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The Role of Explicit Practice on Learning Reading Component Strategies on Adolescents With Reading Difficulties

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The Role of Explicit Practice on Learning Reading Component Strategies
on Adolescents With Reading Difficulties

A Dissertation submitted in partial satisfaction
of the requirements for the degree of

Doctor of Philosophy

in

Education

by

Olivia K. Chan

March 2018

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Dedication

To Chloe,
my past students,
and fellow educators in Special Education:

our discipline is motivated by compassion.
ABSTRACT OF THE DISSERTATION

The Role of Explicit Practice on Learning Reading Component Strategies for Adolescents With Reading Difficulties

by

Olivia K. Chan

Doctor of Philosophy, Graduate Program in Education
University of California, Riverside, March 2018
Dr. Rollanda O’Connor, Chairperson

The majority of the nation’s eighth grade students identified with disabilities scored below basic in the U.S. History assessment in 2014 (NAEP, 2014) while 25% of adolescents without disabilities scored below basic. At the state level, the average eighth grade reading scores in California were significantly lower than the national public. One approach to address below expected levels of reading comprehension is to integrate explicit reading strategies with practice reinforcement in secondary classrooms. Providing reading strategies practice in subject content inclusion classrooms helps students improve reading comprehension of history content passages. Explicit reading comprehension instruction paired with explicit practice is effective for adolescents with Reading Difficulties (RD) because it provides the opportunity to learn correct procedures and apply them for processing new content.

This study evaluated the role of explicit reading strategy practice on reading strategy outcomes by measuring the amount of practice (frequency), and the amount of correct practice (accuracy) documented in student workbooks in history classes.
Understanding the effect of the quantity (frequency) and quality (accuracy) of strategy practice could inform issues of instructional efficiency for adolescents with RD in classroom and curriculum planning. This study examined whether features of explicit strategy practice predict reading component outcomes of 104 eighth grade adolescents with and without RD. Classroom practice workbooks completed by 52 students with RD and 52 typically developing students were analyzed for frequency and accuracy of practice in decoding, vocabulary, and comprehension tasks. Results indicated accurate reading comprehension practice predicts comprehension outcome within the context of explicit instruction for typically developing adolescents. Moreover, practice effects differed between adolescents with and without RD. Accurate decoding practice was found to relate to word reading outcomes for students with reading difficulties. Accurate and frequent comprehension practices were significantly associated with each other for students with RD.
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The majority of this state’s eighth graders identified with disabilities score below basic in reading (National Center for Education Statistics, 2013). One approach to address the diversity of reading abilities is to integrate explicit reading strategies with practice reinforcement in secondary classrooms. Providing explicit reading strategies practice in subject content inclusion classrooms ultimately helps students improve reading comprehension and self-efficacy perceptions (Van Keer & Verhaeghe, 2005). However, adolescents with LD or reading difficulties are struggling to meet proficiency in subject content area classes, largely due to their deficiencies in reading skills thus affecting their ability to create meaning from expository text, or reading comprehension. If expectations to learn content in general education classes are to remain the same for all students, then adjustment in classroom practice would be vital now more than ever to accommodate the diversity of students’ reading abilities. Not only would secondary students directly and explicitly benefit from the disciplinary literacy skills needed for making meaning from content area text (Shanahan & Shanahan, 2008), but learning these reading skills corporately as a classroom increases chances that emerging literacy skills will be practiced and applied correctly.

Why Explore Strategies to Improve Adolescent Reading Development?

Adolescent students in general are not performing proficiently in reading achievement and are also far below proficiency in history. According to the 2013 Nation’s Report Card, 26% of eighth graders in California read below basic level, which is greater than the nation’s average of 18%. Students with learning disabilities (LD) are held accountable to the same content standards as their peers without disabilities (Mastropieri
& Scruggs, 2007); however, 77% of eighth graders identified with disability in this state (64% national average) score below basic in reading. This disparity is a problem that needs to be addressed because the majority of students with LD receive history education instruction in general education classrooms (Coyne, Keme’ennui, & Carmine, 2007; Lintne & Schweder, 2008) and only 5% of the nation’s eighth graders with disabilities score at or above proficiency in U.S. history, with no increase since 2010 (NCES, 2014). In other words, almost all eighth graders with LD are scoring below proficiency and are at-risk of failing in U.S. history. In fact, the majority of eighth graders without disabilities are also at risk in history with a mere 20% of the nation’s eighth graders scoring at proficiency on social studies concepts and content (NAEP, 2014). The Nation’s Report Card suggests that eighth graders at large are ill-equipped to meet the curricular demands of historical inquiry, which could hinder participation as informed citizens. Furthermore, a recent state adoption of the national curriculum, Common Core (CCSS.ELA-LITERACY.RH.6-8.1), reformed history education to align content with a critical thinking emphasis as an instructional outcome. Students are expected to provide reasonable answers to questions in content subjects, which ultimately requires students to have strong reading abilities in order to make meaning and reasonable analysis from factual knowledge provided in text.

Explicit reading comprehension instruction paired with explicit practice is effective for adolescents with LD because it provides the opportunity to learn correct procedures and apply them for processing new content. (Swanson & Hoskyn, 2001). This study aims to evaluate the role of explicit reading strategy practice on reading strategy achievement.
by measuring the amount of practice (frequency), and the amount of correct practice (accuracy) documented in student workbooks in history classes. Understanding the effect of the quantity (frequency) and quality (accuracy) of strategy practice could bring knowledge about instructional efficiency for adolescents with LD in classroom and curriculum planning. Testing the possibility of improving comprehension using explicit reading instruction with whole class practice in history classrooms is the context in which this study’s data were collected. However, few studies have explored the contribution of frequent and accurate practice with explicit reading strategies on growth in reading skills for struggling readers in middle school history classes. Moreover, practice effects might differ between adolescents with and without LD. Thus, I seek to answer the following questions:

1. What is the effect of reading strategy practice, measured in frequency and accuracy, on improvements in reading skills: (a) decoding, (b) vocabulary, and (c) reading comprehension for eighth grade low readers?

2. Are these effects similar for typical readers?

3. What is the effect of combined vocabulary and comprehension strategy practice, measured in frequency and accuracy, on improved comprehension skills?

In this study, I will describe the theoretical premise of reading practice, with a focus on evidence-based instructional approaches unique to adolescents with LD. What are the reading challenges that burden struggling readers in middle school, and can the augmentation of strategy practice have a positive effect on the reading process? Finally, I review the literature that describes the issues with using strategy practice as a predictor
for academic achievement. This review is followed by the current study’s proposed research sample, method, and analytical tools.

**Theoretical Framework for Reading Components and Strategy Practice**

The theoretical framework of this study is based on the Simple View of Reading formula presented by Gough and Tunmer (1986) that proficient reading can be predicted by the product of two basic components: word recognition and language comprehension. Hoover and Gough (1990) defined word decoding as efficient word recognition that goes beyond sounding out words based on phonics rules, and includes fast and accurate reading of familiar and unfamiliar words in both lists and connected text. They defined language comprehension as deficiencies in any of the components in the formula would result in deficient reading comprehension (Catts, Adolf, & Weismer, 2006). On the same line of reasoning, students who strengthen their word reading and ability to derive meaning from words (receptive vocabulary) should strengthen comprehension of printed text.

This study used a database that includes measures of multisyllabic word decoding, academic vocabulary, and reading comprehension as outcomes of explicit instruction in these areas. Thus, the measures reflect the various components of Gough and Tunmer’s simple view of reading. The study focused on examining student practice materials for measures of frequency and accuracy of strategy practice of the reading components taught in class and offered as strategy development in each component of reading.

**Reading comprehension with adolescents.** The Adolescent Reading Model (Deshler & Hock, 2006) provides a conceptual framework for testing the findings for the
adolescent population, and seeks to determine the unique power of specific components of simple reading. The underlying premise of this model is the presumption that most adolescents have acquired the foundational word recognition (phonemic, phonological awareness, sight words) and language skills associated with early reading instruction up to the third grade level, but that some struggling readers still need intervention in these areas. Subsequently, reading instruction for adolescents should include a bridging strategy that provides explicit instruction and teacher-guided support to help struggling readers improve word recognition and fluency, as well as comprehension. Scaffolded instruction is a participatory approach to literacy instruction, similar to the theory of explicit practice (Au & Raphael, 1998), in which a teacher supports student learning and then gradually withdraws that support as students show the capacity to assume more responsibility for their own learning (Alvermann, 2002). A key and distinguishing component for the adolescent reading model is the added role of self-regulation, or executive processes for language comprehension (Kintsch, 1998) that can be evidenced in explicit practice. This important element of integrating cognitive and meta-cognitive strategies requires adolescents to take initiative with strategic action, the initiative that begins the end of teacher support, a practice easily applied as common classroom review and practice. This model heavily relies on students to put effort in constructing meaning of text material (Deschler & Hock, 2006). The outcome of this model is to increase students’ ability to integrate and apply new knowledge to novel learning situations. Students with learning difficulties or disabilities rarely take initiative in their own learning (Torgesen, 2002). This study interpreted the student effort that was built into the
classroom instructional time where students were given opportunities to take initiative to make meaning from text, as deliberate practice that can be counted in frequency and accuracy. I hypothesized that students with LD or difficulties will vary widely from typically developing students in frequency and accuracy of practice, thus affecting their rate of learning particular reading components.

Participants in this study are adolescents with reading difficulties who exhibit learner characteristics that could be problematic in light of the rigorous curricular demands of content area courses. Learner characteristics may involve greater difficulty with manipulating and transforming information, trouble holding large quantities of information in memory, comparing and contrasting relevant information, or expressing succinct thoughts in writing (Deshler et al., 2001; Swanson & O’Connor, 2009). In addition, students with LD tend to focus on unimportant or irrelevant information rather than discern information they need for understanding text (Newman et al., 2006). Subject matter teachers ought to not only deliberately teach students how to process information, but also provide opportunities for students to actually process and review strategies in the classroom. Boling and Evans (2008) held that the summarizing strategy is one of the most challenging intellectual activities required in reading because students must have the ability to delete irrelevant details, combine similar ideas, condense main ideas, and connect themes into concise statements. Producing main ideas and summarizing are the comprehension strategies practiced in this proposed study. Even within the scaffolded framework that supports summarizing, they concede that teacher instruction and practice in each summary step is imperative for the acquisition of summarizing skills. However,
the study does not mention how practice might look, or when to stop practicing. In fact, research on practice of important explicit reading strategies for comprehension in terms of its frequency and accuracy is scarce.

**Explicit practice.** The theoretical basis for student practice is founded on the work of Pearson and Gallagher (1983) and the term “guided practice,” borrowed from Au and Raphael (1998)—that task responsibilities assumed by the teacher could be gradually assumed by the student. As the student assumes more responsibility, the teacher should assume less. However, the process of this transfer is based largely on shared responsibility of teacher and student, and the initiation from the teacher. A resulting benefit of student practice in reading is building stamina. Stamina is critical to becoming a strong reader (Stanovich, 1986), and built by practicing reading and listening to texts of increasing length (Gulla, 2012).

With the assistance of routine explicit strategy practice in classrooms, secondary students would have greater opportunities to acquire the necessary skills to strengthen reading strategies with expository text, thereby increasing reading proficiency and history achievement concurrently (Deshler, 2005; Ferretti, MacArthur, & Okolo, 2001; Swanson & Hoskyn, 2001). Access to and practice of explicit reading strategies together may help students make gains in reading comprehension, the process of both extracting and constructing meaning from text (Snow, 2002). Providing explicit practice as strategy maintenance after direct strategy instruction (Gajria et al., 2007) for older students with LD may be a vital component of a multi-component approach to helping students with
text comprehension (Deshler, Schumaker, Lenz, Bulgren, Hock, Knight, & Ehren, 2001; Roberts, Torgesen, Boardman, & Scammacca, 2008).

