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A synthesis of the Literature on Reading Interventions to Improve Oral Reading Rates

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by

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Table of Contents

List of Tables

Table Page

Abstract

The traditional model of identification and eligibility assessment in Special Education often is to refer-test-place, which is based on a "wait to fail" procedure. Research has shown positive outcomes for the use of a Response to Intervention (RTI) model of assessment as an alternative method of learning disability identification. However, challenges exist in the selection of high-quality, research-based, effective interventions. A review of the literature was conducted to identify reading intervention options based on Curriculum-Based Measurement outcomes that may be selected for RTI use within the model and the potential barriers of their use. Twenty-one studies were identified examining 31 different and/or combined interventions with 223 individuals receiving reading interventions. Results suggest that schools have many successful, empirically-based reading intervention options for use within an RTI model. These will be discussed, as well as challenges and the need for further studies to explore individual effects, at-risk definitions, sufficient growth, administration requirements, and outcome data.

Introduction

Until recently, the traditional model of identification and eligibility assessment in Special Education often is to refer-test-place (VanDerHeyden, Witt, & Barnett 2004). When students are experiencing severe difficulties in the academic curriculum, they are referred for eligibility testing for intense Special Education services. One disadvantage of this model is that the "wait to fail" procedure causes many children to suffer through the educational setting with unmet needs and performing at low levels of proficiency until the referral for testing. When academic deficits are not detected when first emerging and interventions are not available to remediate them, children with academic difficulties fall academically further and further behind each year in school. Often, Special Education is seen as the only available option for intervention, and therefore, over the last 10 years, the U.S. Department of Education (1998) has reported a 238% increase in the number of children identified as "learning disabled", which substantially increased expenditures for some districts. In addition, traditional models of assessment have been shown to disproportionately identify minority students as Learning Disabled (Hosp & Reschly, 2004; Reschly, Kicklighter, & McKee, 1988), have questionable sensitivity to growth and prediction of outcome (Fuchs & Fuchs, 1996; Shinn, 1989, 1998), and have a questionable link to intervention strategies (Reschly & Ysseldyke, 1995). To complicate the process even further, educators are required to ensure that other factors that can potentially affect achievement (e.g., poor or absent instruction, lack of motivation, cultural/educational disadvantage or other environmental variables) are not the major reason for low achievement.

One frustrating outcome of the current assessment and intervention process is the increasing number of low achieving students in our schools and the number of students requiring Special Education services (U.S. Dept. of Education, 1999). In response to this frustration,

adopting Response to Intervention (RTI) as an assessment tool is one alternative approach that has been proposed for defining learning disabilities (Fuchs, Fuchs, & Speece, 2002). The RTI process consists of several components: universal screening, systematic allocation of interventions, and progress monitoring of intervention. Universal screening of all student academic performance several times a year is conducted to systematically identify academic difficulties within the general education curriculum as early as possible is the first step to identify students who may be at –risk for a learning disability. Interventions that address these deficits are systemically allocated to identify at-risk students. Student performance to these interventions is monitored to determine progress toward a specified goal. A poor response to an effective general education curriculum and additional intervention support that is not better explained by other factors such as low motivation or prior poor instruction, may be an indication that a student actually has a learning disability (Fuchs, 2003; Mellard, Byrd, Johnson, Tollefson, & Boesche, 2004). Those students who do not adequately respond to several well implemented intensive level interventions are considered for evaluation for Special Education. Thus, the RTI model proposes to use student response to a series of interventions as the assessment tool for determining when a student has a learning disability. Using early universal screening of all children, the use of evidenced-based intervention for those found to be at-risk, and progress monitoring may increase achievement for many children and decrease the number of children requiring Special Education services. One major advantage of this model is that defining a learning disability is based on how students respond to instructional interventions rather than on standard test scores that reveal low performance levels but do not inform how to instruct students.

Although a few studies that have evaluated RTI show promise (Speece, Case, & Molloy, 2003; VanDerHeyden, Witt, & Naquin, 2003; VanderHeyden, Witt, & Gilbertson, 2007), the process for selecting which intervention best works with an RTI learning disability eligibility process is yet to be established. Selecting an intervention to implement is not without its challenges (Vaughn & Fuchs, 2003). Such challenges include identifying what constitutes an intervention plan and what the optimal frequency, intensity, or duration of the intervention needs to be to quickly determine adequate progress. Identifying students who are not responding to a validated intervention after a reasonable period of time is critical if we are to avoid using another "wait and fail" model. Furthermore, if intervention data are to be used to make an important decision regarding a child's educational program, variables that impact the effectiveness of intervention data, such as treatments that are more likely to implemented accurately and with integrity, should be considered. Thus, identifying resources such as who, where, and how often interventions should be administered is another important consideration that may influence integrity of intervention implementation.

Another important aspect of the RTI assessment process to consider is the ability to define and measure adequate response to intervention within a reasonable period of time. The technical features necessary to measure adequate response to intervention requires that a measurement system be sensitive to individual responsiveness within a short period of time. One well-researched measure that meets this criterion is Curriculum-Based Measurement (CBM) (Shinn, 1989; 1998). CBM provides a validated system of measurement that maintains these necessary technical features, and thus enables teachers to effectively monitor a student's progress and determine if an intervention is effective for a student who is experiencing academic difficulties such as in reading (Fuchs, Fuchs, Hamlett, & Stecker, 1990). With the use of CBM

data, intervention can be evaluated quickly when problems first emerge and before academic deficits that are due to environmental influences (poor motivation, ineffective instruction) are too severe to be remediated in the general education classroom (Fuchs, 2003).

