Using Brief Experimental Analysis to Compare the Effects of Reading Comprehension Interventions with a Middle School Student

Katherine A. Graves[1] ⓘ and Matthew K. Burns[2] ⓘ

Abstract

This study examined the use of a brief experimental analysis (BEA) to efficiently identify effective reading comprehension interventions. BEA offers a swift evaluation of multiple interventions through mini reversals but has previously been mostly applied to reading fluency. The study investigated the impact of the three interventions (i.e., story mapping, reinforcement + corrective feedback, comprehension prompts) on the reading comprehension of an 8th-grade male student performing below grade-level expectations in reading. The results indicated that there were clear differentiated effects across the three interventions, and reinforcement plus feedback resulted in greater changes in skill level. Future research is needed in using BEA to choose an intervention to increase students' reading comprehension in the classroom.

Keywords

brief experimental analysis, reading comprehension, middle school

[1]Department Curriculum and Instruction, University of Texas at Arlington, Arlington, TX, USA
[2]School of Special Education, School Psychology, and Early Childhood Studies, University of Florida, Gainesville, FL, USA

Corresponding Author:
Katherine A. Graves, 700 S. West St., Arlington, TX, 76013
E-mail: Katherine.graves@uta.edu

Although most reading intervention research focuses on students in elementary school, there is also an alarming number of middle school students who continue to lack basic reading proficiency. In 2022, 31% of eighth-grade students performed at or above proficient, which was 3% points lower than 2019 (National Center on Educational Statistics, 2022). Students who did not meet proficiency with universal academic instruction in middle school often received explicit instruction in vocabulary and reading comprehension strategies (Kamil et al., 2008; Torgesen et al., 2007), which led to inconsistent improvements (Scammacca et al., 2015).

It is important to differentiate reading interventions in middle school based on student needs (Reed, 2023). Within a multitiered system of support (MTSS), Tier 3 interventions are highly individualized and may be delivered one-on-one to a small number of students in the school (Coyne et al., 2018; Fuchs et al., 2012). Daly et al. (1997) suggested five hypotheses for student failure that can be used to individualize reading interventions for each student. The five hypotheses include: (a) the student is not motivated to do the work, (b) the student has not had enough practice, (c) the student has not had enough instruction, (d) the content is too difficult, and (e) the student has not had to do the work that way before. School personnel can test each of these hypotheses within a brief experimental analysis as part of the process of selecting reading interventions for Tier 3 (Coolong-Chaffin & Wagner, 2015; Fienup et al., 2015).

Brief Experimental Analysis

Implementing an intervention, measuring outcomes, and determining if the intervention works is a time-consuming process that requires considerable data to reach an accurate decision (Hintze et al., 2018). Brief experimental analysis (BEA) can be used to more quickly examine the effects of interventions before investing considerable time in implementing them (McComas et al., 1996; Noell et al., 1998). A BEA is the process of manipulating environmental or instructional conditions to implement interventions and test the immediate effect on an important outcome (Riley-Tillman et al., 2020). Demonstrating that the effect replicates ensures that the change in behavior can be causally attributed to the intervention being tested (Martens & Gertz, 2009). Several studies have demonstrated the utility of BEA in identifying reading fluency interventions (Andersen et al., 2013; Axelrod & Choolong-Chaffin, 2017; Bauer et al., 2021; Riley-Tillman et al., 2020; Schreder et al., 2012), and BEAs have been used in research with early literacy skills (Ozmen & Atbasi, 2016; McMaster & Pétursdóttir, 2009), math (Everett et al., 2016; Mong & Mong, 2012), and writing (Burns et al., 2009; Parker et al., 2012).

BEAs are less often studied for reading comprehension. Reading fluency interventions identified through BEA have an effect on reading comprehension (Cates et al., 2007). Nikanowicz (2009) tested the effect of combining a fluency and comprehension intervention with notable differentiation. McComas et al. (1996) found that adding a requirement that students write a summary of word meanings led to better comprehension than merely reading the word for one student, and one student increased comprehension more when an instructor previewed main idea, setting, and characters before reading than during a condition in which the participant verbally summarized the details of the passage.

More recently, repeated reading was found to lead to better comprehension in a BEA than previewing vocabulary, click or clunk, or generating questions for one student, and a combination of repeated reading and question generation was more effective for a second student (Ritter, 2020). The BEA did not differentially identify an effective intervention for a third student. Güler and Özmen (2010) found that a multicomponent intervention with previewing, predicting story outcomes, and discussing text after reading led to better reading comprehension in a BEA than any of the

components on their own. Although reading comprehension interventions have led to differentiated effects, none of the studies mentioned here used a conceptual framework to select comprehension interventions to test within the BEA. The importance of using a conceptual framework to drive the BEA "cannot be overstated" (p. 126) to ensure that different functions are being tested (Riley-Tillman et al., 2020). Some studies compared fluency and comprehension interventions (Cates et al., 2007; Nikanowicz, 2009), interventions that required less adult assistance (McComas et al., 1996), and interventions that occurred before, during, or after reading (Ritter, 2020).