For this study, data that could be used to measure explicit strategy practice have been collected, but have not been analyzed on the word reading, vocabulary, and comprehension tasks recorded in student workbooks based on the reading strategies taught in history classrooms. The student workbooks document how frequently practice was conducted and how accurately the tasks were practiced. These features of practice may impact how essential reading comprehension components (decoding, learning academic vocabulary, and constructing main ideas from text) are taught in the classroom. In turn, the act of reading in the history classroom includes decoding multisyllabic words, recalling academic vocabulary, and manipulating text information for constructing meaning.

**Explicit Reading Strategy Practice**

The operational definition of “practice” in this study refers to opportunities presented daily in student materials in which students apply in writing what was learned as a reading strategy (Swanson, 1999) in the classroom following group instruction. Whether completed with a teacher’s guidance, independently, or a combination of both, the practice is explicit in purpose, organized with a scaffolded design, and incremental in difficulty. Swanson and Hoskyn (2001) presented a review of sixteen components of instructional strategies found effective for adolescent students with LD. They found two components—advance organizers and explicit practice—explained significant variance in the prediction of effect sizes. Their review focused on how information was taught and
sustained to influence good information processing; explicit practice and advance organizers were common components in the composite analysis reported. The team described explicit practice as treatment related to distributed review and practice, repeated practice, sequenced reviews, daily feedback, or repetition within text. The benefits are not described in detail beyond having “great enhancement of long-term retention of all kinds of information and skills” (p.116).

Parameters of explicit strategy practice are also important to communicate precisely what is and what is not included in this proposed study. The operational definition of practice here excludes guided reading, which is monitored independent reading in which a small group of students with similar needs read extensively on their own (Willingham, 2009). Instead, the explicit strategy practice would be more similar to study guides (Horton & Levitt, 1989) where learning by doing is more effective than watching. Practice for the purpose of gaining a minimum level of competence until one can reliably complete a task without supervision protects against forgetting. However, explicit strategy instruction has its practical disadvantages for teachers. Explicit reading instruction is time intensive (Harris & Pressley, 1991) and laborious with a full class of diverse learners. Also, practice requires intense, focused effort, and may be boring, thus students may not find it inherently enjoyable. Practice is not rote repetition or drilling, but rather, a deliberate cognitive act that requires decision-making, taking more advanced executive function (Brabeck, Jeffrey, & Fry, 2011; Willingham, 2009).

Another refining distinction of explicit strategy practice is its contrast to formative assessment, where a student’s performance is collected and compared to a set
criteria for the basis of molding ongoing educational objectives (Sadler, 1989), similar to “just-in-time instruction,” where teachers wait until students actually need more information to solve a complex problem, which supposedly helps by keeping the amount of information students hold in their short-term memories at minimum as students attempt or practice (Linneman & Plake, 2006; Simkins & Maier, 2008). Explicit practice produced in this study does not change or influence the objectives of strategy development. Instead, the focus of practice is similar to the mental work that van den Broek and Kremer (2000) described as cognitive or even behavioral activities that will likely increase comprehension.

**Reading Challenges for Secondary Students**

**Expository text.** The fact that history instruction is based heavily on expository text suggests that history classrooms may be perfect settings to practice learning the reading comprehension skills that are particularly important for students with LD (Stearns, Seixas, & Wineburg, 2000). Addressing low history achievement by strengthening reading strategies with frequent and accurate practice could help students develop the Common Core competencies in history curriculum (Schumaker, Deshler, Bulgren, & Davis, 2002). Content courses commonly use expository text for knowledge acquisition. Expository text, in contrast to narrative text, is often rigorously conceptual and based on specialized information. These non-fiction books are designed to explain the “narrative” of the discipline by providing key terms, illustrations, photos of artifacts, or artistic depictions. Furthermore, history texts may include a variety of text structures to explain underlying patterns of change chronologically, politically, socially,
economically, and globally (Meyer & Freedle, 1984). Gersten and Okolo (2007) summarize that even though there is much debate about the relative advantages of domain-specific versus more general cognitive strategy instruction, most of the cognitive strategy research for students with LD has focused on the latter. Even strategies for history reasoning posed by De La Paz, Morales, and Winston (2007) are dependent on the ability of critical reading in order to analyze historical documents and distinguish multiple perspectives of events. Integrating reading instruction with social studies instruction could support teachers in their effort to teach historical reasoning strategies.

For adolescents with LD, expository texts are more challenging than narrative text on three major points: unfamiliar words, specialized academic words, and unfamiliar and changing text structures (Williams & Pao, 2013). Text structure of expository textbooks changes with content for good reason—to best present the narrative of the history story. For example, history textbooks contain description of events, viewpoints from important leaders, and case studies where a main idea summary structure would best fit the organization of that information. Or, an analysis of historical figures may be depicted with a compare and contrast structure. With no predictable pattern of text organization change, teaching commonly used text structures can prepare students for independent reading of novel passages. Frequent distributed explicit strategy practice with these common text structures can help students with LD understand these texts (Williams & Pao, 2013). Developing awareness of how a writer organizes information assists students in recalling the content of a selection (Alvermann, 2002). The explicit strategy practice for reading comprehension in this study uses text enhancers such as advance organizers
related to the main idea structure found in secondary history textbooks. After identifying
details or text structures for making common comprehension relations, students then
write their own summaries and conclusions.

**Difficulty with decoding multisyllabic words.** Older students with LD may be
able to read basic sight words, but continue to struggle with reading multisyllabic words.
Difficulty reading multisyllabic words may lead to increased difficulty in reading fluency
and reading comprehension (McCandliss, Beck, Sendak, & Perfetti, 2003). Lenz and
Hughes (1990) taught twelve middle school students daily for 6 weeks by modeling how
to dissect multisyllabic words to reduce oral reading errors, and help increase
comprehension. O’Connor, Bell, Harty, Larkin, Sackor and Zigmond (2002) modified the
DISSECT method of decoding multisyllabic words by reducing the number of steps
(BEST). This proposed study includes decoding strategy practice using BEST on the
word reading outcomes. Students were given word reading instruction with explicit
strategy practice opportunities built into the same class hour. The strategy practice to
read novel multisyllabic words, sometimes with morphological hints, may be impacted
by the frequency and type of practice (accuracy characteristic). As students practice
reading new words part by word part, increased frequency or accuracy of practice could
correlate with higher recognition of word patterns and higher word reading outcome
scores.
Unfamiliar academic vocabulary. Students with LD often have limited vocabulary knowledge due to reading related difficulties (Baker, Simmons, & Kame’enui, 1998). Limited vocabulary impedes the understanding of text, and it affects the degree to which students with LD can engage in the process of historical inquiry and knowledge acquisition. Vocabulary knowledge is particularly important when so much of history learning is dependent on text-based primary sources (Harmon, Hedrick, & Wood, 2005). The National Center for Education Evaluation (NCEE, 2008) developed an IES practice guide for effective classroom and intervention practices for improving adolescent literacy (Kamil, Borman, Dole, Kral, Salinger, & Torgesen, 2008). The guide offers recommendations for providing explicit vocabulary instruction by integrating vocabulary instruction into the existing curriculum of subject areas to enhance students’ ability to acquire textbook vocabulary. Explicitly teaching vocabulary as part of content area classes may strengthen students’ ability to create meaning from text, but many of the academic words used in secondary textbook are unfamiliar multisyllabic words (Kamil et al., 2008). Teachers can collect “Tier 2” subject-bound academic words as suggested by Beck, McKeown, and Kucan (2002) to build repeated exposure to unfamiliar words before reading expository passages.

Middle school content classes provide an ideal setting to initiate instruction in domain-specific academic vocabulary, especially when different contexts may alter word meanings (Baumann & Graves, 2010). Easily decodable words can take on different meanings depending on the academic discipline in which the word is used (e.g. “force” means energy in physics, while it means coercion in social science). With the increased
morphological complexity comes a higher level of abstraction, which accompanies a higher proportion of Latin and Greek word origins (Nagy & Townsend, 2012), which can be a source of frustration for adolescents with LD who may have grown an aversion to reading (Stanovich, 1986). Vocabulary instruction may be the key for improved adolescent achievement, especially for students with LD (Jitendra, Edwards, Sacks, & Jacobson, 2004). Critical to text comprehension at this stage is intentional teaching of vocabulary to curb the old practice of resorting to guessing meanings (Harmon, Hedrick, & Wood, 2005). Moran (1990) inquired into the use of intensive direct vocabulary instruction in science with sixth-grade migrant students. Students’ performance in science at the end of nine weeks increased at least one letter grade. The vocabulary instruction consisted of structural analysis, repetition and drill of science concepts, and the pre-teaching of science terms. One of the ways of teachers can improve comprehension may be to preteach vocabulary associated with reading assignments (Alvermann, 2000), and the instruction provided with this intervention reflects this approach.

Reading comprehension strategies. According to Francis, Shaywitz, Stuebing, Shaywitz, and Fletcher (1996), about three-fourths of students who struggle with reading in third grade will continue to read poorly throughout high school. Almost 20 years after Durkin’s (1978) report of the paucity of comprehension instruction in her classroom observation study, researchers report comprehension instruction has moved away from the traditional teacher-centered to the student-engaged paradigm where students construct meaning by interacting with text (Dole, Duffy, Roehler, & Pearson, 1991). Cognitively based views also transformed instruction to view novice readers as experts with texts and
tasks by teaching strategies, which are inherently adaptable and generalizable in contrast to rigid, lower-level skills. Duke and Pearson (2009) describe the long string of collective strategies for teaching text comprehension could be embedded, but suggested that comprehension instruction is best focused on a few well-taught and well-learned strategies. In this study, best practices in reading comprehension instruction would be strengthened by exploring a quantitative representation of frequency and accuracy of practice as a practical definition of “well-learned” evidence-based comprehension strategies (Kamil, et al., 2008).

Ellis and Graves (1990) found that a paraphrasing strategy was more effective on reading comprehension of main ideas than repeated readings for students in grades 5-7. Also, the combination of repeated readings in addition to paraphrasing instruction was no more effective than paraphrasing alone. This study extended the work of Ellis and Graves (1990) by exploring the effects of amounts and accuracy of practice. Kamil et al. (2008) suggest also that intensive interventions could be adopted for use in content-area classrooms. The explicit comprehension strategy practice examined here conforms to the suggestions in the form of intense daily practice on generating main ideas and paraphrasing history text. Another effective reading comprehension strategy for adolescents with LD is the usage of text enhancers such as graphic organizers as visual depictions of key concepts that can help struggling readers integrate and process information (Gajria, Jitendra, Sood, & Sacks, 2007). In this study, students were explicitly taught main idea identification and the practice of this evidence-based
comprehension strategy will be the predictor measure of this study (Gajria et al., 2007; Scruggs, Mastropieri, Berkeley, & Graetz, 2010).