Given the availability of CBM as a frequent progress monitoring system of intervention effectiveness, the concept of Response to Intervention appears to be a viable alternative approach to defining reading disabilities while providing intervention to remediate academic deficits. There exists an extensive literature of empirically based reading interventions that may provide insight regarding what interventions are most likely to be effective for individual at-risk students within a short period of time. And many of these studies that have employed CBM measures to evaluate student progress have demonstrated positive effects of various types of reading interventions with at-risk readers. A review of this literature may provide valuable information about which empirically based interventions are available for an RTI evaluation for students with reading difficulties. Given the diversity in school-aged populations and complex range of academic problems, this review may reveal a set of reading interventions that appear in the literature to be useable in the general education and that most students are likely to respond to with success. The knowledge attained from this review may inform intervention providers regarding the intensity, frequency, and/or duration of interventions necessary for successful outcomes. Thus, the first purpose of this review is to summarize current research on RTI assessments for students with a learning disability in reading. The second purpose is to summarize findings on CBM measures for monitoring RTI assessments for difficulties in reading. The third, and primary, purpose is to review the existing literature on reading interventions for remediating performance for students with reading difficulties and monitored with CBM outcome measures. This literature will be reviewed to identify a scientifically

supported set of strategies that can be utilized within an RTI approach to assist in the identification of students with learning disabilities within a short period of time. Based on a review of data from empirically validated effective interventions in the existing literature, the following questions will be considered. Implications to a school psychologist's role for selecting and evaluating reading interventions when participating in an RTI model based on this review are also discussed.

1. Which individual reading interventions have been empirically validated using CBM as a progress monitoring tool?
2. Which student populations have been best represented in the empirically validated interventions (gender, grade, ethnicity, type of disability, initial deficit severity range)?
3. How versatile are the effects of various types of empirically based intervention regarding location and examiner variables?
4. How frequently (sessions per week) was each type of intervention and CBM administration implemented with the students participating in the studies?
5. What range of total number of sessions were conducted?
6. How much time was each intervention implemented with students participating in the study?
7. How does the average growth between the initial baseline performance and final treatment performance as measured by CBM outcomes differ between validated interventions?
8. How does the change in reading level (frustrational, instructional, mastery) differ between validated interventions?

Literature Review

Description and Research Summary of Response to Intervention

Recently, there has been an increased interest in the RTI approach, specifically in response to the Individuals with Disabilities Education Improvement Act of 2004 (IDEA 2004) which allows schools to opt to use a child's response to several quality general education interventions as part of the Special Education eligibility process to determine children with learning disabilities. As a result, findings from recent studies are helping to define RTI as a valid assessment approach that produces data beneficial to guide instruction and identify students who may be in need of extra support through Special Education (O'Connor, Fulmer, Harty, & Bell, 2005; Scanlon, Vellutino, Small, Fanuele,& Sweeney, 2005; Simmons, Coyne, Kwok,McDonagh, Harn, & Kame'enui, 2008; Torgesen, Alexander, Wagner, Rashotte, Voeller, & Conway, 2001; Torgesen, Wagner, Rashotte, Rose, Lindamood, Conway, et al., 1999; Vadasy, Sanders, & Peyton, 2006; VanDerHeyden, et al., 2007).

The ultimate goals of RTI are twofold. The first goal is to ensure that quality instruction, good teaching practices, differentiated instruction, and remedial opportunities are provided in general education. The second goal is that Special Education is provided for students with disabilities who are in need of more specialized services than can be provided in general education (NJCLD, 2005). RTI is an assessment method with a variety of ways to implement interventions to obtain data that would meet these goals. However, most methods are comprised of three key elements: universal screening, intervention, and progress monitoring of student response to intervention. Several models have been proposed comprising three to four tiers of intervention. Specifically, at the first tier, frequent universal screening is conducted to evaluate and confirm that high quality instructional and behavioral supports are provided for the majority

of students (80 to 90% of the school population) in general education. A second tier is implemented to provide a more intensive intervention in general education to small groups of students (approximately 20% of the school population) whose performance and rate of progress lag behind their classroom, school, or district peers. A third tier of intense individualized instruction is provided and more frequently monitored for those students who do not show gains to the second tier level of interventions (Case, Speece, & Molloy, 2003; Martson, 2005; Speece et al., 2003). A poor response at the third tier may be an indication that the student actually has a learning disability and his/her poor performance is not better explained by some other factor such as low motivation or prior poor instruction (Fuchs, 2003; Mellard et al., 2004). Those students who do not adequately respond to three levels of more intensive interventions are considered for a Special Education evaluation conducted by a multidisciplinary team to determine eligibility for Special Education services.

There are several significant advantages to using an RTI approach. First, frequent universal screening of the entire student population serves to evaluate the effectiveness of the current curriculum for the entire student population, including those who may have a Learning Disability (LD). Second, frequent universal screening has been shown to identify struggling students early on in their education, thus reducing the traditional "wait-to-fail" situation for more students (Marston, 2005). Research has shown that children at risk for long-term learning disabilities can be identified in Kindergarten, and by applying interventions early, many of these learning difficulties can be prevented (Speece et al., 2003.) Vellutino, Scanlon, Small, and Fanuele (2006) conducted a 5 year longitudinal study in which students were administered measures of emergent literacy skills, including the Woodcock Reading Mastery Tests-Revised, upon Kindergarten entrance. Students identified as at-risk for reading difficulties based on these

assessments were given a small group, early literacy program intervention two times per week for 30 minutes each session throughout their Kindergarten year with the emergent literacy skills measures being administered several times throughout the year to track progress. Students still at risk at the beginning of 1st grade were given additional one-to-one, daily tutoring for another year. Reading progress was tracked through 3rd grade. Results showed that when students were identified early and interventions were applied, 84% of the at-risk students were reading on an average level on all literacy measures by the end of 3rd grade.

Using RTI data to guide instruction and intensive intervention in the general education may also differentiate between poor performance due to inadequate instruction or motivation and poor performance due to a learning disability. For example, Burns and Senesac, (2005) has showed that elementary students (n = 151) who performed poorly at tier 1 general education instruction and were non-responders at tier 3 (post-intervention) were considered to be dual discrepant (i.e., lower level and lower rates of growth on CBM reading probes than peers). These students' performance was also significantly differentiated from students who perform poorly at tier 1 but were responsive to intervention in tier 2.