As stated earlier, the Daly et al. (1997) five hypotheses for student difficulties can provide a well-researched conceptual framework for selecting interventions within a BEA (Coolong-Chaffin & Wagner, 2015; Riley-Tillman et al., 2020). The hypothesis that (a) the student is not motivated to do the work can be tested by providing a contingent reinforcement; (b) the student has not had enough practice can be tested by providing additional repetition with the skill (c) the student has not had enough instruction can be tested by further modeling the skill for initial acquisition; (d) the content is too difficult can be tested by using easier material during instruction; and (e) the student has not had to do the work that way before can be tested by providing a scaffold or support for the student to complete a novel application of the skill. The Daly et al. (1997) hypotheses have been frequently studied within BEA research (Burns et al., 2009; Ozmen & Atbasi, 2016; Schreder et al., 2012). Next, we will discuss three of the hypotheses and a reading comprehension intervention that addresses each.

Not Motivated - Reinforce for Comprehension

One common reason for students to demonstrate low reading comprehension is a lack of motivation, which then compounds the reading comprehension difficulty (Ahmadi et al., 2013). Motivation to read can be situational or habitual, and intrinsically or extrinsically oriented, but changes in extrinsic motivation (based on the expected consequence) can lead to changes in situational or immediate motivation (Schiefele et al., 2012). BEA research usually addresses motivation by providing a contingent reinforcement, or the delivery of preferred stimuli to increase the likelihood of a behavior or skill occurring (Nevin et al., 1987). Contingent reinforcement has been shown to increase grade-level reading content in a few sessions (Gentilini & Greer, 2020), and reinforcing performance has consistently led to differential effects in a BEA (Cates et al., 2007; Coolong-Chaffin & Wagner, 2015; Fienup et al., 2015).

Need More Help - Story Mapping

A story map is an instructional tool that uses visual symbols to model ideas, concepts, facts, and the relationships between them to support learning and reading comprehension (Dexter & Hughes, 2011; Kurniaman et al., 2018). As students read, they use the story map to write down and organize details of the story, such as setting, characters, problem, events, and solutions (Reutzel, 1985), which helps visualize the structure of the text and improves reading comprehension (Taylor & Beach, 1984). Story map instruction has led to large effects on reading for students with disabilities (ES = 0.96, 95% CI 0.72 to 1.20; Dexter & Hughes, 2011), increased the percentage of reading comprehension questions correctly answered for students with intellectual disabilities (Grünke et al., 2013), and has consistently been shown to increase reading comprehension of students in middle and high school (Watson et al., 2012).

Story mapping needs to be explicitly taught to students. Idol and Croll (1987) suggested that story mapping be taught in three phases that consist of (a) the teacher modeling how to fill out a mapping-worksheet by reading a story out loud and stopping to fill in the worksheet whenever important

information is presented, (b) the teacher leads students through completing a story map as they work together, and (c) the students independently read and complete story mapping that is later checked for accuracy by the teacher.

Have Not Had to Do It That Way - Prompt for Comprehension

Students engage in different behaviors when reading for different purposes, which affects how well they comprehend what they read (Dori et al., 2018; Zhang & Duke, 2008). Thus, students can be prompted to read for comprehension and to monitor their own understanding by identifying the type of questions that will be answered (main idea, facts or details, sequence or organization, or creative reading; McCullough, 1957) and cueing the student to pay attention to or notice the information that matches the type of question being asked before they read (e.g., as you read, pay attention to specific details). Creative reading is the "type of reading in which the reader acts upon material intellectually and emotionally and thereby derives from the experience more than the author may have originally intended" (McCullough, 1957, p. 200). Prompting students to read for comprehension can lead to an increased understanding of what is read for students from varying age groups and reading abilities (Rouse-Billman & Alber-Morgan, 2019). Multiple studies have found that prompting students to read for comprehension increased reading comprehension of students with autism (Finnegan & Mazin, 2016) and reading disabilities (El Zein et al., 2014).

Purpose

The purpose of this study was to examine how well three reading comprehension interventions that align to three of Daly et al. (1997) hypotheses regarding the reasons students encounter academic difficulties can be tested in a BEA with a middle school student with reading difficulties. The three hypotheses tested were insufficient motivation (reinforcement), insufficient instruction (story mapping), and not having ever completed the task that way (prompting). In this study, reinforcement was combined with corrective feedback. The following research question guided the study, to what extent can the effects of three reading comprehension interventions be differentiated within a BEA with a middle school student with low reading skills?

Method

The research question was addressed with a BEA that used a multielement design followed by an extended implementation phase of the most effective intervention. The participant, setting, measures, intervention, and procedure are described next.

Participants and Setting

The participant for the study was one white male residing in the southern region of the United States. The student was in 8th grade and attended a private middle school. He was identified as having difficulties in both reading fluency and reading comprehension using benchmark assessments from the *Dynamic Indicators of Basic Early Literacy Skills, 8th edition* (DIBELS; University of Oregon, Center on Teaching and Learning, 2020) and through parent referral. The student scored below and in the at-risk range using the Oral Reading Fluency winter benchmark.