**Significance of this Study**

The purpose of the study is to understand whether frequency and accuracy of reading strategy practice influences reading outcomes of adolescents with LD. The outcome of this study may help teachers make informed decisions about the role of student practice for content comprehension gains. Measures of word reading, vocabulary, and reading comprehension practice were collected during a three week intervention in six history classes. Students wrote in strategy workbooks that required them to generate daily written responses distributed over 12 days after explicit reading instruction taught by their history teachers. The written practice reflects students’ application of reading strategies (Cepeda, Pashler, Vul, Wixted, & Rohrer, 2006). Finally, these original data will help determine the impact of the quantity and quality of practice on individual and collective growth patterns in reading outcomes. There is much evidence on the effectiveness of reading practice on learning and reading comprehension (Swanson & Hoskyn, 2001); however, frequency and accuracy of reading strategies practice are rarely examined as influences on learning, especially with the goal of finding a dosage recommendation of strategy practice on reading achievement for secondary students with LD.
Literature Review

In this section, I present brief accounts of research to date which between and across them illustrate some of the main issues involved in securing evidence about the effects of the practice of explicit reading strategies for development of reading comprehension for adolescents with LD.

The Impact of Reading Practice in the Classroom

Much of the literature found on the effects of reading practice in the classroom is concerned with literal practice of reading aloud or the extension of time for students in independent silent reading. However, the team of Van Keer and Verhaeghe (2005) conducted research on the importance of explicit reading strategies instruction followed by practice on reading comprehension with elementary school children (grade 2 and 5). The study was premised on the cognitively based views of reading comprehension that emphasize proficient readers use a flexible repertoire of comprehension monitoring and regulating activities. They define cognitive strategies as rereading, activating prior background knowledge, and adjusting reading speed. Dole et al. (1991) had challenged the previous assumption of comprehension as an automatic result of decoding skills and posited that a flexible repertoire would increase the likelihood of comprehension. In addition, Van Keer and Verhaeghe cite the reports of the National Reading Council (Snow, 2002) that the true value of explicit cognitive reading strategy instruction for comprehension is that it helps students assume control (Raphael, 2000). Based on the relative merit of practicing reading strategies in variants of peer tutoring activities against
teacher-led whole class activities, the team hypothesized that instruction followed by practice with different leaders will bring about different achievements in reading comprehension (Pressley, Wharton-McDonald, Hampston, & Echevarria, 1998; Durkin, 1978). Van Keer and Verhaeghe found significant intervention effects with peer tutoring on second and fifth graders’ reading comprehension achievement, as well as fifth graders’ self-efficacy-related thoughts toward reading. Even though they mention they did not directly measure the amount of reading practice or accuracy of practice, the study validated independent practice for internalizing strategies.

Other studies on reading practice in the classroom are important because the findings show a strong connection between wide reading practice in its various forms and reading achievement. What is notable is that reading practice is considered as a variable for studies beyond fluency. Repetitive practice of basic reading skills, not the application of strategy practice proposed here, has also been considered in research. For example, Biemiller (1977-1978) found a positive relation between print exposure to letters and words and reading achievement. Cunningham and Stanovich (1998) found strong connections between reading achievement and vocabulary knowledge with wide reading. Directionally, they assert that first grade reading ability was reliably linked to exposure to print, and rapid acquisition of reading ability might help develop the lifetime habit of reading. They also found that individual differences in exposure to print were found to predict differences in growth of reading comprehension throughout the elementary grades.
Literature on reading practice is usually about the literal act of reading and rereading passages or print for retention of facts or relatively simple skills with young children. Accurate performance is assumed to be necessary for processing. Accurate processing through reading practice is seen as facilitating the transfer of information from working memory to long-term memory (Semb, Ellis, & Araujo, 1993), which is a form of rehearsal that is effortful, controlled thinking (Shiffrin & Schneider, 1984).

Theoretically, automatic processing for reading in stages from visual to phonological to episodic to comprehension aids the semantic stages, and is associated with developing higher speed with lower effort as automaticity increases (LaBerge & Samuels, 1974).

Summary: This study makes a departure from prior research by (a) targeting adolescent students on this strategies-based comprehension study; (b) evaluating features of independent student practice after reading strategies were explicitly taught in the social studies classroom; and (c) using data from student materials to evaluate the performance of students with LD or low reading ability on three measures of reading skills (i.e. decoding, vocabulary, and reading comprehension).

Research Syntheses on Reading Comprehension Practice and Adolescents with LD

Swanson and Hoskyn (2001) identified the instructional components of intervention studies that best predicted positive outcomes for adolescents with LD across many academic areas. The team sought to identify which tactics of the eight instructional factors best predicted effect sizes for adolescents with LD. These eight factors drawn from 45 instructional activities seemed to capture the majority of 93 interventions programs for adolescents at the time of study. The explicit factor represented two
instructional components: advance organization and explicit practice, but only explicit practice contributed significant variance. Treatment activities related to distributed review and practice, repeated practice, sequenced reviews, daily feedback, and/or weekly reviews contributed the highest significant variance to effect sizes.

Faggella-LUBY and Deshler (2008) wrote a summary of six literature reviews and research syntheses on reading comprehension and their general findings for adolescent students with LD, including Swanson and Hoskyn’s (2001) review. They extrapolated four factors that should be included as part of future research and development agendas. Two of the four are addressed in this proposed study: (1) study the role that dosage plays as an independent variable, and (2) study factors that can enhance scaling of reading comprehension interventions. In terms of cognitive strategies (e.g. explicit practice), they noted caution on two points that this study also addresses: the absent description of the amount of time in instruction and a phenomena that there appears to be a “threshold point at which continued instruction no longer explains student gains” (p.73). The team suggests two possible explanations for the threshold point as either considerable variance in explicitness of instruction or possibly prior student mastery of strategies attained leading up to discontinuation of instruction (e.g. unnecessary prolonged practice). The results of this study tightened the timeframe of that threshold point of student practice on explicit reading strategies for adolescents with LD. This study sought to make an exploratory comparison of measures (frequent or accurate) of explicit strategy practice that are most effective with adolescents with LD on growth in reading components.
Experimental Studies on Effects of Reading Practice on Reading Comprehension

Shany and Biemiller (1995) conducted an experimental study on the direct effects of increasing the amount of reading practice on a range of reading processes of poor readers in grades 3 and 4. Reading practice had beneficial impact on reading comprehension. Twenty-nine children were selected with 19 assigned to two experimental groups and 10 in a control group. One experimental group received practice with teacher assistance. The other experimental group received practice while listening to a tape. The control group received normal classroom reading instruction. Over a 16-week treatment period, monthly tests and posttests from the Canadian Test of Basic Skills (CTBS) were given. Reading practice involved oral reading with the teacher supplying any word the child could not read or reading practice with an audiotaped recording of passages. In summary, they found significant gains for both treatment groups exceeding the control group for reading comprehension scores, with no significant difference between the two treatment groups. They also found significant gains for listening comprehension, reading speed for primer text, and verbal efficiency. They did not expect or find a significant effect of assisted practice on decoding or reading pseudowords.

Fifteen years later in 2010, the team Shany and Biemiller reanalyzed data from their 1995 study with elementary children. They contrasted 14 children who had below median gains in reading comprehension and 15 who had above median gains. As in the 1995 study, they found reading practice had a large beneficial impact on reading comprehension. They wanted to examine individual differences in pre-program reading
and language status and differences in program progress associated with magnitude of reading comprehension gains over the 16 weeks of reading practice in their assisted reading. Using reading comprehension outcome to represent the most important indicator of successful reading, they contrasted participants showing the greatest progress in reading comprehension with those showing the least progress. Students who had made greater gains in reading comprehension also had significantly larger gains in vocabulary. The reading practice did not produce the vocabulary gains, but those who made larger gains in vocabulary had higher gains in reading comprehension. This information has bearing on this study with middle school students, in which practice could have a positive influence on both vocabulary and reading comprehension.

More recently, Topping, Samuels, and Paul (2007) explored the effect of independent reading practice on student achievement by analyzing a large dataset on 45,670 students from grades 1-12 collected from 139 schools in 24 different states using a computer assessment system (Accelerated Reader) counting over 3 million books. The team considered quantity of reading practice (engaged reading volume), measures of quality of practice (in terms of successful comprehension on AR tests), and classroom placement as significant factors. They found a positive relationship between the amount of reading practice and achievement gain, especially with the older students when both high quantity and high quality reading practice in combination were examined. The team concluded that time spent reading without guidance has only modest influence on reading achievement, negating their hypothesis that practice does not make perfect but that attuned, successful practice makes perfect. Appropriate, effective practice
implementation involves not only monitoring reading practice, but also implies action to guide the student towards successful comprehension. The team state that “actually monitoring the behavior and progress of individual students in a consistent, reliable, valid, detailed and timely way presents large practice problems for a teacher” so they defer to the computerized formative assessment systems for reading as a “progress- and activity-monitoring tool” that was used for data capture (p.255). The monitoring of reading practice in this proposed study is simply emphasizing that the data captured occurred in the classroom setting where an educator was present, as opposed to unsupervised, computerized practice where identity of participant is verifiable as the actual participant who completed the workbook activities, which is a departure from the study of the Topping et al. team.

Topping et al. (2007) tested a complex model of the effects of reading practice on reading achievement, in which quality of independent reading practice was seen as equally important to quantity of reading practice or reading volume, implying that both having access to opportunities to practice and actually taking those opportunities influence comprehension. Exploring the interaction of quantity and quality across the grades, they found an interaction where gains in achievement were found only with the combination of higher quantity and higher quality. High quantity with low quality was rare. Students with the combination of low quantity and low quality did particularly poorly relative to peers. Interestingly, they found moderate quality (75-79%) did not yield gains, even at moderate quantity. Not until the threshold of 80-84% quality did higher quantity begin to yield higher achievement. This combination seemed more
pronounced in the higher grades of 6-12, which informs the expectation of modest effect for comparison of frequency and accuracy of reading practice in this study.

**Benefits of Deliberate Practice on Expert Performance**

Twenty-three years ago, Ericsson, Krampe, and Tesch-Römer (1993) proposed that expert performance reflects a long period of deliberate practice rather than innate ability, or “talent”. Ericsson et al. (1993) found that elite musicians had accumulated thousands of hours more of deliberate practice than less accomplished musicians, and concluded that their theoretical framework could provide “a sufficient account of the major facts about the nature and scarcity of exceptional performance” (p. 392). Researchers interested in the theory and science of expert performance tested the implications and asserted that one can achieve almost anything with practicing more intensively than others (Watson, 1930).

Campitelli and Gobet (2008) conducted a longitudinal study on the role of practice on chess mastery by collecting questionnaires to 104 players of different skill levels. Using archival data, they tracked rating of some of the players throughout their career on the number of hours of individual and group practice, their use of different learning resources, and whether they had been trained by a coach. They found a strong correlation between chess skill and number of hours of practice, and group practice was a better predictor of high-level performance than individual practice. They also found that the masters level players had a higher chess rating than expert players after only three years of serious dedication to chess, although there were no differences in the number of hours of practice. The explanation given is that masters level players practice at an earlier
age. Finally, they found that activities such as reading books and using computer software were important for the development of high level performance. The results indicate limits in the deliberate practice framework.

Campitelli and Gobet (2011) conducted a synthesis of studies evaluating the deliberate practice (DP) theory in the domain of chess mastery for knowledge acquisition. The operating definition of deliberate practice is an activity that an individual intentionally repeats in order to improve performance. The DP framework claims that such behavior is necessary and sufficient to achieve high levels of expert performance. Their research found evidence that suggests DP is necessary but not sufficient, which counters the DP theory that rejects evidence that other variables are also necessary to achieve high levels. Instead, DP requires attention as an executive function, necessary for rehearsal, but not sufficient for achieving high level knowledge acquisition. Campitelli and Gobet suggested a minimum number of 3000 hours of DP in chess domain to achieve expert performance. They suggest future studies should be done for domains outside of chess and music.