RTI has been shown to decrease the over-identification of minority students for Special Education (Marston, Muyskens, Lau, & Canter, 2003; VanderHeyden & Witt, 2005; VanderHeyden, Witt, & Naquin, 2003). When a greater percentage of a student population was referred than the expected rate in a school, use of RTI assessments lowered the percent of student's referred (VanDerheyden et al., 2006). It may be likely that RTI reduces the bias in assessment of students who are culturally or linguistically diverse.

Despite the many advantages and benefits of RTI, there are several areas of concern. One significant concern is with accurate implementation of RTI given that the assessment data is

collected as some type of intervention is implemented with at-risk children. Currently, there are few researched methods that have effectively increased and maintained teacher integrity of interventions although less than 20% of interventions teachers agree to implement are implemented correctly or at all (Wickstrom, Jones, LaFluer, & Witt, 1998). Thus, it is necessary to research and select the structure and component of the method to be used that is most likely to be implemented in a manner that will effectively support and identify children with disabilities across different school and districts. For example, some researchers advocate that a more rigid RTI framework consisting of a few selected standard empirically based protocols may increase the likelihood of implementation success across schools and districts due to ease in training and follow through on correct implementation (Barnett, VanDerHeyden, & Witt, 2007; Fuchs, Mock, Morgan & Young, 2003). The decision of how rigid or flexible an RTI method is may affect the skills needed by personnel, the cost of staff resources, and the ability to replicate the method in other schools to provide meaningful outcomes for children. Alternatively, flexibility within an RTI approach to problem solve individual problems may be beneficial to the individual student (NJCLD, 2005) but may be more difficult to train, uniformly apply and assess for accurate implementation. However, this type of method requires extensive problem solving expertise and procedures will vastly differ with individual students making effective program procedures harder to monitor and replicate across school settings. The method of RTI selected also leads to the question of the possible need to redefine the role of general and Special Education teachers, psychologists, and other personnel. For example, schools may need to reallocate resources to determine who will provide the instruction and intervention at each level, who will determine when a child is not responding, and who will ensure that the RTI procedures are implemented fully and with fidelity (Mastropieri & Scruggs, 2005).

A major limitation to RTI is the many unanswered questions that remain in the recently emerging RTI literature. Unclear issues for an effective structure of an RTI model include the number of tiers and the type of instruction and intervention at each tier for elementary or secondary students (Mastropieri & Scruggs, 2005). The requirement to use scientific, research-based instruction within each tier is limited by the lack of existing scientific, research-based interventions for reading comprehension, mathematics, and written expression. Other issues involve the limitation of research to identify the criteria to determine when a student is not responding and should move to the next tier. In addition, there are major challenges concerning intervention fidelity including the selection and monitoring of appropriate interventions and the determination of adequate intervention intensity, frequency, and duration.

Finally, adequate school resources may also cause challenges in implementing an RTI method of assessment. These resources include time, the provision of space, materials, and technology not only for the application of the method but also for professional training, the need to adequately collect and document progress significantly increases paperwork and record keeping which is subjected to the availability of staff and computers, the financial support needed to implement and RTI model, and the competency and the need to provide new instruction to the personnel and professionals that would be implementing the model.

Although these are complex issues, a review of the current literature on the effectiveness and efficiency of intervention may suggest intervention options that may best address some of these issues. Identifying potentially acceptable intervention options may lead to further research that compares the effectiveness of different intervention options that are used as RTI data on the improvement of student outcomes for the lowest readers.

Summary of research support for Reading Curriculum Based Measurement

In order to monitor an RTI assessment, educators need an effective and efficient tool to identify children early who are at-risk for poor performance and monitor the effect of remediating instruction. To accomplish this, an assessment tool must be sensitive to progress toward outcome in a brief period of time and can be administered many times throughout the school year so that student difficulties are identified when problems first emerge.

CBM is one well-studied assessment tool that can be used to frequently monitor student progress on reading passages over time (Deno, 1985; Fletcher et al., 2005; Shinn, 1989; Shinn, 1998). CBM was developed by Deno in 1985 as an alternative approach for teachers to evaluate their instruction and monitor their students' progress. CBM has been shown to be effective in obtaining individual student performance data to support educational decisions. Uses of CBM include screening to identify disabilities, evaluating pre-referral interventions, determining eligibility for and placement in Special Education, evaluating instruction, and evaluating reintegration and inclusion of students into mainstream programs. The development of CBM has been linked to addressing the disadvantages of standardized, norm referenced assessment. These disadvantages include lack of treatment utility, the mismatch between assessment and curriculum, extensive training, costs and time, insensitivity to small treatment gains, inadequacy in diagnosing learning disabilities, primary focus on the child as the problem, exclusion of consideration of environment factors, and cultural bias (Shinn, 1989).

One advantage of CBM is the quick and easy administration (Deno, 2003). CBM involves the use of measurement materials or short probes consisting of academic content drawn specifically from the curriculum that the student is expected to know over a certain period of

time. Measurement tasks for reading involve students reading grade appropriate reading passages while an examiner or teacher records oral reading fluency (ORF). ORF is calculated as the number of correctly words read out loud by the student per minute. The student's progress can be frequently monitored, even daily, to evaluate the change in words read correctly per minute on grade level reading passages throughout a school year. This progress is used to discriminate between those students who are adequately learning within the curriculum with or without intervention support and those students who are not progressing at satisfactory rates and need additional intervention support.

Measurement duration, administration, student directions, and scoring procedures have been standardized (Shinn, 1989). This standardization is necessary to ensure adequate reliability for individual and group comparisons over time, as well as to develop local norms and to identify effectiveness of curriculum across students (Shapiro, 1996).