Measures

Previous meta-analytic research identified a need for additional studies that mirrored the standardized assessments (Scammacca et al., 2008). Thus, the effect of the intervention was measured by providing 10 comprehension questions for each passage that addressed main idea, facts or details, sequence or organization, and creative reading (McCullough, 1957). Main idea questions ask the student to draw conclusions about the passage as a whole and its purpose (e.g., *"Choose the best title for this passage"*). Fact or detail questions ask about specific parts of the passage (e.g., *"Which best defines the word* duplicated *as it is used in the sixth paragraph?").* Sequence or organization questions ask about the order in which events occurred or how a portion of the reading is organized (e.g., *"Which event happened first?"*). Creative reading asks the reader to understand something that is not directly stated in the passage (e.g., *"Which statement would the author most likely agree with?"*). The comprehension questions were provided by the EReading website (Mortini, 2020) and were multiple choice. The data consisted of the percentage (out of 10) of comprehension questions correctly answered.

Materials

All the passages used were informational texts at the student's reading level. The leveled comprehension passages were retrieved from www.ereadingworksheets.com (Mortini, 2020) and were screened by the researcher to ensure a match to the student's independent reading level (i.e., vocabulary was not too difficult for an 8th grader). EReading comprehension provided passages long enough to assess reading comprehension and 10 multiple-choice comprehension questions for each. Initially, 15 non-fiction reading passages were chosen. Words read per minute were collected for each passage and recorded. The passages were then ranked from least to highest, and the top three and bottom three passages were eliminated, leaving 10 passages. The 10 passages were then randomized into different treatments to ensure equal difficulty between interventions.

Experimental Conditions

Three conditions were tested within the BEA. One addressed the hypothesis that the student was not motivated by adding a contingent reinforcement, one tested not having enough instruction by having the student complete a story map, and one tested the hypothesis that the student had not been asked to do the task that way before by prompting the student what to look for when reading. The conditions were randomly assigned across sessions. The interventions occurred via video conferencing. The researcher tutored the student in reading comprehension for 25-minute sessions four times a week. There were two times of day the student and researcher met, either 7:00 a.m. before school or 6:30 p.m. after school activities. Virtual settings were set up via email with the parent, but the student independently got on each session and engaged with the researcher.

Reinforcement Plus Feedback. Prior to the implementation of the experiment, the student and the researcher brainstormed to determine five contingent reinforcers (e.g., ice cream, an hour undisturbed in his room, an hour to game). Due to the intervention being implemented online, the researcher worked with the student and the student's parent to deliver contingent reinforcement. The parameters for the reinforcers were: (a) the student found it reinforcing, (b) it could be delivered once or multiple times and still be reinforcing for the student, and (c) the parent was willing to deliver immediately following the intervention.

The contingent reinforcement was earned and delivered when the student answered at least 90% of the comprehension questions correctly. The student also received immediate reinforcement and feedback after answering each question. The researcher delivered praise and corrective feedback if answered incorrectly, and praise and performance feedback if answered correctly. No feedback was provided in the other conditions. Corrective or performance feedback are defined as elaborate feedback, which have been shown to be more effective and preferred over simple feedback (i.e., if the answer was correct or incorrect; Hattie & Timperley, 2007; Shute, 2008, Van der Kleij et al., 2015). Examples of corrective or performance feedback include referring to a false response, explaining why a specific response is correct or incorrect, or providing additional instruction or background knowledge on a specific topic (Golke et al., 2015)

Comprehension Prompt. The prompts for this piece of the intervention were generated by the researcher. Two prompts were used based on prior research using prompting for comprehension (Rouse-Billman & Alber-Morgan, 2019). Before the session, the researcher previewed the questions and grouped them together based on *type* of question according to McCullough (1957). The prompts began with the phrases "*Pay attention to...*" or "*As you read, notice...*". According to the types of questions (e.g., main idea, facts or details, sequence or organization, and creative reading), the researcher chose the most frequent type of question and created a prompt related to it. Next, the second prompt was related to the second most frequent type of question. This intervention was implemented in a total of three sessions, with a total of six prompts related to the text the student was engaging with. An example of a prompt related to sequence or organization was, "*As you read, make sure you are paying attention to the order in which things happen.*" An example of a prompt related to facts or details was, "P*ay attention to why google became so popular and why they improved their search quality.*" The prompts were delivered verbally by the researcher to the student after the title was read of the passage, and before the student began reading the passage out loud.

Story Mapping. The story map for this intervention was retrieved from www.adlit.org/strategies/22736. The graphic organizer was sent virtually to the student and printed out for him to write on. Prior to using the story map, the researcher directly instructed the student on how to complete it through modeling, leading, and testing the procedure (Idol & Croll, 1987). The researcher modeled using the story map and think-aloud strategies with a sample passage. Next, the student and researcher completed one together from a sample passage. Then, the student independently completed a story map with a sample passage, and the researcher provided performance feedback. The story map had seven boxes to put information from the reading (see Figure 1) and was a graphic organizer directed for use with fictional texts.

Figure 1. Story Mapping Worksheet.

From Our Classroom Strategy Library

Story Map

Name _____

Story Title _____

Setting
  Where?
  When?