Duckworth, Kirby, Tsukayama, Berstein, and Ericsson (2011) examined the expert performance and deliberate practice of children improve in an academic skill of learning vocabulary for a national spelling bee. The team found that deliberate practice mediated the prediction of final performance by personality trait of grit. The authors examined the effectiveness and subjective experience of three different preparation activities to improve spelling skill, including the following: deliberate practice of memorizing words while alone, quizzed by others, or wide reading for pleasure. The
expert performance approach is applied for the first time to a domain directly related to academic learning in children. Duckworth et al., (2011) operationally define deliberate practice as studying and memorizing words while alone, and measures the number of hours participants of a nationwide spelling bee content record by survey. In the current study, the domain of reading is separated into three reading tasks, namely decoding, vocabulary knowledge, and reading comprehension. The operational definition of deliberate practice is measured in the frequency and accuracy of practice as measured in student workbooks.

Summary: Even though some studies have found deliberate practice to be a significant predictor over innate ability alone, there are conflicting studies that suggest deliberate practice may not be sufficient to explain individual differences in performance, especially in the field of expertise or elite performance research (Hambrick, Oswald, Altmann, Meinz, Gobet, & Campitelli, 2014). Chess and music have been the target domains of widely studied expertise research—the task now is to develop and test theories that take into account many potential cognitive domains where deliberate repetition of skills may be transferable and manifest in other observable academic skills. This study applies the expert performance approach of deliberate practice, measured as accurate and frequent practice, to a domain directly related to academic learning in adolescents. The results from this proposed study may add to the discussion about deliberate practice specifically for the field of reading skill development building for adolescents with LD to achieve higher levels of reading mastery.
Method

This study examined the effects of explicit practice on multiple reading component skills with students with and without reading difficulties in eighth grade U.S. history classrooms.
Participants and Setting

Data for this study were derived from an extant database from the BRIDGES (Building Reading Interventions Designed for General Education Subjects) project, a three-year intervention study set in public middle schools to improve reading skills of secondary students with goals to increase the intensity of instruction for students who need learning support in the setting of history classrooms. Reading measures, classroom practice materials, and classroom observations were collected. This study used the reading measures and classroom practice work from two middle schools in two neighboring school districts in the same county in Southern California. Data were taken from Year 3 of BRIDGES, when participants received explicit reading strategies instruction delivered by their assigned teacher and completed classroom practice materials, which were collected at three time points of the school year—fall, winter, and spring. Specifically, this study used the data collected during the fall cycle, as the explicit reading practice is not confounded by the accumulation had winter and spring cycles been considered. Although student learning outcomes have been assessed as part of the larger BRIDGES project, the students’ workbooks had not been analyzed, nor were they included in the larger study’s research questions. Data collected were from School A of District A and School B of District B of the 2014-2015 school year.

Selection criteria The eligible participants are eighth grade students who were given a reading assessment during their seventh grade year using a standardized reading fluency measure (Test of Silent Contextual Reading Fluency; TOSCRF; Hammill, Wiederholt, & Allen, 2006). The TOSCRF is a reliable and valid measure of reading comprehension
and general reading ability that measures a student’s ability to recognize individual words displayed in a complete sentence so that the sentence makes sense. Students who scored 2 years below grade level on the TOSCRF were identified as potential participants. From this pool, a subset of students who received a failing score in their seventh grade history social science course were presented to eighth grade history teachers for participation recommendations. Lastly, students and parents together must consent to participation. Participating students are from two different schools, but received the same reading strategy instruction alongside their history class peers.

A total of six history teachers, two from special education and four from general education classes, delivered the reading strategy instruction as part of the intervention agreement. Student practice workbooks were collected from 104 students—52 intervention participants and 52 peers who were randomly selected from the same classrooms. A total of 104 students will be included in this proposed study. The majority language of English language learners (ELL) in both districts was Spanish. Students identified as English Language Learners (ELL) make up 33% of the 52 BRIDGES group. This study did not include a match by ELL because the comparison interest is based on the diversity of reading ability. The district student demographic is organized in Table 15.

**Design and Procedures**

Teachers implemented explicit researcher-designed reading instruction that corresponded with three units of history that served as the textual context for the reading practice materials. Participants and their classroom peers were provided daily practice
opportunities focused on learning the reading strategies for decoding, academic vocabulary acquisition, and reading comprehension skills.

Data collected under the supervision of the principle researcher included assessments measured at two time points: a pretest in the fall before the start of intervention, a posttest after the first 12-day intervention and workbooks in which students practiced word reading, vocabulary exercises, and summarizing main idea tasks.

**Materials description**

Reading strategy workbooks were given to all history class students of participating history teachers, and class time was provided for students to practice reading strategy tasks. These student workbooks were used for the explicit practice measures used in the test analyses. The workbooks contained practice activities that reinforced instruction for decoding of multisyllabic words, defining vocabulary with application, and summarizing main ideas. The materials were formatted to allow distributed, daily written practice for each of the three reading skills.

Student materials for special education classes were written at a lower lexile level and modified with sentence starters or partially-filled examples in graphic organizers. Furthermore, these workbooks contained a reduced number of questions per skill. For example, the number of decoding questions were reduced by 15.74% and vocabulary questions were reduced by 9%. Examples were also provided for explicit instruction of skill tasks that needed to be completed by students.

Intervention instruction included strategies for decoding multisyllabic words, vocabulary learning practice, and a specific reading comprehension skill of identifying
and summarizing main ideas. Student workbooks provide twelve days of practice for these three reading components. Students practiced decoding skills on multisyllabic word by drawing a line to separate the word into word parts using a decoding strategy of identifying parts by vowels. Besides the practice for reading words, the language comprehension component included vocabulary development of academic words derived from the unit found in the text. The vocabulary practice format varied day by day, but included writing tasks that required students to match definitions, write novel sentences, and make inferences about a word’s usage. The reading comprehension practice emphasized identifying the main subjects and relevant action predicates in a provided text passage. Strategy practice for understanding main ideas included identifying the main idea component (main subject, corresponding action, action predicates) and organizing those components into an advance organizer. In addition, opportunities to write a summary or paraphrase of the main idea of the passage using the advance graphic organizer encouraged independent practice.

Descriptive statistics were generated for practice variables to summarize observations of frequency and accuracy of practice for individuals on the three reading component strategies, e.g. decoding, vocabulary development, and reading comprehension. Results were summarized in a table. Under the null hypothesis, I would expect practice results on reading components to be similar for the two groups (students with RD and typically developing students).

Correlational analyses were conducted to test the strength of association between each reading component skill and the two measures of practice (frequency and
Hierarchical multiple regression analyses were conducted with each strategy posttest as the dependent variable. Researcher specifies a priori sequence for sets of predictor variables based on sound theoretical reasons for expecting them to predict the outcome. Setwise or blockwise method was used to determine which practice predictors contribute substantially to the model’s ability to predict the reading component outcome.

The model of statistical testing will address the following research questions:

1. What is the effect of reading strategy practice, measured in frequency and accuracy, on improvements in reading skills for (a) decoding, (b) vocabulary, and (c) reading comprehension for eighth grade low readers?

2. Are these effects similar for typical readers?

3. What is the effect of combined vocabulary and comprehension strategy practice, measured in frequency and accuracy, on improved comprehension skills?

In order to answer the first research question – What is the effect of reading strategy practice, measured in frequency and accuracy, on improvements in specific reading skills—a hierarchical multiple regression analysis will be used to estimate the variance accounted for by the frequency and accuracy of practice on reading skills learning. Multiple regression investigates the extent to which two or more independent variables from the same group of participants are associated. Furthermore, a hierarchical approach will enable a best possible weighting of the two or more independent variables by allowing a specific order of entry of variables determined by the research question to control for the effects of covariates or to test effects of predictors independent of the
influence of others (Field, 2009). Known predictors are usually entered first in order of their importance in predicting the outcome variable. In this case, the pretest of the reading component was entered first as a covariate to account for student reading ability. The next variables to enter into the model were the independent variables of practice of interest, which are: (1) frequency of practice, which represents the quantity of practice, and (2) accuracy of practice, which represents the quality of practice. The practice variables, measured as frequency and accuracy, on reading components will be tested separately for the outcome variables: (a) decoding, (b) vocabulary, and (c) reading comprehension strategy.

The practice variable of frequency comprises raw interval scores that vary by scale. No samples have shown any amount of practice that has exceeded what is printed in the student practice material on any given day. Any observed effect of frequency and accuracy of practice can then be said to be independent of the effects of the variable of the pretest. Finally, the correlational and hierarchical multiple regression analyses would represent independent statistical tests of the three reading components.

The second research question is similar to the first research question except the population of interest are typically developing classmates defined as students who were in attendance in the same classroom as an intervention student participant. A hierarchical multiple regression analysis using the same independent variables and outcome variables would be appropriate to answer this question: (2) Are these effects similar for typical readers? The typical reader group membership will follow the following criteria: be classroom peers of BRIDGES students, read at or near grade level define as a range (e.g.,
90 or above). This research question allowed for a comparison of a peer group for a practical comparison of means test and for an examination of the role of explicit strategy practice on improved reading skill performance with typical students in inclusion secondary classrooms.

In order to answer the third research question: (3) What is the effect of combined vocabulary and comprehension strategy practice, measured in frequency and accuracy, on improved comprehension skills?, a hierarchical multiple regression will be conducted to examine the practice effect of vocabulary and comprehension together on improved comprehension skills. The frequency practice measures will be set apart from the accuracy practice measures to yield cleaner results for interpretation. In the first analysis, the independent variables will include the pretest as a covariate to account for reading ability, then the variables of interest, which are the vocabulary frequency of practice variable and the reading comprehension frequency of variable will be added. At step three, vocabulary accuracy and the comprehension accuracy of practice would be entered.

**Reading Component Practice Measure**

The reading components and tasks referenced in this study include: 1) decoding tasks for word reading practice, 2) generating definitions, antonyms, and usage vocabulary tasks for academic vocabulary practice, and 3) identifying main ideas and summarizing for reading comprehension practice.

The frequency count is the total number of times each student practiced a reading component task during the cycle. The accuracy count is the ratio of the correct practice
over frequency count during the cycle. For example, one of the decoding tasks presented eight words to be decoded in the practice workbook. If all eight words are attempted, a point was counted for each attempt, so the total score for frequency practice for the decoding task would be 8. Each word that is correctly decoded will receive a point for accuracy of practice. In this example, if two of the eight words were correctly decoded, then the student receives a total score of 2 for the accuracy of practice, and the ratio of 2/8 or 25% accuracy rate would be recorded. Students’ frequency of practice score varies when students do not attempt all tasks supplied in the exercise. Likewise, students’ accuracy of practice score varies when students do not correctly complete the tasks.

Decoding measures count the number of words decoded. Vocabulary measures count the number of vocabulary problems. Comprehension measures count the number of main ideas identified and the number of related action predicates of a text. There is an exact number of subjects and action predicates that students are asked to identify in a given passage. Those subjects and predicates the student should have identified and written as a summary paragraph in the workbook would count as a frequency practice score.

**Results**

To test the hypothesis posed in Research Question 1: What is the effect of reading strategy practice, measured in frequency and accuracy, on improvements in reading skills: (a) decoding, (b) vocabulary, and (c) reading comprehension for eighth grade students with reading difficulties (RD)?, correlational analyses and hierarchical multiple regressions were utilized to determine whether practice frequency and practice accuracy would have a significant effect on reading skills as measured with posttests for decoding,
vocabulary and reading comprehension. Three separate regression analyses (decoding, vocabulary, reading comprehension) were conducted on the practice variables measured in reading workbooks and the reading component pre- and post-tests.