One advantage of using the CBM approach for monitoring students' progress is that CBM measures are sensitive to small but meaningful academic performance changes over a short period of time. According to Shinn and Bamonto (1998), this sensitivity allows detection of differences among individuals who do and do not demonstrate a skill level or shows differences in skill proficiency over time. Marston et al. (1984) examined the sensitivity of change in oral reading rate CBM reading probes by comparing short-term reading progress for 10- and 16-week intervals between both standardized reading tests and CBM. Results demonstrated that although the standardized assessment measured improvement, the CBM showed greater growth in reading performance and correlated strongly with teacher perceptions of student improvement. This suggests that CBM measures are sensitive to effective instructional changes and academic performance by frequently monitoring student progress.

Reliability for CBM measures for reading has also been empirically demonstrated. Correlations between ORF and standardized, comprehensive measures of reading range from r = .63 to r = .90 (Deno, Marston, Mirkin, 1982; Marston, Fuchs, & Deno 1986; Marston, 1989). In addition, ORF measures have been reported to have high test-retest reliability estimates (range, r = .92 to .97) and alternate-form reliability estimates (range, r = .89 to .94; Baker & Good, 1995; Shinn, 1989). With English Language Learners (ELL) and English speaking populations, Baker, Plasencia-Peinado, and Lezcano-Lytle (1998) found test-retest reliability to be .87 and .92, respectively. In addition, they calculated split-half reliability to be .99 for both groups.

Much research has been done on the validity of CBM. For example, Fuchs, Fuchs, and Maxwell (1988) explored the content validity of CBM measures for reading. These authors found a correlation of .92 between oral reading rates and the Reading Comprehension subtest of the Standford Achievement Test and a .81 correlation with the Word Study Skills subtest. CBM studies with elementary students indicate that oral reading rates are a good indicator of reading proficiency and a consistent indicator of reading comprehension when compared to comprehension measures on standardized reading tests (Wayman, Wallace, Wiley, Ticha, & Espin, 2007). Fewster and MacMillan (2002) demonstrated discriminative validity for the use of CBM in a study with 465 students in 6th and 7th grade. Results from this study revealed that evaluation of progress using CBM data differentiated between student groups of various proficiency levels including groups identified as low achieving, having learning disabilities or mild mental retardation, groups of students without these disabilities, and groups of students with honors class membership. However, a review of CBM studies conducted by Wayman et al., (2007) indicate that correlations between oral reading rate measures and criterion measures are mixed ranging between .40 to .70. Treatment validity has been explored, as well, and research

has shown evidence of CBM data used to increase student achievement and metacognition. Fuchs, et al., (1984) found that teachers using CBM procedures with students having mild disabilities saw significantly greater gains in reading achievement than did teachers in a control group that did not use CBM data. Fuchs, Fuchs, and Hamlett (1993) found greater gains on the Reading Comprehension subtest of the SAT when teachers monitored reading progress. Fuchs et al. (1984) demonstrated that students whose teachers used CBM had greater and more accurate awareness of reading goals. Even students who were given graphic feedback of their CBM scores were shown to be more motivated (Christ & Schanding, 2007), have less variability in scores (Fuchs, Fuchs, Hamlett, & Whinnery, 1991), and have increased self-perceptions of competence in reading (Glor-Scheib & Zigmond, 1993).

Stecker, Fuchs, and Fuchs (2005) reviewed several studies between 1980 and 2005 that have utilized CBM to identifying students in need of additional instructional support, and to monitor progress and plan instruction within general education classrooms. An examination of results from studies investigating effects of teacher review of use of CBM data on the achievement of students indicates that growth was obtained only when teachers made the effort to modify instruction for low performing students. Moreover, provision of clear data-based guidelines on determining inadequate progress and recommended types of instructional program changes may be needed to increase effective instructional modifications. Thus, CBM data is useful when teachers are provided with support on how to respond to the presented CBM data.

In addition to meeting adequate reliability and validity, CBM meets the criteria of a "good test" according to Choate, Enright, Miller, Poteet, and Rakes (1992). These criteria include ease of administration and scoring, time efficient, pleasant for the student, sensitivity to small performance changes, and amenable to frequent administration. Thus, CBM appears to be

an acceptable alternative or addition to standardized, norm referenced assessment.

As evidenced by a review of the literature, support for reading CBM has been well established and documented. This evidence provides support on the technical adequacy and utility of reading CBM as an effective tool that can be a useful and practical assessment tool to use for a RTI assessment. CBM data is a valid tool that can be used for ongoing identification of at-risk students likely to benefit from further intervention at any time during a school year and monitoring progress of applied intervention with at-risk students.

Literature Review on Effective Reading Interventions Based on CBM Outcome Measures

The major RTI challenge is selection of high-quality interventions that will be effective when implemented with integrity. A review of the literature may provide an additional knowledge base about intervention options and potential barriers there may be to their use. In particular, a review of change in reading performance based on CBM outcomes may help to define what constitutes empirically based, effective reading intervention as far as options for different student populations, versatility of location and examiner, administration variables such as time, frequency, location, and intensity, and effective growth rates.

Method

Study Selection

The PsycInfo, Ebscohost, and Psychology and the Behavioral Sciences Collection databases were used as the primary source for locating studies using CBM to measure individual response to reading interventions. The following descriptors were used in the database search: curriculum based measurement, curriculum based assessment, reading interventions, progress monitoring, and oral reading fluency. Studies were searched back to 1980 and the references of the selected studies were searched for other potential relevant studies.

Studies that were reviewed in this literature met three inclusion criteria. First, studies that examined the effects of reading interventions on examined oral reading rates (i.e., correct words per minute) were included. Second, single subject studies were included for analysis of individual change in reading performance over time with intervention. Third, CBM was administered at least twice per intervention with no more than 2 weeks between administrations.

Areas of Evaluation and Coding Procedures

A total of 21 articles were identified using the inclusion criteria for this review. The author reviewed and coded each of the identified studies. All data were coded by individual participating students rather than article in order to evaluate individual change in oral reading rates.