Main Characters

Problem

Event 1   Event 2   Event 3

Resolution

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Design

A brief multielement (rapidly changing reversal; BEA) design (Riley-Tillman et al., 2020) was used within one subject to determine the most effective intervention for reading comprehension. The order of the interventions was determined randomly and then reversed for the subsequent sessions (i.e., B-C-D-D-C-B-B-C-D). BEA decisions are more reliable if they include at least three data points per condition, and using fewer data points results in questionably reliable interpretations (Burns et al., 2017). The most effective intervention was then implemented two additional times to ensure its stability and effectiveness (see Table 1 for schedule).

Table 1. Intervention Days and Times.

Intervention	SM	P & R	R	P	SM	P & R	R	R
Day	1	2	3	4	5	6	7	8
Time of day	PM	PM	PM	AM	AM	PM	AM	PM

Note. R = Reinforcement, SM = Story Mapping, P = Prompt for Comprehension, PM = 6:30 pm, AM = 7:00 am

Procedure

Intervention sessions were 25 minutes long and occurred four times each week. One intervention was implemented in each session that occurred either at 7:00 a.m. before school or 6:30 p.m. after school activities.

Each session began with a warmup activity that consisted of reading 10 grade-level vocabulary words out loud. After the warmup was completed, the researcher indicated to the student which intervention would be used during the session. If the intervention required directions, such as the story map, the research delivered them. The researcher than read the title of the passage out loudand gave the students directions to read the passage out loud. If the student stumbled on a word he did not know, the researcher pronounced it for him.

Following the passage, the student completed the 10 written comprehension questions. The student could scroll to the text and use it to answer the questions. The correct answers to the questions were not given until the student answered all the questions, except during the reinforcement intervention phase. In addition to reinforcement, performance feedback was given during the reinforcement phase. Performance feedback can be considered a form of instruction, particularly *corrective* feedback in response to incorrect answers. After all the questions were answered, the researcher went through each question and explained to the student why it was correct or incorrect. Finally, the researcher and student collaboratively graphed the student's scores at the end of each session.

Interscorer Reliability and Fidelity

Interscorer reliability and fidelity of the intervention were assessed across 40% of sessions. The researcher measured interscorer reliability and fidelity by watching recorded sessions. To determine interscorer reliability, a second researcher, who was not a part of the study, verified the number of correct reading comprehension questions the student answered. The researcher was provided an answer sheet with the correct answers to verify the interventionist was scoring the reading comprehension questions correctly. No training of the second researcher was necessary due to the correct answers being provided. Interscorer reliability was determined to be 100% by taking the total number the researcher indicated the interventionist scored correctly divided by the total number of questions.

To determine fidelity, a second researcher used a checklist to mark when the procedural steps were followed. Each step could be rated a 1 *(not evident)*, a 2 *(completed with partial proficiency)*, or a 3 *(proficient)*. The total number of points rated was divided by the total number of points possible to earn, equaling a percentage of fidelity. Three checklists were developed from prior research on the procedures of the interventions (Gentilini & Greer, 2020; Reutzel, 1985; Rouse-Billman & Alber-Morgan, 2019). For reinforcement, the fidelity of the intervention was calculated at 85%, story mapping was implemented with 92% fidelity, and prompting for comprehension was implemented with 90% fidelity.

Results

The researcher question addressed whether BEA could be used to identify an intervention to best support a student in his reading comprehension. Figure 2 shows the BEA results for the student. Table 1 illustrates the intervention days and times. Visual analyses and non-overlap of all points (NAP) were used to assess the results of the study.

Table 2. Intervention Effectiveness.

Intervention	M	SD	NAP
Reinforcement	.86	.09	.77
Story Mapping	.65	.07	.17
Comprehension Prompts	.73	.21	.5

Story mapping (SM) yielded the lowest average percent correct on the reading comprehension questions with scores of 60% and 70%, which compared to 90% and 50% for comprehension prompts (P) and 90% and 80% for reinforcement plus feedback (R+F). Thus, story mapping was stopped after two data collection points due to the lowest average scores, and comprehension prompts and reinforcement continued for one more intervention session each. The results of the visual analysis indicated reinforcement plus feedback had a higher level than story mapping with clearly differentiated results (i.e., no overlapping data points) and higher than comprehension prompts with moderately clear differentiated results. While story mapping had an increasing trend, it resulted in the lowest average score (i.e., level).

Reinforcement plus feedback had the highest mean score (M = 86%), indicating that using reinforcement and feedback led to the student scoring above 80% correct on average (Table 2). Reinforcement plus feedback also had a small standard deviation (SD = 9%), which indicated low variability. Prompting's mean was in the middle of the other two interventions (M = 73%) but with the largest standard deviation (SD = 21%). The results suggested that reinforcement plus feedback was the most effective intervention in increasing levels of reading comprehension (see Table 2 for effect sizes).