Prior to conducting hierarchical multiple regression, the relevant assumptions were tested. The sample size of the two groups, 52 students with RD, 52 typically developing students, was each deemed adequate given two independent variables to be included in the analysis (Tabachnick & Fiddell, 2001). The assumption of independence of observations was met after an examination of the residual plots of errors versus the predicted values of the dependent variable for all analyses. Tests for multicollinearity indicated that a very low level of multicollinearity was present. The range of variance inflation factor (VIF) examined in each analysis was very close to 1 and confirms that collinearity is not a cause for concern (Field, 2009). An examination of the Mahalanobis distance scores indicated no multivariate outliers. Residual and scatter plots indicated the assumptions of normality, linearity, and homoscedasticity were satisfied. Checking the graph of residuals showed the scatterplots were randomly and evenly dispersed throughout the plot (Field, 2009) to show assumptions of linearity and homoscedasticity have been met. The normal probability plot of standardized residuals showed that the points of observed residuals lie on a straight line of a normal distribution, which indicates the test of normality was met.

**Practice Frequency and Practice Accuracy on Decoding Improvement for Students with RD**
Decoding pre and posttests were not given to typically developing classmates, hence the decoding analysis only reflects the performance of students with RD. A hierarchical multiple regression analysis was performed to investigate the effect of decoding practice factors (frequency and accuracy) on decoding outcomes of students with RD, after controlling for individual decoding skills using the pretest. Additionally, the correlation analysis of the predictor variables (pretest decoding; decoding practice frequency and decoding practice accuracy) were examined and are presented in Table 1. A significant correlation was found between accurate practice of decoding and the decoding posttest, \( r = .24, \ p < .05 \). A positive association was found for students who accurately decode and decoding performance at posttest. The correlation between accurate practice and the pretest is moderate and statistically significant, \( r = .26, \ p < .05 \). A positive relation at pretest can suggest multicollinearity, or a confounding variable.

In the first step of the regression, the decoding pretest was entered and the regression statistics are in Table 2. This model was statistically significant \( F(1, 50) = 223.29, \ p < .001 \) and the pretest explained 81.7% of the variance in the decoding posttest, \( (\Delta R^2 = .82, \ p < .001) \). The decoding practice frequency was entered at Step 2. The total variance explained by the model did not change and the model overall was statistically significant, \( F(2, 49) = 110.75, \ p < .001 \), due to the strong predictor pretest. The introduction of decoding practice accuracy entered at Step 3 explained no additional variance in decoding at posttest, after controlling for the pretest of decoding. The final adjusted model at Step 3 was statistically significant, \( F(3, 48) = 72.33, \ p < .001 \), also due to the pretest decoding coefficient being statistically significant, pretest \( \beta = .91, \ p < .001 \).
Practice variables did not add or subtract from decoding achievement for students with RD.

Practice Frequency and Practice Accuracy on Vocabulary Learning for Students with RD

In order to answer research question 1b: What is the effect of practice frequency and accuracy on vocabulary learning for students with RD?, a correlational and hierarchical multiple regression analyses was used, after controlling for vocabulary knowledge using the vocabulary pretest. Vocabulary practice frequency and accuracy variables were entered after step one, when the vocabulary pretest variable was entered to determine if there were any significant effects on vocabulary learning as measured with a vocabulary posttest.

A correlations matrix of the predictor variables (pretest vocabulary; vocabulary practice frequency and vocabulary practice accuracy) and descriptive statistics of vocabulary posttest was examined and presented in Table 3. The independent variable correlations were weak and not statistically significant, indicating multicollinearity is not a cause for concern (Tabachnick & Fidell, 2007). There is a significant correlation between the covariate vocabulary pretest and the vocabulary posttest, $r=.23, p<.05$. A positive correlation exists when one variable increases while the other also increases, suggesting here that as a pretest score increases by one unit, a posttest score increase will likely be associated. Students in this sample who scored higher at the pretest were likely to score high at the posttest. Although the practice variables did not show a significant association to the posttest outcome variable, the mean scores from pretest ($m=4.59, n=52$)
to the posttest (m=7.45, n=52) in this study, which increased significantly, warrant an investigation of whether the practice variables contribute to overall vocabulary outcome. Statistical descriptive information is also recorded in Table 3.

In the hierarchical multiple regression, the vocabulary pretest was entered as a covariate at Step 1. The vocabulary frequency of practice was then entered at Step 2. The vocabulary accurate practice was entered at Step 3, and the regression summary is in Table 4. None of the three regression models were statistically significant, suggesting that the two practice variables did not add enough to the vocabulary instruction intervention to see significant effect change.

**Practice on Reading Comprehension Learning for Students with RD**

To answer research question 1c: What is the effect of practice frequency and accuracy on reading comprehension learning for students with RD?, a correlation and hierarchical multiple regression analysis were performed. As mentioned before, the reading comprehension measure required students to identify the main ideas of a passage and to write a summary.

The correlations amongst the predictor variables (pretest reading comprehension, reading comprehension practice frequency, and comprehension practice accuracy) included in the study were examined and these are presented in Table 5. The reading comprehension practice accuracy variable was significantly correlated with reading practice frequency, $r=.261, p<.05$. The variables have weak correlations, indicating multicollinearity is not a cause for concern. Statistical descriptive information is recorded in Table 5.
The regression statistics are recorded in Table 6 and show how independent variables were added at three stages. The reading comprehension pretest was entered in the first step as a covariate, then the reading comprehension practice variables were added in the next sequential steps, specifically with the practice frequency variable added in step two and then the practice accuracy variable added in step three. None of the models created from the hierarchical multiple regression are statistically significant.

**Practice Frequency and Practice Accuracy on Vocabulary Learning with Typically Developing Adolescents**

The second aim of this study was to compare differences in the association between frequency and accuracy of practice and reading outcomes for typical readers versus poor readers. Research Question 2 asks: What is the effect of explicit reading practice frequency and accuracy on improvements in reading skills: (a) vocabulary learning and (b) reading comprehension with typical eighth grade students?

To answer research question (2a): What is the effect of explicit reading practice frequency and accuracy on vocabulary learning with typical adolescent students?, correlation and hierarchical multiple regression were conducted. Table 7 summarizes the correlations amongst the predictor variables (pretest vocabulary; vocabulary practice frequency and vocabulary practice accuracy), along with the mean values, standard deviations, and ranges. The vocabulary pretest is moderately correlated with the reading comprehension posttest, \( r = .52, p < .001 \). Additionally, vocabulary practice frequency has a weak significant association with the vocabulary posttest, \( r = .24, p < .05 \), which suggests
that students who practiced vocabulary more frequently scored higher on the vocabulary posttest.

In the hierarchical multiple regression analysis, the vocabulary pretest was the first variable entered as a covariate at Step 1. At Step 2, the vocabulary practice frequency variable was entered to the model. Finally, the vocabulary practice accuracy variable was entered at Step 3. Results of the regression analysis are summarized in Table 8. The hierarchical multiple regression revealed that at Step 1, the pretest variable contributed significantly to the regression model, $F(1,50)=18.11, p<.001$, and accounted for 27% of the variation ($\Delta R^2=26.6, p<.001$). Introducing the explicit practice frequency variable at Step 2 explained an additional 3.2% of variation in posttest vocabulary, but the standardized coefficient was not significant. The overall model at Step 2 was significant, $F(2,49)=10.4, p<.001$. Also, the standardized partial coefficient vocabulary pretest was significant, $\beta=.50, t(49)=4.11, p<.001$. Vocabulary practice accuracy at Step 3 did not result in a significant change in variance explained by the model, but the overall model was significant, $F(3,48)=7.22, p<.001$. The vocabulary practice variables did not make a unique contribution to the overall model. The final model results show the vocabulary pretest variable remained a significant contributor to explaining variance of the vocabulary posttest, $\beta=.49, t(48)=4.09, p<.001$.

Practice Frequency and Practice Accuracy on Comprehension Learning with Typically Developing Adolescents

To answer research question 2b: What is the effect of explicit reading practice frequency and accuracy on comprehension learning with typically developing
adolescents?, a correlational analysis and a hierarchical multiple regression were used to investigate the effect of comprehension practice factors (frequency and accuracy) on performance on reading comprehension.

The correlations amongst the predictor variables (pretest of reading comprehension; reading comprehension practice frequency and accuracy) were examined. Table 9 displays the correlations amongst the variables along with the mean values, standard deviations, and ranges. There is a weak correlation between the reading comprehension pretest and the comprehension posttest, $r=.33$, $p<.01$. There is a moderately strong association between accuracy of comprehension practice and the posttest, $r=.46$, $p<.001$, which suggests that typically developing students who practiced correctly also scored high on the comprehension posttest. There is a moderate correlation between accurate practice and the pretest, $r=.41$, $p<.001$. Students who scored high on identifying main ideas before the start of the strategy instruction were likely to score high on comprehension practice accuracy. A moderate association between comprehension practice accuracy and frequency, $r=.45$, $p<.001$, raised attention to recheck variables for multicollinearity. The collinearity diagnosis showed that VIF is close to 1, which shows multicollinearity is not a cause for concern.

A hierarchical multiple regression was performed to investigate the extent to which the comprehension practice factors (frequency and accuracy) affect levels of comprehension posttest, after controlling for individual comprehension ability (pretest). The results are in Table 10. In Step 1, the reading comprehension pretest variable was entered. This model was statistically significant, $F(1,49)=5.91$, $p<.05$, and accounted for
11% of the variance ($ΔR^2= .108, p<.05$). The standardized beta for the pretest coefficient is also significant $β=.33, t(49)=2.43, p<.05$). After entering the explicit practice frequency variable at Step 2, the total variance explained by the model as a whole was found statistically significant, $F(2,48)=3.44, p<.05$, but the partial coefficient of comprehension practice frequency was not significant. Additionally, the $R^2$ change for the model at Step 2 was not significant, implying that the overall model was significant due to the variance accounted for in the pretest coefficient. Finally, when the three independent variables (pretest, practice frequency, and practice accuracy) were included in Step 3, the total variance of comprehension knowledge explained by the model increased to 24% ($ΔR^2=.11, ΔF(1, 47)=6.79, p<.05$), and the model overall was statistically significant, $F(3,47)=4.84, p<.01$. The practice accuracy partial coefficient recorded a higher and statistical significant beta value ($β=.40, pr^2=.13, p<.05$). From Step 2 to Step 3, the pretest reading comprehension variable no longer recorded as statistically significant, which suggests that comprehension practice accuracy uniquely contributed to the model over and beyond the covariate of reading comprehension pretest variable. For typically developing students, results suggest that accurately practicing comprehension tasks may be a positive mediating factor contributing to reading comprehension learning.

Vocabulary and Reading Comprehension Practice Frequency and Practice Accuracy on Reading Comprehension Learning of Adolescents with Reading Difficulties

To answer research question 3: What is the effect of combined vocabulary and comprehension strategy practice measured in frequency and accuracy, on improved
comprehension skills?, a correlational and hierarchical multiple regression analyses were used to investigate the effects of vocabulary and comprehension practice factors (frequency and accuracy) on performance on reading comprehension, first with adolescents with RD, then with typically developing students.