Each participant's demographics were coded including participating grade levels (elementary, middle, or high school), gender, disability classification, and initial deficit severity range (frustrational, instructional, and mastery). The setting for intervention (general education classroom, Special Education classroom, home, or other location) and who administrated the intervention (experimenter, teacher, parent, or peer tutor) were also recorded.

Intervention administration procedures were evaluated for each participant. First, the amount of time that the treatment took to administer was coded within ranges including 1 to 10, 11 to 20, 21 to 30, and 31 to 40 minute ranges. Second, the amount of times the intervention was administered per week was coded within ranges of 1 time per week, 2 to 3 times per week, and 4 to 5 times per week. Finally, the amount of times CBM was administered to evaluate intervention progress was coded.

Also recorded for each participant was intervention and intervention progress as evaluated by oral reading rates. Progress was evaluated two ways. First, growth in oral reading rates was determined from the difference between the initial baseline data point and the final treatment point presented on student graphed data that was provided in a study. Second, growth was examined as the difference in the change of reading level between the initial baseline session and final treatment session reading level performance. Reading level was defined at three distinct levels: mastery, instructional and frustrational reading levels. Instructional level is considered to be tasks that provide the student with the optimal learning opportunity by working on tasks that are sufficiently familiar but provides some degree of unknown material to be learned. On these types of tasks, growth is expected to occur given standard effective teaching practices. Tasks that students do slowly or with a great amount of errors are considered to be at a frustrational level, while tasks that can be proficiently completed are considered to be at a mastery level (Binder, 1996). Based on previous research (Deno & Mirkin, 1977; Shapiro, 1996), the instructional level applied for reading is 40-60 words correct per minute for grades 1 and 2, and 70-100 words correct per minute for grades 3 and above. Scores above instructional range were considered at mastery level. Alternatively, scores below instructional level was considered at frustrational level.

The studies reviewed were described in several ways. First, the study design was evaluated. Coded categories for study design included multi-element, multiple baseline, alternating treatment, and withdrawal single subject. Second, the provision of treatment integrity was measured to assess the degree that the intervention was implemented and was coded as either "yes" if provided or "no" if no integrity measure was mentioned in the study results.

Coding Results

Twenty-one research studies were identified that met inclusion criteria. From these studies, 223 individuals received interventions. Due to the majority of studies reviewed using multiple participants and/or more than one intervention, data were coded by participant rather than by study. Among the 21 studies, four treatment designs were employed. Specifically, 48% used an alternating treatment design, 33% used multi-element, 10% used multiple baseline, 5% used a withdrawal single subject design, and 5% used a with-in group repeated measure design. All 21 studies used Oral Reading Fluency as the dependent variable and 86% reported adequate treatment integrity.

Participant Data

Table 1 presents participant characteristics. More males (75%) than females (23%) participated in the studies with the remaining participants (2%) not being identified by gender. The majority of participants (69%) were elementary age with the other participants in middle school (16%) and high school (16%). Across all participants,
58% were identified with a disability, the most common general disability category being Learning Disabled (44%). The remaining participants were identified as At-Risk (34%) for reading difficulties and English Language Learners (7%). Based on initial baseline performance, most participants (66%) were identified as reading on a frustrational level. Of the remaining participants, 22% were identified as reading on an instructional level, 9% on a mastery level, and 3% not being identified with a reading benchmark level.

Table 1

Participant Characteristics

	Percentage of Participants	Number of Participants
Gender		
Male	74.9%	167
Female	22.9%	51
Not identified	2.2%	5
Disability Category		
Learning Disabled	44.4%	99
Emotionally Disturbed	14.3%	32
At Risk	34.1%	76
English Language Learner	7.2%	16
Age		
Elementary	68.6%	153
Middle	15.7%	35
High	15.7%	35
Reading Level		
Frustrational	66.4%	148
Instructional	21.5%	48
Mastery	9.4%	21
Not identified	2.7%	6

Intervention Types

Nineteen different reading interventions were empirically validated using CBM as a progress monitoring tool in this review. Twelve additional interventions were identified using a combination of one or more of the nineteen original interventions. Tables 2 and 3 list and describe each of these interventions and the percentage and number of participants that were monitored for each of them. Although 31 different and/or combined interventions were examined, few replicated results across studies.

Table 2

Intervention and Descriptions

Intervention	Description	Percentage of Participants	Number of Participants
Silent Preview	The student was instructed to read the passage silently and inform the experimenter when finished.	15.2 %	(34)
Taped Words	The student first read along with an audio tape of the word list. The subject read the words out loud to insure the task was being performed. The student then read the word list and passage in randomized order.	4.0%	(9)
Listening Passage Preview	The experimenter first read the passage to the student (modeled) and then the student read the passage repeatedly 3 times with feedback as to the speed of reading.	8.5%	(19)
Listening Discussion	The teacher discussed approximately 10 key words form the story then reads the story out loud while the students read the story silently.	4.0%	(9)
Silent Discussion	The teacher discussed approximately 10 key words from the story, and then the students read the passage silently.	3.6%	(8)
Immediate Feedback	Seven index cards containing words were read by the student. If the word was read correctly within 3 seconds, the student received a token. If the word was read incorrectly or not read correctly within 3 seconds, the word was read for them. The student then repeated the word. Each set of words were presented 3 times. Token were exchanged for stickers at the end of the session.	1.3%	(3)