Figure 2. Results of the Brief Experimental Analysis.
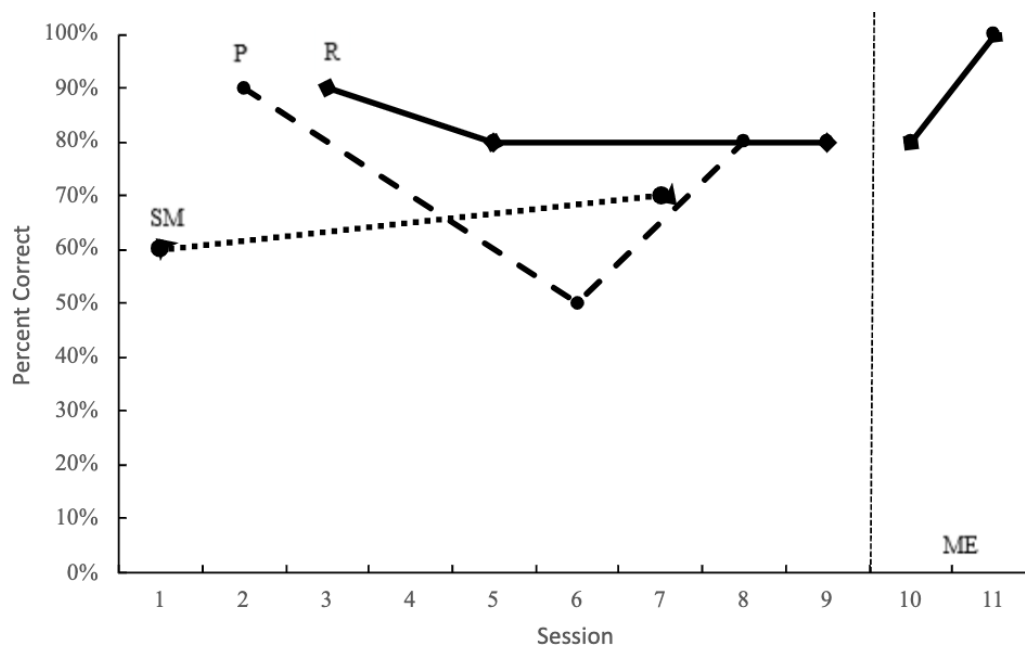
Discussion

The three reading comprehension interventions led to differential effects for this middle school student with reading difficulties. Reinforcing reading comprehension while providing performance and corrective feedback led to the most positive effects, and story mapping had the lowest effects. These results extend the evidence base for BEA in reading comprehension and suggest that BEA holds promise for use with a consequence manipulation.

Previous studies have used BEA in reading fluency interventions (Andersen et al., 2013; Burns & Wagner, 2008; Gortmaker et al., 2007) but have much less frequently applied it to reading comprehension. Although the current data are consistent with previous research that found differentiated effects for comprehension interventions within a BEA (McComas et al., 1996; Güler & Özmen, 2010; Ritter, 2020), this study was the first to select interventions to test the Daly et al. (1997) hypotheses with reading comprehension. Comprehension prompts addressed the hypothesis that the student was not asked to do the work that way before, reinforcement plus feedback addressed motivation, and story mapping addressed needing more help. Story mapping and comprehension prompts suggested the student struggled with academic skills, and reinforcement plus feedback suggested the student struggled with behavioral skills (i.e., motivation). Given that the reinforcement plus feedback condition led to differentially positive effects as compared to the other two, which supported the hypothesis that the student was not performing high in reading comprehension because of behavioral skills. The study also supported the validity of the Daly et al. (1997) framework for conducting a BEA.

The use of corrective and performance feedback for reading comprehension has been shown to be more effective than just providing information about whether the answers were correct or incorrect (Hattie & Timperley, 2007; Shute, 2008, Van der Kleij et al., 2015). The reinforcement condition included the more elaborate method of feedback, and the other conditions did not. Including the use of corrective and performance feedback may have increased the effectiveness of the reinforcement condition. Thus, it cannot be disentangled whether the reinforcement, feedback, or both contributed to the higher reading comprehension scores.

Implications for Practice and Future Research

The primary purpose of the study was to examine the possibility of using the Daly et al. (1997) hypotheses to test reading comprehension interventions within a BEA. Given the positive effects noted here, future researchers could use BEA technology to test reading comprehension interventions and could test different hypotheses and interventions for each hypothesis. Future research could explore the effectiveness of reinforcement alone compared to reinforcement plus performance feedback. Moreover, considerable replication research is needed to extend the research to different student groups and reading comprehension difficulties.

Practitioners could consider using BEAs to compare the effects of potential reading comprehension interventions that could be implemented as a Tier 3 intervention with middle school students, which has been supported by previous research (Coolong-Chaffin & Wagner, 2015). However, additional research is needed before the procedures used here can be confidently used in practice.

Limitations

The results of the study must be evaluated in the context of the limitations inherent in the study design. First, the study occurred in a tutoring situation, making the relationship between the researcher and the student different than if this occurred in a classroom setting with a teacher and a student. The student and the researcher did have an established tutor/tutee relationship prior to

the study, which might have influenced how the student responded to praise from the familiar researcher, rather than an unfamiliar person. Second, the interventions occurred virtually with video conferencing software. Future research could study virtual reading comprehension strategies implemented by teachers. Third, the intervention sessions occurred at different times of day (e.g., some sessions were at 7:00 am before the student went to school, and some were at 6:30 pm after the student got home from a full day of school and athletics after school; see Table 1). The researcher anecdotally noted that during the 7:00 am sessions, the student read at a slower rate and reported feeling tired. While each intervention condition included both times of day, future research should be consistent in the time of day and context surrounding the sessions.