The correlations amongst the predictor variables (pretest, frequent vocabulary practice, frequent comprehension practice, accurate vocabulary and comprehension practice) are low, see Table 11, thus multicollinearity is not a cause for concern. The vocabulary practice frequency has a weak association with comprehension posttest, $r=.25, p<.05$, suggesting that students who practice more vocabulary activities are likely to score higher on the comprehension posttest. A negative weak association between vocabulary practice frequency and reading comprehension pretest was recorded, $r=-.34, p<.01$, suggesting an inverse relation between practice frequency and the reading comprehension pretest, in which as one variable increases as the other decreases, and vice versa (Field, 2005). This result could suggest that students with RD who scored low at the pretest were likely to have more in vocabulary practice. Likewise, students with RD who scored high on the pretest were likely to have less frequent practice. There is a moderate association between reading comprehension practice frequency and vocabulary practice frequency, $r=.49, p=.000$. Students who practiced much on reading comprehension were likely to also practice much on vocabulary. Accurate reading comprehension practice is weakly correlated with reading comprehension frequency, $r=.26, p<.05$. There is a weak correlation between accurate practice of both comprehension and vocabulary, $r=.39, p<.01$. These positive associations suggest that
students with RD who scored high in practice accuracy were likely to also practice more frequently.

Table 12 shows the results of the hierarchical multiple regression of the practice variables on reading comprehension for students with RD. The reading comprehension pretest was entered in Step 1. The frequencies of the two reading skill variables (vocabulary practice frequency and comprehension frequency practice) were then entered at Step 2. The accuracy of vocabulary and reading comprehension practice variables were entered at Step 3. None of the three regression models were statistically significant.

Vocabulary and Reading Comprehension Practice Frequency and Practice Accuracy on Reading Comprehension Learning of Typically Developing Adolescents

The correlations amongst the predictor variables (comprehension pretest; vocabulary frequency, comprehension frequency, vocabulary practice accuracy, and comprehension practice accuracy) are recorded in Table 13 for typically developing students. The reading comprehension pretest is positively correlated with comprehension posttest, \( r = .33, p < .01 \). The accuracy of vocabulary practice has a weak association with reading comprehension posttest, \( r = .27, p < .05 \), suggesting that typically developing students who practiced accurately were likely to also score high on the comprehension posttest. A moderate association between accuracy of reading comprehension practice and the comprehension posttest was recorded, \( r = .46, p \leq .001 \), suggesting that students from this sample who score high on accurate comprehension practice were likely to score high on the comprehension posttest. Both the vocabulary and comprehension accuracy
practice variables are positively associated with the comprehension posttest outcome. The frequency of vocabulary practice was weakly and negatively associated with the comprehension pretest, \( r = -0.24, p < 0.05 \). A negative correlation signifies an inverse relation between the two variables, suggesting that for typically developing students, an increase in vocabulary practice frequency would occur when the pretest unit decreases, and vice versa. A moderate association between accuracy of comprehension practice and the comprehension pretest was also found, \( r = 0.41, p \leq 0.001 \), which would suggest that for typically develop students, students with higher pretest scores would also practice more accurately. Frequency of comprehension practice is weakly correlated with frequency of vocabulary practice, \( r = 0.39, p < 0.01 \), which could indicate that students who scored high on frequency of practice, did so for both reading skills. The opposite would also be likely: that those students who scored low on frequency practice, did so for both reading skills. Moderate correlations were found between frequency of comprehension practice and accuracy of comprehension practice, \( r = 0.45, p \leq 0.001 \). Typically developing students who practiced comprehension tasks frequently were likely to have accurately practiced the comprehension tasks.

Hierarchical multiple regression analysis with typically developing students was conducted and displayed in Table 14. The reading comprehension pretest was entered at Step 1. This model was significant \( F(1,49) = 5.91, p < 0.05 \) and explained 10.8% of variance in the reading comprehension posttest (\( R^2 = 0.108, p < 0.05, \beta = 0.33, p < 0.05 \)). Two more practice frequency factors (vocabulary and reading comprehension) were then entered at Step 2. This overall model was not significant, but the reading comprehension pretest
coefficient remained a significant predictor of the comprehension posttest, $\beta=.30, p<.05$. The frequency of vocabulary practice and comprehension practice did not affect significant change to further explaining variance of the comprehension posttest.

The accuracy of vocabulary and reading comprehension practice factors were entered at Step 3. After controlling for the comprehension pretest and the two frequency of practice variables, the adjusted final model at Step 3 was statistically significant $F(5,45)=3.56, p<.01$. The change statistics were statistically significant, $\Delta R^2=.158$, $\Delta F(2, 45)= 4.96 p<.05$, and the final model explained 28.3% of variance in reading comprehension posttest ($R^2=.283, p<.05$). The comprehension pretest coefficient no longer accounted for a significant variance in the model from Step 2 to Step 3. Conversely, the reading comprehension practice accuracy variable accounted for significant variance at Step 3, which suggests a positive mediating effect. The accuracy of comprehension practice also significantly predicted the reading comprehension posttest, $\beta=.39, p<.05$, which may have implications for further examination of the predictive power of accurate practice.

**Discussion**

A major aim in this study was to examine the effects of frequency and accuracy of reading practice on eighth graders’ reading achievement. The study considered the pretest–posttest strategy retention assessments of three explicit reading processes—decoding, vocabulary, and reading comprehension—but focused on examining the extent to which the frequency and accuracy of strategy practice documented in student workbooks had an effect on reading outcomes. A previous study found that instructional
effects were significant for all skills for students with Reading Difficulties (RD) and with students developing typically (O’Connor et al., 2017). In the current study, the following major findings can be summarized about middle school readers: (1) accurate decoding practice is weakly associated with decoding skill outcomes for students with RD; (2) frequent vocabulary practice is weakly associated with vocabulary outcomes for typically developing students; (3) accurate comprehension practice is moderately associated with frequent comprehension practice for students with RD; and (4) accurate practice of reading comprehension is a significant predictor of reading comprehension outcome for typically developing students. Features of practice (frequency and accuracy) associated with skill improvement in other studies appeared to be less influential in the current study. In the following sections, I consider these findings first for students with RD, and then for typical readers.

Effect of Decoding Practice for Students with RD

First, students’ accurate decoding practice and skill outcome were weakly correlated for students with RD. However, accurate practice was not a unique contributor to decoding outcome. The decoding pretest accounted for more than 80% of the variance found in decoding achievement, suggesting that the weak significant correlation of accurate decoding practice was subsumed or overshadowed by the decoding pretest. The positive association between accurate practice and decoding skill outcome suggests that students with disabilities were able to learn to break apart multisyllabic words correctly within the twelve-day intervention. However, increasing frequency of practice of deconstructing long words after the point of accurately learning decoding brought no
further benefits in increasing posttest scores. This confirmed the foundational research that adolescents with RD respond well to decoding strategies in a relatively short time frame (O’Connor & Vadasy, 2013).

Although the practice variables of frequency and accuracy did not predict decoding outcome significantly, students improved in decoding significantly from pretest to posttest. All students practiced this skill during the intervention. Though it did not uniquely contribute to the model used in this study, the association between accurate practice and decoding posttest deserves special attention because it aligns to prior research that found that furnishing practice for poor readers is effective (Archer et al., 2003; Swanson & Hoskyn, 2001). Archer et al. (2003) found that with verbal prompting, students were able to successfully correct 50% of their multisyllabic word reading errors without further help from teachers. Swanson and Hoskyn (2001) found that practice of reading strategies is a significant component of effective reading intervention instruction. The average decoding accuracy from this study after 12 days of written prompting was 58%, suggesting that students had considerable room to grow. It would be reasonable to expect students with RD who practice reading multisyllabic words part-by-part accurately with explicit strategy instruction could develop reliable recognition of word patterns, thus influencing higher word reading outcome scores. Considering that low accurate practice is linked to low decoding outcome for students with RD, I suggest new classroom practices. Content subject teachers may find that taking the time to assist students with reading difficulties in mastering decoding of multisyllabic words could improve reading of multisyllabic words. In turn, improving the reading of academic words that are central
to understanding text could enhance reading comprehension (August et al., 2009; Kamil et al., 2008).

Increasing frequency of decoding practice did not correlate with positive decoding outcomes for students with disabilities. Participants in this study were prompted to decode about 100 multisyllabic words, while participants in Archer et al.’s study (2003) were prompted to decode 787 novel words. On the other hand, the results imply that practicing, when done correctly, has a positive influence on decoding outcome.

A likely explanation of this surprising result for students with RD is that the average frequency of decoding practice in these classes was sufficient to learn the decoding strategy proficiently, implying that more decoding practice was unnecessary. Since every student did practice, the amount of practice may have hit a ceiling effect. The average posttest score was 90.4. Moreover, students with RD tended to benefit from learning decoding strategies in the context of content area courses (Baumann & Graves, 2010; Shanahan & Shanahan, 2008).

**Effect of Vocabulary Practice for Students with RD**

Similar to decoding results, vocabulary practice did not have an impact beyond that provided during the explicit instruction and practice all students received. Neither frequency nor accuracy of vocabulary practice were associated with vocabulary achievement for students with RD. The relatively high vocabulary posttest results confirmed widely accepted vocabulary research that an important feature of explicit instruction includes at least twelve meaningful practice opportunities that are interactive.
and varied (Harmon et al., 2005; McKeown, Beck, & Omanson, 1985; National Reading Panel, 2002), and this feature was already incorporated in the lesson design.

However, that highly accurate vocabulary practice was not associated with greater gains in vocabulary outcome was surprising. In this study, students with RD practiced correctly on average about 96% of the time, suggesting that students were given plenty of formative feedback in the classroom; hence, the accurate practice may not represent independent practice. It is possible that students with RD were given feedback during practice that hindered the cognitive engagement mentioned in earlier studies (Shany & Biemiller, 1995; 2010). So the accurate practice that students with RD showed may reflect tutored practice (Van Keer & Verhaeghe, 2005) more than independent striving for improvement.

Similar to the Duckworth et al. (2011) study, the current investigation sought to apply an expert performance approach--deliberate practice--to a domain directly related to academic learning in adolescents. During deliberate practice, effortful activities are typically planned to include immediate informative feedback designed to improve an aspect of performance (Duckworth et al., 2011; Ericsson et al., 1993).

Nevertheless, students with RD as a whole saw growth in their vocabulary knowledge base. Furthermore, students with RD had greater variance in accuracy of vocabulary practice than their typical peers, which suggests a possible confirmation of the tendency for adolescents with reading difficulties to have a weaker foundation of multisyllabic words (Stanovich, 1986). A possible explanation for practice accuracy not predicting outcome in this case could be students simply “going through the motion,” i.e.,
mechanical practice without true engagement with the morphological complexities found in Tier 2 words (Nagy & Townsend, 2012). Posttest gains still confirm that vocabulary instruction improved vocabulary of students with LD (Jitendra, et al., 2004), but there is no evidence in this study that frequent or accurate practice is a mediating factor. Unfortunately, an opposing explanation may also be tenable. Students with RD may have language delays that could not be bridged with only 12 days of vocabulary instruction with explicit vocabulary practice, a deficiency frequently found in adolescents with learning disabilities (Deshler et al., 2001). In counting the frequency of vocabulary practice, the Kamil et al. (2008) report did not distinguish among different types of vocabulary practice tasks that may enable students with RD to comprehend increasingly more complex grade level texts. For example, the vocabulary practice here included tasks that use academic words in daily life and in various academic content areas, explicit generative response prompts, and associative response prompts. Future expansion of this study could include separating generative response practice against associative response practice to rule out guessing and count definitions generated by students.

