one minute three times. Sometimes you will read the passage for five minutes. While you are reading, I will use an audio recorder to record your voice. Then I will use recording to help count how many words you read during the session.

3. How long will I be in the study?
Each time you read the session will last about 10 minutes. You will be asked to read each day during school hours, 5 days a week, for a minimum of one month. The entire study should not last longer than a couple months.

4. Can I stop being in the study?
   
   You may stop being in the study at any time.

5. What bad things might happen to me if I am in the study?

   Since reading is a normal activity for you to do in school, nothing bad is going to happen to you for participating in this study.

6. What good things might happen to me if I am in the study?

   You might become a better reader.

7. Will I be given anything for being in this study?

   You will be able to select one item from a variety of stickers, pencils, or water-based tattoos.

8. Who can I talk to about the study?

   For questions about the study you may contact Joshua Garner garner.112@buckeyemail.osu.edu or Nancy Neef neef.2@osu.edu

   To discuss other study-related questions with someone who is not part of the research team, you may contact Ms. Sandra Meadows in the Office of Responsible Research Practices at 1-800-678-6251.
Signing the assent form

I have read (or someone has read to me) this form. I have had a chance to ask questions before making up my mind. I want to be in this research study.

Signature or printed name of subject ________________________________ Date and time ________________________________

Investigator/Research Staff

I have explained the research to the participant before requesting the signature above. There are no blanks in this document. A copy of this form has been given to the participant or his/her representative.

Printed name of person obtaining assent ________________________________ Signature of person obtaining assent ________________________________