An additional limitation of this study was that in the reinforcement condition, the threshold for receiving reinforcement was initially set too high. In previous work with the student intervening with fluency, the researcher used different reading comprehension questions (five in total), and the student tended to score around 80%. The researcher then chose a cut-off of 90% correct to receive the final reinforcement based on this previous work. On the first data collection point, the student scored 90% and received the final reinforcement. For the next three data points using this intervention, the student received a score of 80%, not receiving the final reinforcement. Another data collection point had to be implemented at a lower threshold (80%) to ensure that the student was receiving the intervention to determine its efficacy. Future research may include a more attainable threshold for the student to receive the final reinforcement on a more consistent basis.

The final limitation of this study was the story mapping resource used. The story mapping graphic organizer was designed to be used with fictional texts. It included the setting, main characters, problem, events, and resolution. This error occurred because the story mapping tool was chosen before the reading passages were chosen. Instructions for using this graphic organizer were given before the intervention was implemented. Due to this, the researcher decided to modify the graphic organizer rather than choose a different organizer and reteach the skill, potentially confusing the student. In future research, it is imperative to use an appropriate story mapping tool relative to the type of text being used. While this study modified the tool, the results could still be affected by this modification. Further, the story mapping condition ceased after two data points. The other conditions continued for a total of three data points. Story mapping was stopped due to the lowest average scores; however, if it continued, there was the possibility of seeing an increasing trend. Future experiments should continue interventions for enough sessions to determine if there is a trend.

Conclusion

Despite the limitations, the current student extends the understanding of the use of BEA for choosing an appropriate intervention for a student in a one-to-one setting. The results also support using BEA with reading comprehension interventions. Using a BEA to select an intervention is efficient and leads to positive outcomes for students who struggle with reading comprehension.

References

Ahmadi, M. R., Ismail, H. N., & Abdullah, M. K. K. (2013). The relationship between students' reading motivation and reading comprehension. *Journal of Education and Practice*, *4*(18), 8-17. https://iiste.org/Journals/index.php/JEP/article/view/7814

Andersen, M. N., Daly III, E. J., & Young, N. D. (2013). Examination of a one-trial brief experimental analysis to identify reading fluency interventions. *Psychology in the Schools*, *50*(4), 403-414. https://doi.org/10.1002/pits.21682

Axelrod, M. I., & Coolong-Chaffin, M. (2017). Using BEA to select skill and/or performance interventions for oral reading fluency. http://digital.library.wisc.edu/1793/82506

Bauer, M., Golz, M., & Coolong-Chaffin, M. (2021). Using BEA in a virtual reading intervention. http://digital.library.wisc.edu/1793/82506

Burns, M. K., & Wagner, D. (2008). Determining an effective intervention with brief experimental analysis for reading: A meta-analytic review. *School Psychology Review, 37, 126-136.* https://doi.org/10.1080/02796015.2008.12087913

Burns, M.K., Ganuza, Z.M., & London, R.M. (2009). Brief experimental analysis of written letter formation: Single-case demonstration. *Journal of Behavioral Education, 18*(1), 20–34. https://doi.org/10.1007/s10864-008-9076-z

Burns, M. K., Taylor, C. N., Warmbold-Brann, K. L., Preast, J. L., Hosp, J. L., & Ford, J. W. (2017). Empirical synthesis of the effect of standard error of measurement on decisions made within brief experimental analyses of reading fluency. *Psychology in the Schools*, *54*(6), 640-654. https://doi.org/10.1002/pits.22022

Cates, G. L., Thomason, K., Havey, M., & McCormick, C. (2007). A preliminary investigation of the effects of reading fluency interventions on comprehension: Using brief experimental analysis to select reading interventions. *Journal of Applied School Psychology*, *23*(1), 133-154. https://doi.org/10.1300/J370v23n01_07

Coolong-Chaffin, C. M., & Wagner, D. (2015). Using brief experimental analysis to intensify Tier 3 reading interventions. *Learning Disabilities Research & Practice, 30*(4), 193–200. https://doi.org/10.1111/ldrp.12086

Coyne, M. D., Oldham, A., Dougherty, S. M., Leonard, K., Koriakin, T., Gage, N. A., Burns, D., & Gillis, M. (2018). Evaluating the effects of supplemental reading intervention within an MTSS or RTI reading reform initiative using a regression discontinuity design. *Exceptional Children, 84*(4), 350–367. https://doi.org/10.1177/0014402918772791

Daly, E. J., Witt, J. C, Martens, B. K., & Dool, E. J. (1997). A model for conducting a functional analysis of academic performance problems. *School Psychology Review, 26,* 554-574. https://doi.org/10.1080/02796015.1997.12085886

Dexter, D. D., & Hughes, C. A. (2011). Graphic organizers and students with learning disabilities: A meta-analysis. *Learning Disability Quarterly*, *34*(1), 51-72. https://doi.org/10.1177/073194871103400104

Dori, Y. J., Avargil, S., Kohen, Z., & Saar, L. (2018). Context-based learning and metacognitive prompts for enhancing scientific text comprehension. *International Journal of Science Education*, *40*(10), 1198-1220. https://doi.org/10.1080/09500693.2018.1470351