**Effect of Reading Comprehension Practice for Students with RD**

For students with RD, accurate comprehension practice was significantly correlated to frequency of comprehension practice. Although this study could not determine a causal direction, this positive association may suggest that frequent comprehension practice could help students improve accuracy of their comprehension skills. Practically, teachers can expect students with RD to be able to learn to identify main ideas with increasing practice. Although reading strategy practice is not new (Duke & Pearson, 2008), this
finding may help teachers value the time invested if encouraging frequent reading comprehension practice can yield improved accuracy, which is an admirable short-term goal for struggling readers. For example, practice workbooks are seldom collected or corrected as a tool of formative assessment because the task is labor and time intensive. Rather, more efficient tools of summative assessment such as quizzes are commonly used. The positive association between frequent practice and accurate practice suggests that reinforcement activities, such as comprehension task skills practice, may yield subtle benefits for adolescents with RD. This positive connection may be an overlooked but compelling reason to encourage guided practice of comprehension tasks when working with adolescents with RD to identify main ideas in expository text. Findings in this study suggest assigning more student practice could lead to improvement in correctly completing comprehension tasks, which deserves further study.

Surprisingly, accurate practice of the main ideas identification task did not associate with comprehension achievement. The mean score gains for students with RD from pretest to posttest (i.e., 3.54 to 11.56) resulted in main idea performance that did not differ from typically developing students. Still, these remarkable gains were not associated specifically with variation in frequency or accuracy of practice.

It may be that the qualities of comprehension practice measured here (e.g., frequency and accuracy) fail to capture historical reasoning and analysis. The nature of history comprehension relies on understanding expository text, which contains information that is conceptually rigorous and domain specific (Gersten & Okolo, 2007). Identifying and summarizing main ideas in expository passages requires students with disabilities to
catch the historical meaning of events and determine which events are significant in light of the historical time period and culture. Such historical thinking is analytic in nature and relies of depth of thinking (De La Paz et al., 2007), which was not measured here, aside from the comprehension outcome.

**Effect of Frequency and Accuracy of Vocabulary Practice for Typically Developing Students**

The second aim of this study was to analyze the effects of practice on reading skills for typically developing students. Research Question 2, which analyzed the frequency and accuracy of practice on two different reading skills for typically developing students, are discussed in two sections: first by vocabulary practice then by comprehension practice.

For typically developing peers, the current study found that two factors—prior vocabulary knowledge and frequent vocabulary practice were weakly \((r=.24, p<.001)\) associated with vocabulary skill outcome. The correlational finding aligns with prior research, in which Cunningham and Stanovich (1998) found that vocabulary knowledge improved with repeated exposure to words, i.e. practice. Although typical readers grew from pretest to posttest, as a whole they practiced vocabulary correctly 99% of the time. This lack of variability in accuracy of vocabulary practice suggests that when vocabulary tasks were practiced, they were usually correct.

Following theories of deliberate practice, one could also reason that for typically developing students, frequency of vocabulary practice was a form of rehearsal (Duckworth et al., 2011; Shiffrin & Schneider, 1984) because the practice was built upon
a foundation of vocabulary knowledge. Ericsson explains that this type of expert practice will follow when one first demonstrates mastery over the existing knowledge and techniques (Ericsson et al., 1993). In other words, typical readers do not need as much practice beyond instruction to learn and remember vocabulary word meanings as do peers with disabilities, such that the threshold point of mastery could occur faster than for poor readers, so that frequency of vocabulary practice represents surplus practice that is beyond the necessary practice for understanding.

**Effect of Frequency and Accuracy of Reading Comprehension Practice for Typically Developing Students**

For typically developing adolescents, accurate comprehension practice and pretest were significantly associated with improved comprehension outcomes. Additionally, accurate practice was a significant predictor of students’ reading comprehension scores. Similar to students with RD, typically developing students made great gains from pretest to posttest, moving from means of 6.63 to 14.29. This confirms that reading comprehension instruction that was designed for the benefit of students with RD also benefited typically developing peers in the same inclusive classroom. The instructional implication of this positive significant association confirms the benefit of reading comprehension instruction in content subject inclusive classrooms.

Additionally, accurate comprehension practice emerged as the solitary significant predictor of reading comprehension outcome posttest in the final model (see Table 10). After the addition of all variables, indeed converges with research suggesting that on average, accurate reading practice benefits comprehension outcomes for typically
developing students (Shany & Biemiller, 2010). Moreover, this model result suggests that students who correctly worked through the main idea identification prompts were likely to also achieve greater comprehension improvement. As a unique contribution to reading practice research, this study found that accurate practice is the more important predictor, which departs from literature (Ellis et al., 1990; Topping et al., 2007). For example, the current model extends the work of Ellis and Graves, (1990), which found that paraphrasing of main ideas was more effective for improving comprehension than repeated readings, by counting the frequency and accuracy of engaging in the more complex cognitive activities involved in generating main ideas. When teachers offer opportunities for effortful reading strategy practice, such as identifying main ideas from expository text and assessing for accuracy of this practice, there is potential for dramatically improving student reading comprehension performance (Jitendra et al., 2000).

**Effect of Combined Vocabulary and Comprehension Practice on Reading**

**Comprehension for Students with RD**

Research Question 3 addresses the question of whether frequent and accurate practice for both vocabulary and comprehension can predict variation in comprehension skill outcome. The implications of these findings are discussed first for students with RD and then for typically developing students.

For students with RD, frequent vocabulary practice was weakly associated with comprehension outcome. This analysis is distinct from Research Question 1, which examined the frequency and accuracy of vocabulary practice against vocabulary outcome.
and found no significant association. This positive association of frequent vocabulary practice with comprehension outcome is an important confirmation of the body of research on the topic of the role of vocabulary knowledge in reading comprehension (Gersten et al., 2001; Nagy, 1988; Qian, 1999). The practical implication of this finding aligns with the recommendations of the National Reading Panel to integrate explicit vocabulary instruction into daily curriculum of content area literacy (Kamil, et al., 2008). Moreover, the positive association of frequent vocabulary practice with reading comprehension confirms theoretical assertions that vocabulary knowledge is the basis of subject content knowledge. Knowledge of word meanings is crucial for students’ ability to construct meaning from information found in primary sources and expository texts that are the bedrock of academic disciplines (Stearns, et al., 2000). Teachers may find that students with RD who frequently practice vocabulary tasks also score higher in reading comprehension of content in a relatively small amount of instructional time.

A second finding for students with RD was that frequency of vocabulary practice was moderately associated with frequency of comprehension practice. Implications for teachers would be to include vocabulary learning tasks so that students who practice completing vocabulary prompts would concurrently practice comprehension tasks. Also not surprising, it raises the possibility that practice of both vocabulary and comprehension strategies may be needed for improvement in comprehension of history content.

A third finding for students with RD was that frequent vocabulary practice was negatively associated with the reading comprehension pretest. One way to interpret this
inverse association could be that students with RD who scored higher on the comprehension pretest were less likely to practice vocabulary tasks. It could also be that students who scored lower on the pretest were encouraged or required by their teachers to practice more frequently on vocabulary tasks. More relevant to classroom practice, this inverse relationship may be an artifact of teacher skill in individualizing practice opportunities in response to students’ initial vocabulary knowledge.

A fourth finding is that accurate reading comprehension practice is weakly correlated to both frequent reading comprehension practice and accurate vocabulary practice. Practice was guided by teachers, who likely influenced frequency and accuracy of practice. Evidence in the current study suggest that students with RD who accurately practiced their vocabulary tasks and frequently practiced comprehension tasks were more likely to produce correctly completed comprehension tasks. Note also that accurate vocabulary practice alone did not associate with reading comprehension outcome, but when accurate vocabulary practice was paired with frequent practice of reading comprehension, the association was significant. Since correct vocabulary practice can explain about as much variance as frequently practicing reading comprehension tasks accurately, the vocabulary component of a reading practice regimen should not be viewed as subordinate to reading comprehension tasks. For adolescents with RD, frequent vocabulary practice together with frequent reading comprehension practice can play a role in improved reading comprehension.
Effect of Vocabulary and Comprehension Practice on Reading Comprehension Outcome for Typically Developing Students

For typically developing adolescents, three predictor variables were positively correlated with comprehension outcome. Accurate comprehension practice was moderately associated with comprehension, while the other two predictors, accurate vocabulary and comprehension pretest were weakly correlated to comprehension outcome. Typically developing students who scored well on the comprehension pretest were also highly accurate in their vocabulary and comprehension practice. They were more likely to have results of high overall comprehension posttests. In line with this interpretation, students who scored low on the comprehension pretest and also low in their accuracy in vocabulary and comprehension practice were likely to score low on the comprehension posttest. The dual predictors of accurate vocabulary practice with accurate comprehension practice combine to correlate with positive comprehension outcomes. Efforts to emphasize habits of accurate practice may help create an environment of deliberate practice where such effortful skills practice improves reading comprehension skills achievement.

The correlation amongst accurate comprehension practice, frequent comprehension practice, and accurate vocabulary practice for adolescent students aligns with the findings of Shany and Biemiller (2010), where elementary students who had greater gains in reading comprehension also had significantly greater gains in vocabulary. In contrast, greater frequency of reading practice for typically developing students did not significantly predict comprehension of content. This suggests that frequent practice
without taking into account the quality of practice is insufficient for improving comprehension of content (see Tables 11 and 12).

Most importantly, the results of the hierarchical regression determined that the addition of accurate comprehension and vocabulary practice improved the final model of reading comprehension overall. The variability accounted for by accurate practice was 16%, accounting for a total of 27% of the variance, which suggests that accurate practice is a more reliable predictor than prior comprehension knowledge, and frequency of vocabulary and comprehension practice. This result converges with those of Shany & Biemiller, (2010), who found practice being the superior predictor of final performance in reading comprehension. An instructional implication of these findings is that for typically developing adolescents who have acquired their skills, accurate comprehension practice completed in the classroom may improve the prediction of reading comprehension, which has both instructional and research implications.

Instructionally, typically developing secondary students benefited from comprehension practice that is distributed even after students demonstrate mastery, which could reinforce knowledge or academic learning that students have already acquired. Secondary students practiced with high accuracy in the classwork that included immediate informative feedback on their performance, confirming an important characteristic of deliberate practice (Duckworth et al., 2010). In terms of research on deliberate practice, the results justify a closer examination of deliberate practice in academic domains.
Limitations and Future Directions

The current study had at least three important limitations. First, a ceiling effect in
data-gathering occurred with the measures of accurate vocabulary and reading
comprehension practice, such that respondents on average scored at the highest quartile,
not distinguishing scores above the 96th percentile. Ceiling effects may limit the range of
data reported, which were altogether between .81 and 1, reducing variability in the
gathered data. This impacted the power of statistics on correlations between the accurate
practice measures and their corresponding outcome variable. However, this limitation
reflects the practice feedback provided by teachers, which was apparently effective.
Nevertheless, the variability among frequency measures of practice show evidence that
students also practiced independently.

A second limitation is that the maximum number of practice problems offered
varied by teacher and sometimes between a teacher’s subset of class periods. Teachers
were instructed to assign strategy practice strictly within the classroom time as opposed
to allowing workbooks to be completed outside of the class time. Teachers report that
circumstances such as school assemblies affected practice time for certain class periods
as well.

A third limitation is that the current investigation was not designed to
systematically vary frequency of practice. Workbooks were not structured prior to
intervention to collect a preselected amount of practice that would represent categorical
groupings of below, average, and above average amounts. This limitation precluded the
ability to group the data by "practice frequency," which might have produced different results.