5 Second Feedback	Similar to Immediate Feedback, however, 5 seconds were waited before presenting the next word.	1.3%	(3)
Repeated Readings Fixed Rate	Students read and continued to reread a story passage until they reached a criterion of 90 correct words per minute.	3.1%	(7)
Repeated Readings Improvement	Students read and continued to reread a story passage until they achieved 3 successive improvements on correct words read per minute.	1.8%	(4)
Repeated Readings and Performance Feedback	The passage was read repeatedly 4 times by the student with feedback as to the speed of reading.	2.7%	(6)
Rapid Oral Presentation	The student followed along, reading silently, as the experimenter read aloud at a natural rate.	8.1%	(18)
Slow Oral Presentation	The student followed along, reading silently, as the experimenter read aloud at a reduced rate of approximately 50 words correct per minute.	8.1%	(18)
Reward	Students were asked to select three items from an informal reinforcement survey that they would be willing to work for. These were listed in order of preference. If the student was able to read the passage at a rate greater to the mastery level (60 CRW per min for 1st and 2nd grades, 100 CRW for 5th and 6th grades), they would receive the first preferred item. If the passage was read at a rate equal to mastery level, they received the second preferred item, and a rate slightly less the master level, they would receive the third rated item.	1.8%	(4)
Reading to Read	The student was told they would be working on improving their reading. They were given a story to read as quickly as they could without any errors. Each story was read until the student could read at the rate of 100 words per minute without any errors. If an error was made, the examiner supplied the word and asked the child to	1.3%	(3)

	repeat it and continue reading. After each reading, the student was given feedback and praise.		
Assisted Reading	The teacher tape recorded each passage for four minutes at the rate of 128 words per minute. The student silently read the passage while listening to the recorded reading. The student then read the passage aloud once followed by silent reading of the passage three times without the taped reading. Finally, the student read the passage out loud a second time.	1.3%	(3)
Phonic Analysis	The student was instructed to attend to various phonetic elements of the error word (e.g. "what does this letter make?") and told to sound out each element. After successfully sounding out each word, the word is read at a normal rate.	2.2%	(5)
Goal Setting	The student was told they could earn a reward for meeting a goal. When the goal was met, a reward box containing tangible items was presented for an item to be chosen by the student.	1.8%	(4)
Word Supply	If an error was made during reading, the experimenter immediately supplied the word, the student repeated the word once, and then continued reading.	2.2%	(5)
Drill	When an error was made the experimenter immediately corrected the word. At the end of the session, all error words were printed on an index card and presented individually to the student. If the student made an error, the experimenter supplied the correct word and had the student repeat the word. Then the experimenter asked "what is this word?" If it was read correctly, the card was placed at the back of the deck for later presentation. The procedure was continued until the child correctly read all words. The deck was reshuffled and the procedure was repeated until the student successfully read the entire without an error on two consecutive presentations.	1.8%	(4)

Table 3

Combined Interventions

	Percentage of Participants	Number of Participants
Listening Passage Preview + Repeated Readings	5.8%	(13)
Listening Passage Preview + Repeated Readings + Easy Materials	1.3%	(3)
Listening Passage Preview + Repeated Readings + Reward	4.5%	(10)
Listening Passage Preview + Repeated Readings + Performance Feedback	2.7%	(6)
Listening Passage Preview + Repeated Readings + Performance Feedback + Reward	2 .7%	(6)
Word Supply + Reward	0.4%	(1)
Positive Practice + Reward	0.4%	(1)
Sentence Repeat + Reward	0.9%	(2)
Goal Setting + Reward	1.8%	(4)
Repeated Readings + Goal Setting + Listening Passage Preview	1.8%	(4)
Repeated Readings + Listening Passage Preview + Goal Setting + Reward	1.8%	(4)
Repeated Readings + Performance Feedback + Reward	1.3%	(3)

Intervention Administration Procedures

Thirty-one different reading interventions were utilized across the participants. Table 4 presents data on the amount of time that an intervention was administered to a student, the number of times the intervention was administered per week, and the number of times the CBM assessment was administered per intervention session. Of the studies that reported the time it took to implement the intervention (61%), the majority (29%) were administered within 11-20 minutes with 16% being administered in 1-10 minutes, 10% being administered in 21-30 minutes, and 6% being administered in 31-40 minutes. Of the interventions reporting how often they were administered (90%), 18% were administered two to three times per week and 71% were administered four to five times per week. Among the 31 interventions, 99% reported using CBM after each intervention session.

Location and Examiner Data

Table 5 presents location that the intervention was administered in each study and who administered the intervention. Interventions were administered in the Regular Education classroom (12%), in the Special Education classroom (22%), in another location at the school (59%) such as the library or a private room or office outside of the classroom, or in the participant's home (2%). Twelve locations (5%) were not reported. The majority of interventions were administered by the researcher (82%). The remaining interventions were administered by the classroom teacher (12%), a peer (1%), or by the parent (1%). Ten examiners (5%) were not reported.

Table 4

Intervention Timing and Frequency Procedures

	Percentage of participants	Number of participants
Intervention administration time:		
1-10 minutes	16.1%	36
11-20 minutes	28.7%	64
21-30 minutes	10.3%	23
31-40 minutes	5.8%	13
Not Reported	39.0%	87
Intervention administration frequency:		
2-3 times per week	18.4%	41
4-5 times per week	71.3%	159
Not reported	10.3%	23
CBM administration frequency:		
Each session	98.7%	220
Not Reported	1.3%	3

Table 5

Location of Intervention and Examiner

	Percentage of Participants	Number of Participants
Location		
Special Ed classroom	22.0%	49
Regular Ed classroom	11.7%	26
Other location at school	59.2%	132
Home	1.8%	4
Not Reported	5.4%	12
Examiner		
Researcher	81.6%	182
Teacher	12.1%	27
Peers	0.9%	2
Parent	0.9%	2
Not Reported	4.5%	10

Intervention Outcomes

Table 6 lists the interventions showing average growth for each intervention in order from most growth to least growth. The mean and standard deviation were computed for the last data point in each baseline condition and the last data point during the treatment phase for all students participating in an intervention. Growth was determined from the difference between the mean baseline data and the mean treatment data. All but one of the 31 interventions showed positive growth in words read per minute with a range of 1 word read per minute of growth for the Reward intervention to 67 words read per minute of growth for the Listening Passage Preview + Repeated Readings + Easy Material. Goal Setting showed a negative growth rate of -1.0 words read per minute.