El Zein, F., Solis, M., Vaughn, S., & McCulley, L. (2014). Reading comprehension interventions for students with autism spectrum disorders: A synthesis of research. *Journal of Autism and Developmental Disorders*, *44*, 1303-1322. https://doi.org/10.1007/s10803-013-1989-2

Everett, G. E., Swift, H. S., M c Kenney, E. L., & Jewell, J. D. (2016). Analyzing math-to-mastery through brief experimental analysis. *Psychology in the Schools*, *53*(9), 971-983. https://doi.org/10.1002/pits.21959

Fienup, D. M., Reyes-Giordano, K., Wolosik, K., Aghjayan, A., & Chacko, A. (2015). Brief experimental analysis of reading deficits for children with attention-deficit/hyperactivity disorder. *Behavior Modification*, *39*(1), 191-214. https://doi.org/10.1177/0145445514550393

Finnegan, E., & Mazin, A. L. (2016). Strategies for increasing reading comprehension skills in students with autism spectrum disorder: A review of the literature. *Education and Treatment of Children*, *39*(2), 187-219. https://www.jstor.org/stable/44684103

Fuchs, D., Fuchs, L. S., & Compton, D. L. (2012). SmartRti: A next generation approach to multi-level prevention. *Exceptional Children, 78*(3), 263–279. https://doi.org/10.1177/001440291207800301

Gentilini, L. M., & Greer, R. D. (2020). Establishment of conditioned reinforcement for reading content and effects on reading achievement for early-elementary students. *Psychological Record, 70*(2), 327–346. https://doi.org/10.1007/s40732-020-00382-6

Golke, S., Dörfler, T., & Artelt, C. (2015). The impact of elaborated feedback on text comprehension within a computer-based assessment. *Learning and Instruction*, *39*, 123-136. https://doi.org/10.1016/j.learninstruc.2015.05.009

Gortmaker, V. J., Daly, E. J., III, McCurdy, M., Persampieri, M. J., & Hergenrader, M. (2007). Improving reading outcomes for children with learning disabilities: Using Brief Experimental Analysis to develop parent-tutoring interventions. *Journal of Applied Behavior Analysis, 40*(2), 203–221. https://doi.org/10.1901/jaba.2007.105-05

Grünke, M., Wilbert, J., & Stegemann, K. C. (2013). Analyzing the effects of story mapping on the reading comprehension of children with low intellectual abilities. *Learning Disabilities: A Contemporary Journal*, *11*(2), 51-64. https://eric.ed.gov/?id=EJ1039818

Güler, Ö., & Özmen, R. G. (2010). Using the brief experimental analysis to determine the effective reading comprehension strategy in story comprehension of students with mental retardation. *International Online Journal of Educational Sciences*, *2*(3), 930-954. https://iojes.net/?mod=makale_tr_ozet&makale_id=41348

Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Educational Research*, *77*(1), 81-112. https://doi.org/10.3102/003465430298487

Hintze, J. M., Wells, C. S., Marcotte, A. M., & Solomon, B. G. (2018). Decision-making accuracy of CBM progress-monitoring data. *Journal of Psychoeducational Assessment*, *36*(1), 74-81. https://doi.org/10.1177/0734282917729263

Idol, L., & Croll, V. J. (1987). Story-mapping training as a means of improving reading comprehension. *Learning Disability Quarterly, 10*(3), 214-229. https://doi.org/10.2307/1510494

Kamil, M. L., Borman, G. D., Dole, J., Kral, C. C., Salinger, T., & Torgesen, J. Y. (2008). *Improving adolescent literacy: Effective classroom and intervention practices (NCEE #2008-4027)*. National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education. https://eric.ed.gov/?id=ED502398

Kurniaman, O., Zufriady, Z., Mulyani, E. A., & Simulyasih S. B. N. (2018). Reading comprehension skill using graphic organizer for elementary school students. *Journal of Teaching and Learning in Elementary Education*, *1*(2), 75-80.

Martens, B. K., & Gertz, L. E. (2009). Brief experimental analysis: A decision tool for bridging the gap between research and practice. *Journal of Behavioral Education*, *18*, 92-99. https://doi.org/10.1007/s10864-009-9079-4

McComas, J. J., Wacker, D. P., & Cooper, L. J. (1996). Brief experimental analysis of stimulus prompts for accurate responding on academic tasks in an outpatient clinic. *Journal of Applied Behavior Analysis, 29*(3), 397–401. https://doi.org/10.1901/jaba.1996.29-397

McCullough, C. M. (1957). Responses of elementary school children to common types of reading comprehension questions. *The Journal of Educational Research, 51*(1), 65-70. https://doi.org/10.1080/00220671.1957.10882440

McMaster, K. L., Du, X., & Pétursdóttir, A. L. (2009). Technical features of curriculum-based measures for beginning writers. *Journal of Learning Disabilities*, *42*(1), 41-60. https://doi.org/10.1177/0022219408326212

Mong, M. D., & Mong, K. W. (2012). The utility of brief experimental analysis and extended intervention analysis in selecting effective mathematics interventions. *Journal of Behavioral Education*, *21*, 99-118. https://doi.org/10.1007/s10864-011-9143-8