Date and time ________________________________ AM/PM

This form must be accompanied by an IRB approved parental permission form signed by a parent/guardian.
APPENDIX C: READING PASSAGE A
I ride a big yellow bus to school. I stand on the corner of our street with my friends and we wait for the bus. My friend’s grandma waits with us. When it’s raining, she holds an umbrella to keep us dry. Sometimes when it’s cold she brings us hot chocolate. I leave my house to walk to the bus stop after my parents go to work. I watch the clock so I know when to leave. Sometimes mom phones me from her office to remind me. Sometimes she can’t call, so I have to be sure to watch the time. Our bus driver puts his flashing yellow lights on and then stops right next to us. When he has stopped he turns the red lights on so all the cars will stop. He makes sure we are all sitting down before he starts to go. He watches out for us very carefully. My friends and I are the first ones to be picked up by the bus. We like to sit right behind the bus driver and watch while he picks up all the other kids. We know where everyone lives. By the time we get to our school, the bus is almost full. Sometimes the kids get noisy and the driver has to remind us to keep it down. He says their noise makes it hard for him to concentrate and drive safely. I am glad that our bus driver is so careful. Today I got to go as high as a tall, tall mountain, but I wasn’t outside and I didn’t climb a trail to get there. I was inside all the time because I was riding in an elevator that went up almost a mile high. I went with my mother to visit her friend. Her friend works in a building that is 44 stories tall. We took a taxi downtown to the building. We went inside and looked for the elevator. When we got on, there were four other people already on it. Everyone pushed a button for the floor they wanted. My mother pressed the button for the 44th floor. The elevator started going up. The other people all got off by the tenth floor and we were the only ones left. The elevator moved so fast I had to hold on to the bar. My mom held my hand and smiled at me. “Isn’t this exciting?” she asked. I nodded but my tummy felt funny. It felt like I needed to eat lunch. My ears felt funny also. My mom said it was because we had gone up so high that the air pressure was different. Finally the elevator slowed and stopped. “We’re here,” said mom. While we were up so high we visited the observation deck. There was quite a view. It felt like we could see all the way to the next state. My mom’s friend says when there is a storm it is really exciting to watch. If I had a cat, I’d name her Princess. I’d treat her just like a princess. She would wear a gold ribbon with a big bow
around her neck. She’d sleep on a red velvet pillow. She’d eat out of a fancy dish just like that white cat on TV. My cat Princess would have green eyes. Her eyes would be narrow slits most of the time. Her eyes would be as wide as marbles whenever she looked at me. She would like me the very best of all the people in the world. I can’t have a cat because I have allergies. When I touch a cat my nose starts itching. If I touch my face after touching a cat, my eyes swell up. Sometimes I have trouble breathing. My mom has to give me medicine when that happens. If I’m at school when I have trouble breathing I have to go to the office and see the nurse. Our neighbor has a cat named Gray Kitty. Gray Kitty likes me. He always comes up and rubs my legs. Even if I don’t touch him I might start itching. I feel bad that I have to run away from Gray Kitty, because he likes me. One day our neighbor surprised me. She gave me a cat of my own! Not a real live cat, but a stuffed one. She has silky fur and big green eyes and a gold ribbon with a big bow around her neck. I named her Princess and I can hold her all I want. Six years ago my family grew from two people to four people in one day. That was the day my sister and I were born. That was the day Mom and Dad had to start buying two of everything. My mom and dad say we were much more than twice the work of one baby. They also said we gave back more than twice as much love and fun. We look just alike because we are identical twins, but we don’t act just the same. My sister likes peas and beans and I hate them. I like grape juice and she likes apple juice. She likes to read. I would rather climb a tree than read a book. Mom and Dad are the only ones who can tell us apart when we dress the same. They know the secret. I have a mole on my ear and my sister doesn’t. We look so much alike that we can even fool Grandma and Grandpa. It’s nice to be a twin sometimes. We always have someone our own age who will share our secrets. Sometimes we don’t want to share everything. Sometimes it is nice to have my mom or my toys all to myself. Dad says we aren’t really that much alike because no person is exactly like anyone else. I decided my favorite color is the rainbow. It has all the colors in it: red, yellow, blue, green, and purple. They are all my favorite colors. How could I ever choose just one? Red makes me feel like smiling. I love red cards and shiny red apples. My favorite type of candy is a red gum drop. My favorite flower is a red rose. I’m happy
when I get to see a red sunset. Blue makes me feel like taking a nap. My bed is fluffy blue and white with clouds all over it. I love the blue sky and ocean. Blue bubble gum is the best flavor of ice cream. Yellow makes me feel like jumping rope. I love the sun in summer and the full moon in the fall. Our meadow is full of yellow flowers that dance in the breeze. Applesauce is one of my favorite treats, and it is kind of yellow. Fuzzy yellow ducklings always make me laugh. Green makes me feel like climbing a tree. I love playing in the grass and the fields. Green gummy bears and pears are my special snacks.

My favorite place to go is a park filled with trees and grass. Purple makes me feel like eating grapes. I use my purple crayon so much it is almost gone. My favorite backpack is purple, too. Whenever anyone asks me what my favorite color is, I tell them it is a rainbow.
I love going to the movies. My favorite place to go to a movie is not at the theater, though. My family doesn’t like to go to the theater. Mom says we have to plan ahead so we don’t miss the first part of the movie. Dad says we have to hunt for a parking place. My big brother says if we are late we have to take the worst seats. My sister says it’s too noisy. The favorite place for my family to see movies is at home.

We don’t have to find a parking place. We have the best seats in the house, our big soft couch. We can even lie on the floor on pillows if we want to. We don’t even have to wear shoes. We can watch a movie anytime we want. Even our dog, Boots, can watch the movies with us. Sometimes I can invite my friend or my cousin over. The popcorn is free at home and we can have all the seconds we want. Sometimes Mom and Dad let me pick out the movie with their help. We go to the video store and rent it for the night or the weekend. On special nights Mom and Dad let me rent two movies. Dad makes the popcorn and we all get comfortable in the family room. I love going to the movies. I learned that the wind is important for more than flying kites or making our wind chime make music. Without the wind, our world wouldn’t have any people, food, or animals.