Table 6

Intervention Mean (M), Standard Deviation (SD) and Range for Change in Words Correct Per Minute Between First Baseline and Final Intervention Session

Intervention	N	Baseline	Treatment	Growth
Listening Passage Preview + Repeated Readings + Easy Material	3	M = 34.67 SD = 7.09 (27.00 to 41.00)	M = 101.33 SD = 18.04 (84.00 to 120.00)	M = 66.67 SD = 25.11 (43.00 to 93.00)
Listening Passage Preview + Repeated Readings + Performance Feedback + Reward	6	M = 54.83 SD = 34.16 (31.00 to 115.00)	M = 107.00 SD = 24.65 (74.00 to 136.00)	M = 52.17 SD = 20.18 (21.00 to 77.00)
Listening Passage Preview + Repeated Readings + Performance Feedback	6	M = 54.83 SD = 34.16 (31.00 to 115.00)	M = 105.83 SD = 34.95 (53.00 to 145.00)	M = 51.00 SD = 30.80 (15.00 to 85.00)
Repeated Readings + Performance Feedback + Reward	3	M = 50.67 SD = 30.89 (23.00 to 84.00)	M = 98.33 SD = 17.04 (88.00 to 118.00)	M = 47.67 SD = 16.50 (34. 00 to 66.00)
Sentence Repeat + Reward	2	M = 49.00 SD = 11.31 (41.00 to 57.00)	M = 92.00 SD = 19.80 (78.00 to 106.00)	M = 43.00 SD = 8.49 (37.00 to 49.00)
Repeated Readings + Performance Feedback	6	M = 42.67 SD = 21.88 (23.00 to 84.00)	M = 85.33 SD = 20.23 (61.00 to 105.00)	M = 42.67 SD = 22.24 (21.00 to 82.00)
Listening Passage Preview + Repeated Readings + Reward	10	M = 45.50 SD = 29.31 (19.00 to 115.00)	M = 81.80 SD = 31.94 (37.00 to 132.00)	M = 36.30 SD = 20.20 (12.00 to 64.00)
Repeated Readings Fixed Rate	7	M = 44.71 SD = 19.48 (23.00 to 84.00)	M = 78.00 SD = 20.87 (62.00 to 119.00)	M = 33.29 SD = 12.28 (20.00 to 50.00)
Listening Passage Preview + Repeated Readings	13	M = 43.00 SD = 25.99 (19.00 to 115.00)	M = 74.15 SD = 20.80 (51.00 to 114.00)	M = 31.15 SD = 16.97 (-5.00 to 59.00)
Word Supply + Reward	1	M = 55.00 SD = 0.00 (55.00 to 55.00)	M = 82.00 SD = 0.00 (82.00 to 82.00)	M = 27.00 SD = 0.00 (27.00 to 27.00)

Listening Passage Preview	19	M = 51.63 SD = 12.79 (30.00 to 75.00)	M = 77.58 SD = 21.08 (41.00 to 117.00)	M = 25.95 SD = 19.09 (-3.00 to 73.00)
Repeated Readings + Goal Setting + Listening Passage Preview	4	M = 31.50 SD = 14.06 (19.00 to 51.00)	M = 53.50 SD = 10.66 (46.00 to 69.00)	M = 22.00 SD = 3.92 (18.00 to 27.00)
Reading to Read	3	M = 55.67 SD = 15.04 (40.00 to 70.00)	M = 76.33 SD = 4.73 (71.00 to 80.00)	M = 20.67 SD = 15.14 (10.00 to 38.00)
Repeated Readings + Listening Passage Preview + Goal Setting + Reward	4	M = 31.50 SD = 14.06 (19.00 to 51.00)	M = 51.50 SD = 8.27 (45.00 to 63.00)	M = 20.00 SD = 17.98 (-6.00 to 33.00)
Word Supply	5	M = 30.00 SD = 6.56 (22.00 to 40.00)	M = 49.60 SD = 11.78 (34.00 to 60.00)	M = 19.60 SD = 9.13 (7.00 to 29.00)
Drill	4	M = 58.75 SD = 12.01 (45.00 to 73.00)	M = 77.75 SD = 21.68 (59.00 to 98.00)	M = 19.00 SD = 12.73 (5.00 to 35.00)
5 Second Feedback	3	M = 5.67 SD = 1.53 (4.00 to 7.00)	M = 24.67 SD = 1.53 (23.00 to 26.00)	M = 19.00 SD = 2.65 (16.00 to 21.00)
Immediate Feedback	3	M = 5.67 SD = 1.53 (4.00 to 7.00)	M = 23.00 SD = 1.73 (22.00 to 25.00)	M = 17.33 SD = 3.21 (15.00 to 21.00)
Repeated Readings Improvement	4	M = 40.25 SD = 7.80 (29.00 to 47.00)	M = 57.50 SD = 8.58 (50.00 to 69.00)	M = 17.25 SD = 6.90 (8.00 to 23.00)
Positive Practice + Reward	1	M = 25.00 SD = 0.00 (25.00 to 25.00)	M = 41.00 SD = 0.00 (41.00 to 41.00)	M = 16.00 SD = 0.00 (16.00 to 16.00)
Assisted Reading	3	M = 60.67 SD = 14.74 (44.00 to 72.00)	M = 75.67 SD = 9.29 (68.00 to 86.00)	M = 15.00 SD = 8.54 (7.00 to 24.00)
Listening Discussion	9	M = 37.89 SD = 39.51 (15.00 to 141.00)	M = 49.78 SD = 49.89 (23.00 to 181.00)	M = 11.89 SD = 11.47 (1.00 to 40.00)