Mortini, D. (2020). *Reading comprehension passages*. Ereading Worksheets. https://www.ereadingworksheets.com/e-reading-worksheets/about/

National Center on Educational Statistics. (2022). *NAEP: The nation's report card*. U.S. Department of Education. https://www.nationsreportcard.gov/reading?grade=8

Nevin, J. A., Smith, L. D., & Roberts, J. (1987). Does contingent reinforcement strengthen operant behavior?. *Journal of the Experimental Analysis of Behavior, 48*(1), 17-33. https://doi.org/10.1901/jeab.1987.48-17

Nikanowicz, C. L. (2009). *A brief experimental analysis of reading comprehension* (Doctoral dissertation, Miami University).

Noell, G. H., Gansle, K. A., Witt, J. C., Whitmarsh, E. L., Freeland, J. T., LaFleur, L. H., Gilbertons, D. N., & Northup, J. (1998). Effects of contingent reward and instruction on oral reading performance at differing levels of passage difficult. *Journal of Applied Behavior Analysis, 31*(4), 659-663. https://doi.org/10.1901/jaba.1998.31-659

Özmen, E. R., & Atbasi, Z. (2016). Identifying interventions for improving letter formation: A brief experimental analysis of students with intellectual disabilities. *International Electronic Journal of Elementary Education*, *9*(1), 197-209. https://www.iejee.com/index.php/IEJEE/article/view/152

Parker, D. C., Burns, M. K., McMaster, K. L., & Dickey, B. N. (2012). An application of brief experimental analysis with early writing. *Journal of Behavioral Education, 21*, 329–349. https://doi.org/10.1007/s10864-012-9151-3

Reutzel, D.R. (1985). Story maps improve comprehension. *Reading Teacher, 38*(4), 400-404. https://www.jstor.org/stable/20198799

Reed, D. K. (2023). Reading intervention in middle schools: Challenges and suggested approaches. *Middle School Journal, 54*(5), 42-51. https://doi.org/10.1080/00940771.2023.2254176

Riley-Tillman, T. C., Burns, M. K., & Kilgus, S. P. (2020). *Evaluating educational interventions: Single-case design for measuring response to intervention*. Guilford Publications.

Ritter, C. (2020). *Identification of reading comprehension interventions using brief experimental analysis* (Doctoral dissertation, University of Cincinnati).

Rouse-Billman, C., & Alber-Morgan, S. (2019). Teaching self-questioning using systematic prompt fading: Effects on fourth graders' reading comprehension. *Preventing School Failure*, 63(4), 352-358. https://doi.org/10.1080/1045988X.2019.1619508

Scammacca, N. K., Roberts, G., Vaughn, S., & Stuebing, K. K. (2015). A meta-analysis of interventions for struggling readers in grades 4–12: 1980–2011. *Journal of Learning Disabilities*, *48*(4), 369-390. https://doi.org/10.1080/1045988X.2019.1619508

Schiefele, U., Schaffner, E., Möller, J., & Wigfield, A. (2012). Dimensions of reading motivation and their relation to reading behavior and competence. *Reading Research Quarterly*, *47*(4), 427-463. https://doi.org/10.1002/RRQ.030

Schreder, S. J., Hupp, S. D., Everett, G. E., & Krohn, E. (2012). Targeting reading fluency through brief experimental analysis and parental intervention over the summer. *Journal of Applied School Psychology*, *28*(2), 200-220. https://doi.org/10.1080/15377903.2012.670047

Shute, V. J. (2008). Focus on formative feedback. *Review of Educational Research*, *78*(1), 153–189. https://doi.org/10.3102/0034654307313795

Taylor, B. M., & Beach, R. W. (1984). The effects of text structure instruction on middle-grade students' comprehension and production of expository text. *Reading Research Quarterly, 19*(2), 134-146. https://www.jstor.org/stable/747358

Torgesen, J., Houston, D., & Rissman, L. (2007). *Improving literacy instruction in middle and high schools: A guide for principals.* RMC Research Corporation, Center on Instruction.

University of Oregon, Center on Teaching and Learning (2020). *DIBELS 8th Edition 2017-2019 Percentiles.* (Technical Report 2001). Author.

Van der Kleij, F. M., Feskens, R. C., & Eggen, T. J. (2015). Effects of feedback in a computer based learning environment on students' learning outcomes: A meta-analysis. *Review of Educational Research*, *85*(4), 475-511. https://doi.org/10.3102/0034654314564881

Watson, S. M., Gable, R. A., Gear, S. B., & Hughes, K. C. (2012). Evidence-based strategies for improving the reading comprehension of secondary students: Implications for students with learning disabilities. *Learning Disabilities Research & Practice*, *27*(2), 79-89. https://doi.org/10.1111/j.1540-5826.2012.00353.x

Zhang, X., Mostow, J., Duke, N., Trotochaud, C., Valeri, J., & Corbett, A. (2008). Mining free form spoken responses to tutor prompts. In *Educational Data Mining 2008*. https://www.cs.cmu.edu/~listen/pdfs/EDM2008%20freeform-final.pdf