Wind moves the heat from the sun all around the planet. Without the wind, about half of the earth would be too hot for any living thing. Most of the rest of the earth would be too cold. In fact, most of our country would be under ice. Wind is useful to all living things. It brings moisture up from the oceans into the air. Then the wind blows the moisture around. The moisture falls as rain, dew, or snow and ice. Many plants and trees depend on the wind. The wind helps them spread their seeds to new places. Wind also blows pollen around so trees, grass, and grains can ripen. Without the wind, farmers couldn’t grow corn or wheat. Bees help the wind spread pollen. Their job is to fly from blossom to blossom with pollen on their feet and wings. You can see for yourself how the wind spreads seeds. The next time you see a yellow dandelion that has turned into a white puffball, blow it. Or, if you find a maple tree seed with wings that looks like a helicopter, throw it. You’ll see all of the seeds go flying and you will be helping the wind do its job.

When I grow up I want to fly in space. I have my plan all worked out. First I will go to college and then I am going to learn how to fly planes. I will fly very fast planes that can
go faster than the speed of sound. When I can fly planes very well, I will learn how to fly space ships. I will get to wear a silvery space suit and live inside a spaceship. I will be inside the space ship when we blast into space. When I am up in space, I will watch the sun and moon come up every day. I will be so close to the stars that I can count them. Maybe I will see other space ships and wave as they go by. I will float around whenever I want. It will be just like flying. I will get to put on my space suit and walk in space.

When I look down I will see the green and blue earth far below. I might even be able to see where I live. I will be on TV to describe what I see. The whole world will be watching and listening to me. When we get to the moon, I will walk all across the surface. It will be dusty and crunchy. I will pick up samples of moon rocks to bring back. I want to drive all over the moon in a little moon buggy. I will plant the flag on the moon. I might even see some little green aliens running around. I can’t wait to fly in space. We had open house at my school last week. My whole family went: my mom, my grandma, and I. We sat together at my table in my room. It was a tight squeeze for my mom and grandma, but they made it. My class has second and third graders in it. Some of my friends were there and their families came, too. My best friend was there. His stepfather and mother sat with him at his table. They took up the whole table because his little brother came along. I waved at him. My other friend and her big sister came, too. Their family had two classes to visit at the same time because her brother goes to my school, too. Her mom went to her brother’s room, and her big sister came to her room. I like my teacher a lot. Our room looked really nice. Our teacher had been saving all of our best penmanship and drawings. They were hung all over the walls. My grandmother could tell right away which ones were mine. She used to be an artist. She says I take after her. My teacher told all the parents how important it is for them to make sure we do our homework. He said anytime they have questions about us they can talk to him. Afterwards he talked to my mom and me. He said what a good job I was doing and my mom gave me a big hug when we left. Today our teacher said we would each write a story. She said if we wanted we could draw pictures to go with it. I decided to write my life story. I started with the night I was born. I drew a picture of me as a tiny baby. I
wrote about what my first words were and how I liked to play. When I was little I was always making tall towers. My grandfather said he thought I would build hotels when I grew up. I drew a picture of me playing with my blocks. I also liked to ride my scooter and swing on the swings in the park. I drew pictures of me on my scooter and a picture of my dad pushing me on the swing. The next picture is of me licking an ice cream cone and getting it all over me. I still love chocolate ice cream. Then I wrote about my first day at school. I wrote about how I cried and cried because I didn’t want my mother to leave me. I made a drawing of me with a sad face. The last page is about my last birthday party. I drew of picture of me blowing out the candles on my birthday cake. There are six candles and I blew them all out.

The follow is: READING FORM B

Total number of words: 1206

Times New Roman, 11 font, 1.5 spacing, left indent, 1-inch margins
APPENDIX E: DATA SHEET FOR IOA AND TREATMENT INTEGRITY
Reading Endurance Data Collection, IOA, and Integrity

Date: ____________  Student: __________________________

Data to be collected (circle): 3x1-minute  1x3-minute  Probe (5 mins)

This table is to be used for the 3x1 or the 1x3 timings:

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<thead>
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<th>O1 O2</th>
<th>O1 O2</th>
<th>O1 O2</th>
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</tr>
</thead>
<tbody>
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<td>30s</td>
<td>40s</td>
<td>50s</td>
<td>1m</td>
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<td>1m30s</td>
<td>1m40s</td>
<td>1m50s</td>
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<td></td>
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<td>2m40s</td>
<td>2m50s</td>
<td>3m</td>
<td></td>
</tr>
</tbody>
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Observer 1: Total rate (count/time) __________ Observer 2: Total rate (count/time) __________

Agreement: (Total count/total count): ____________

This table is to be used for the five minute probe:

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<td>4m40s</td>
<td>4m50s</td>
<td>5m</td>
<td></td>
</tr>
</tbody>
</table>

Observer 1: Total rate (count/time) __________ Observer 2: Total rate (count/time) __________

Agreement: (Total count/total count): ____________

Treatment Integrity

Did this student read during the appropriate time interval?
Observer 1: Yes  No

Was the correct passage provided?
Observer 1: Yes  No

Was the error-correction procedure implemented when errors occurred?
Observer 1: Yes  No

____________%
APPENDIX F: SOCIAL VALIDITY SCORING SHEET
Social Validity for Endurance:

<table>
<thead>
<tr>
<th>Question</th>
<th>Students Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Which way of reading practice did you like the best? Reading for one minute several times or reading for three minutes?</td>
<td></td>
</tr>
<tr>
<td>In general, do you prefer to read for longer periods of time or shorter?</td>
<td></td>
</tr>
<tr>
<td>Do you feel like you are a better reader after participating in this study?</td>
<td></td>
</tr>
<tr>
<td>Do you feel like you can read for longer periods of time after participating in this study?</td>
<td></td>
</tr>
<tr>
<td><em>For the Teacher</em> Did you notice any improvement in the students reading abilities after their participation in this study?</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX G: IRB APPROVAL LETTER
February 9, 2012

Protocol Number: 2012B0014
Protocol Title: THE COMPARISON OF LONG VERSUS SHORT PRACTICE TRIALS ON THE FACILITATION OF ENDURANCE, Nancy Neef, Joshua Garner, Jessica Heacock, Neal Miller, PAES
Type of Review: Initial Review—Expedited
IRB Staff Contact: Michael Donovan
Phone: 614-292-6950 Email: donovan.6@osu.edu

Dear Dr. Neef,

The Behavioral and Social Sciences IRB APPROVED BY EXPEDITED REVIEW the above referenced research. The Board was able to provide expedited approval under 45 CFR 46.110(b)(1) because the research meets the applicability criteria and one or more categories of research eligible for expedited review, as indicated below.

Date of IRB Approval: February 9, 2012
Date of IRB Approval Expiration: January 31, 2013
Expedited Review Category: 7

In addition, the research was approved for the inclusion of children (permission of one parent sufficient)

If applicable, informed consent (and HIPAA research authorization) must be obtained from subjects or their legally authorized representatives and documented prior to research involvement. The IRB-approved consent form and process must be used.

Changes in the research (e.g., recruitment procedures, advertisements, enrollment numbers, etc.) or informed consent process must be approved by the IRB before they are implemented (except where necessary to eliminate apparent immediate hazards to subjects).

This approval is valid for one year from the date of IRB review when approval is granted or modifications are required. The approval will no longer be in effect on the date listed above as the IRB expiration date. A Continuing Review application must be approved within this interval to avoid expiration of IRB approval and cessation of all research activities. A final report must be provided to the IRB and all records relating to the research (including signed consent forms) must be retained and available for audit for at least 3 years after the research has ended.

It is the responsibility of all investigators and research staff to promptly report to the IRB any serious, unexpected and related adverse events and potential unanticipated problems involving risks to subjects or others.

This approval is issued under The Ohio State University's OHRP Federawide Assurance #00006378. All forms and procedures can be found on the OHRP website — www.orhp.osu.edu. Please feel free to contact the IRB staff contact listed above with any questions or concerns.

Michael Edwards, PhD, Chair
Behavioral and Social Sciences Institutional Review Board

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APPENDIXES H – M: THE STANDARD CELEBRATION CHARTS