Future research could explore the gain scores for the three reading components to reanalyze the data that would allow for a comparison of low and high gain scores in each component against the two variables of practice (Shany & Biemiller, 2010). Data are available to replicate the approach of Shany and Biemiller (2010) in a reanalysis on positive gain scores, but with adolescent participants instead of primary-aged students.

**Conclusion**

Aligning with evidence-based recommendations for integrating reading comprehension practice with reading instruction for adolescents with RD, this study confirmed significant associations between frequent and accurate strategy practice on component reading skills of decoding, vocabulary learning, and comprehension (Kamil et al., 2008; Swanson & Hoskyn, 2001). Accurate reading comprehension practice predicts comprehension achievement within the context of explicit instruction for typically developing adolescents. Teachers seeking to help students achieve high comprehension outcomes could communicate to students that accurate practice habits are more advantageous to achievement than frequent practice when reinforcing skills after explicit reading instruction. In addition, the positive association between decoding component practice with reading achievement confirmed the benefits of learning theories of rehearsal for students with RD (Cunningham & Stanovich, 1998). As accurate decoding practice was found to relate to word reading achievement, this study showed explicit decoding
instruction that includes emphasis on accurate practice is an effective way to improve word reading for adolescent readers with reading difficulties.
References


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### Tables

**Table 1**  
*Correlation Matrix and Descriptive Statistics for Decoding Practice Variables for Students with RD*

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*Means*  
30.15 22.96 90.38 .58

*Standard Deviations*  
8.1 10.43 14.28 .18

*Range*  
10-40 2-39 43-108 .21 -.94

*Possible Range*  
0-40 0-40 0-118 0-1

*Note. RD=Reading Difficulties. n=51. *p<.05. ***p<.001.*

**Table 2**  
*Hierarchical Multiple Regression Analyses on Decoding Practice Variables of Students with RD*

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*Note. RD=Reading Difficulties. ***p<.001.*
Table 3
*Correlation Matrix and Descriptive Statistics for Vocabulary Practice Variables for Students with RD*

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Note. RD=Reading Difficulties. n=51. *p<.05.

Table 4
*Hierarchical Multiple Regression Analyses on Vocabulary Practice Variables for Students with RD*

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<td>1.96</td>
<td>4.03</td>
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</table>

Note. RD=Reading Difficulties.
### Table 6

*Hierarchical Multiple Regression Analyses on Reading Comprehension Practice Variables of Students with RD*

<table>
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<tr>
<th>Step</th>
<th>ΔR²</th>
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<th>β</th>
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Note. RD = Reading Difficulties. n=52. *p<.05.

### Table 5

*Correlation Matrix and Descriptive Statistics for Reading Comprehension Practice Variables for Students with RD*

<table>
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<th></th>
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<td></td>
<td></td>
</tr>
<tr>
<td>2. Reading Comprehension Pretest</td>
<td>-.07</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Reading Comprehension Practice Frequency</td>
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<td>-.17</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4. Reading Comprehension Practice Accuracy</td>
<td>.10</td>
<td>.42</td>
<td>.26*</td>
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*Means*<br>11.56 3.54 84.4 .97<br>*Standard Deviations*<br>4.56 3.03 18.08 .04<br>*Range*<br>0-20 0-11 34-108 .87-1<br>*Possible Range*<br>0-20 0-20 0-108 0-1

Note. RD = Reading Difficulties.
Table 7
Correlation Matrix and Descriptive Statistics for Vocabulary Practice Variables of Typically Developing Students

<table>
<thead>
<tr>
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<td></td>
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</tr>
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<td>2. Vocabulary Pretest</td>
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<td></td>
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<td>3. Vocabulary Practice Frequency</td>
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<td>.12</td>
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<td>4. Vocabulary Practice Accuracy</td>
<td>.09</td>
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Means
8.58 6.83 40.46 .99
Standard Deviations
1.47 2.43 5.43 .02
Range
4-10 0-10 20-46 .88-1
Possible Range
0-10 0-10 0-46 0-1

Note. n=52. *p<.05. ***p<.001.

Table 8
Hierarchical Multiple Regression Analyses on Vocabulary from Practice Variables of Typically Developing Students

<table>
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<tr>
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<th>β</th>
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</thead>
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<td>.53</td>
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<td></td>
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<td>.31</td>
<td>.07</td>
<td>.52***</td>
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<td>1.37</td>
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<td>.07</td>
<td>.50***</td>
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<td>.03</td>
<td>.18</td>
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<td>.07</td>
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Note. ***p<.001.
Table 9
Correlation Matrix and Descriptive Statistics for Reading Comprehension Practice Variables for Typically Developing Students

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<th>4</th>
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<tbody>
<tr>
<td>1. Reading Comprehension Posttest</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Reading Comprehension Pretest</td>
<td>.33**</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Reading Comprehension Practice Frequency</td>
<td>.19</td>
<td>.18</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4. Reading Comprehension Practice Accuracy</td>
<td>.46***</td>
<td>.41***</td>
<td>.45***</td>
<td>1</td>
</tr>
<tr>
<td><strong>Means</strong></td>
<td>14.29</td>
<td>6.63</td>
<td>82.02</td>
<td>.97</td>
</tr>
<tr>
<td><strong>Standard Deviations</strong></td>
<td>3.59</td>
<td>4.48</td>
<td>13.97</td>
<td>.04</td>
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<td><strong>Range</strong></td>
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<td>0-18</td>
<td>46-113</td>
<td>.81-1</td>
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<tr>
<td><strong>Possible Range</strong></td>
<td>0-20</td>
<td>0-20</td>
<td>0-113</td>
<td>0-1</td>
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</tbody>
</table>

*Note. n=51. **p<.01, ***p≤.001.

Table 10
Hierarchical Multiple Regression Analyses on Reading Comprehension Practice Variables of Typically Developing Students

<table>
<thead>
<tr>
<th></th>
<th>ΔR²</th>
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<th>SE</th>
<th>β</th>
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<tr>
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<td>.86</td>
<td>.33*</td>
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<td>.26</td>
<td>.11</td>
<td>.33*</td>
</tr>
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<td><strong>Step 2</strong></td>
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<td>2.89</td>
<td>.30*</td>
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<td>.11</td>
<td>.30*</td>
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<td>.04</td>
<td>.14</td>
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<td>-18.59</td>
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<td>.11</td>
<td>.17</td>
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<td>.04</td>
<td>-.02</td>
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</table>

*Note. *p<.05.
Table 11
Correlation Matrix and Descriptive Statistics for Reading Comprehension and Vocabulary Practice Variables for Students with RD

<table>
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<tr>
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<td>1</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>2. Reading Comprehension Pretest</td>
<td>-.07</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>3. Vocabulary Practice Frequency</td>
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<td>1.00</td>
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<td></td>
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<td>4. Reading comprehension Practice Frequency</td>
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<td>-.17</td>
<td>.49***</td>
<td>1.00</td>
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<tr>
<td>5. Vocabulary Practice Accuracy</td>
<td>.03</td>
<td>.25</td>
<td>.11</td>
<td>.19</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>6. Reading comprehension Practice Accuracy</td>
<td>.10</td>
<td>.12</td>
<td>-.09</td>
<td>.26*</td>
<td>.39**</td>
<td>1.00</td>
</tr>
</tbody>
</table>

**Means**

|                  | 11.56         | 3.54            | 41.37         | 84.4          | .96           | .97           |

**Standard Deviations**

|                  | 4.56          | 3.03            | 4.82          | 18.08         | .05           | .04           |

**Range**

|                  | 0-20          | 0-11            | 19-47         | 36-108        | .76-1         | .87-1         |

**Possible Range**

|                  | 0-20          | 0-20            | 0-47          | 0-107         | 0-1           | 0-1           |

*Note. RD= Reading Difficulties. n=52. *p<.05. **p<.01. ***p<.001.*
Table 12
Hierarchical Multiple Regression Analyses on Reading Comprehension and Vocabulary Practice Variables of Students with RD

<table>
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<th>SE</th>
<th>$\beta$</th>
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<td>.21</td>
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<td>.02</td>
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<td></td>
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<td>-.02</td>
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<td>.04</td>
<td>-.07</td>
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<td>-.06</td>
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</table>

Note. RD = Reading Difficulties.
Table 13
Correlation Matrix and Descriptive Statistics for Reading Comprehension Practice Variables for Typically Developing Students

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<th>3</th>
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<th>6</th>
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</tr>
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</tr>
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<td>1.00</td>
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<td></td>
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</tr>
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<td>.18</td>
<td>0.39**</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
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<td>.08</td>
<td>-.11</td>
<td>.09</td>
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<td>6. Reading Comprehension Practice Accuracy</td>
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<td>.41***</td>
<td>.16</td>
<td>.45***</td>
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<td>1.00</td>
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Means

<p>| | | | | | | |</p>
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</table>

Standard Deviations

<p>| | | | | | | |</p>
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<td>5.48</td>
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<td>.04</td>
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</tbody>
</table>

Range

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<tbody>
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<td>20-46</td>
<td>46-113</td>
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<td>.81-1</td>
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Possible Range

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<tbody>
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<td>0-113</td>
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Note. n=51. *p<.05. **p<.01. ***p≤.001.
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<th>ΔR²</th>
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<th>SE</th>
<th>β</th>
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<td>Reading Comprehension Pretest</td>
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<td>.00</td>
<td>.00</td>
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<td>Reading Comprehension Practice Frequency</td>
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<td>-.02</td>
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<td>-.00</td>
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<td>-.02</td>
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<td>.22</td>
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*Note. *p*.05.
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<th>District B</th>
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<td>1,023</td>
<td>42,335</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>American Indian</td>
<td>3 (0.3%)</td>
<td>45 (0.2%)</td>
<td>6 (0.6%)</td>
<td>159 (0.4%)</td>
</tr>
<tr>
<td>Asian</td>
<td>23 (2.2%)</td>
<td>643 (3.3%)</td>
<td>64 (6.3%)</td>
<td>1,425 (3.3%)</td>
</tr>
<tr>
<td>African American</td>
<td>17 (1.6%)</td>
<td>736 (3.9%)</td>
<td>86 (8.4%)</td>
<td>2,980 (7.0%)</td>
</tr>
<tr>
<td>Filipino</td>
<td>4 (0.4%)</td>
<td>301 (1.6%)</td>
<td>34 (3.3%)</td>
<td>525 (1.2%)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>930 (86.9%)</td>
<td>15,220 (78.5%)</td>
<td>387 (37.8%)</td>
<td>25,660 (60.6%)</td>
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<tr>
<td>Pacific Islander</td>
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<td>72 (0.4%)</td>
<td>4 (0.4%)</td>
<td>203 (0.5%)</td>
</tr>
<tr>
<td>None Reported</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>18 (1.8%)</td>
<td>498 (1.2%)</td>
</tr>
<tr>
<td>White</td>
<td>81 (7.5%)</td>
<td>2,128 (11%)</td>
<td>390 (38.1%)</td>
<td>10,153 (24.0%)</td>
</tr>
<tr>
<td>Two or more races</td>
<td>12 (1.1%)</td>
<td>225 (1.2%)</td>
<td>34 (3.3%)</td>
<td>727 (1.7%)</td>
</tr>
<tr>
<td>Free or reduced lunch</td>
<td>992 (92.7%)</td>
<td>15,625 (80.6%)</td>
<td>425 (41.5%)</td>
<td>26,901 (63.6%)</td>
</tr>
<tr>
<td>English learner</td>
<td>472 (44.1%)</td>
<td>7,733 (39.9%)</td>
<td>49 (13.5%)</td>
<td>7,274 (17.2%)</td>
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</table>