Taped Words	9	M = 74.11 SD = 16.86 (45.00 to 92.00)	M = 85.78 SD = 13.65 (58.00 to 101.00)	M = 11.67 SD = 11.42 (1.0 to 38.00)
Phonic Analysis	5	M = 30.00 SD = 6.60 (22.00 to 40.00)	M = 40.40 SD = 11.10 (25.00 to 52.00)	M = 10.40 SD = 7.70 (-2.00 to 19.00)
Silent Preview	34	M = 66.14 SD = 31.05 (26.00 to 139.00)	M = 75.41 SD = 30.21 (13.00 to 130.00)	M = 9.26 SD = 14.49 (-18.00 to 54.00)
Slow Oral Presentation	18	M = 79.72 SD = 36.24 (26.00 to 139.00)	M = 88.22 SD = 30.45 (40.00 to 134.00)	M = 8.50 SD = 11.85 (-8.00 to 41.00)
Rapid Oral Presentation	18	M = 79.72 SD = 36.24 (26.00 to 139.00)	M = 83.00 SD = 35.73 (26.00 to 135.00)	M = 3.28 SD = 9.65 (-16.00 to 22.00)
Goal Setting + Reward	4	M = 31.50 SD = 14.06 (19.00 to 51.00)	M = 34.00 SD = 11.63 (21.00 to 48.00)	M = 2.50 SD = 11.00 (-3.00 to 19.00)
Silent Discussion	8	M = 25.00 SD = 8.68 (15.00 to 42.00)	M = 26.75 SD = 9.02 (19.00 to 41.00)	M = 1.75 SD = 5.97 (-10.00 to 10.00)
Reward	4	M = 31.50 SD = 14.06 (19.00 to 51.00)	M = 33.00 SD = 8.98 (27.00 to 46.00)	M = 1.50 SD = 7.51 (-5.00 to 8.00)
Goal Setting	4	M = 31.50 SD = 14.06 (19.00 to 51.00)	M = 30.50 SD = 12.07 (14.00 to 40.00)	M = -1.00 SD = 15.17 (-12.00 to 21.00)

Effectiveness

Growth was also examined as the difference in the change of reading level performance between the initial baseline session and final treatment session. For each intervention, Table 7 presents the percentage of students at mastery, instructional and frustrational reading levels at initial baseline and post-treatment reading levels. Table 8 shows the percentage and number of participants that increased reading levels for each intervention in order from highest percentage of increase to lowest for each reading level. Of the 217 students on which reading level was reported, 148 (68%) students read on a frustrational level, 48 (22%) students read on an instructional level, and 21 (10%) students read on a mastery level during baseline. Post-treatment, 83 (38%) students read on a frustrational level, 68 (31%) students read on an Instructional level, and 66 (30%) students read on a Mastery level. Of the 217 students, 51 (23%) increased their words read correctly per minute one level, 28 (13%) increased two levels, and 138 (64%) remained at their baseline level.

Table 7

Percentage of students at Mastery (M), Instructional (I), and Frustrational (F) Reading Level at Initial Baseline and Final Treatment Session.

	Baseline Level:	Treatment Level:
Silent Preview	M: 21% I: 24% F: 56%	M: 27% I: 29% F: 44%
Taped Words	M: 0% I: 67% F: 33%	M: 11% I: 67% F: 22%
Listening Passage Preview	M: 0% I: 16% F: 84%	M: 11% I: 47% F: 42%
Listening Discussion	M: 0% I: 0% F:100%	M: 0% I: 0% F: 100%
Silent Discussion	M: 0% I: 0% F:100%	M: 0% I: 0% F: 100%
Repeated Readings Fixed Rate	M: 0% I: 43% F: 57%	M: 57% I: 29% F: 14%
Repeated Readings Improvement	M: 0% I: 50% F: 50%	M: 25% I: 50% F: 25%
Repeated Readings and Performance Feedback	M: 0% I: 33% F: 67%	M: 67% I: 33% F: 0%
Rapid Oral Presentation	M: 39% I: 28% F: 33%	M: 39% I: 28% F: 33%
Slow Oral Presentation	M: 39% I: 22% F: 39%	M: 39% I: 33% F: 28%

Reward	M: 0% I: 25% F: 75%	M: 0% I: 25% F: 75%
Reading to Read	M: 0% I: 0% F:100%	M: 0% I: 33% F: 67%
Assisted Reading	M: 0% I: 33% F: 67%	M: 0% I: 33% F: 67%
Phonic Analysis	M: 0% I: 0% F:100%	M: 0% I: 20% F: 80%
Goal Setting	M: 0% I: 25% F: 75%	M: 0% I: 25% F: 75%
Word Supply	M: 0% I: 0% F:100%	M: 20% I: 40% F: 40%
Drill	M: 0% I: 25% F: 75%	M: 0% I: 50% F: 50%
Listening Passage Preview + Repeated Readings	M: 0% I: 15% F: 85%	M: 46% I: 39% F: 15%
Listening Passage Preview + Repeated Readings + Easy Material	M: 0% I: 0% F:100%	M: 67% I: 33% F: 0%
Listening Passage Preview + Repeated Readings + Reward	M: 0% I: 20% F: 80%	M: 60% I: 20% F: 20%
Listening Passage Preview + Repeated Readings + Performance Feedback	M: 0% I: 17% F: 83%	M: 83% I: 17% F: 0%
Listening Passage Preview + Repeated Readings + Performance Feedback + Reward	M: 0% I: 17% F: 83%	M:100% I: 0% F: 0%
Word Supply + Reward	M: 0% I: 0% F:100%	M:100% I: 0% F: 0%

Positive Practice + Reward	M: 0% I: 0% F:100%	M: 0% I: 100% F: 0%
Sentence Repeat + Reward	M: 0% I: 0% F:100%	M:100% I: 0% F: 0%
Goal Setting + Reward	M: 0% I: 25% F: 75%	M: 0% I: 25% F: 75%
Repeated Readings + Goal Setting + Listening Passage Preview	M: 0% I: 25% F: 75%	M: 25% I: 25% F: 50%
Repeated Readings + Listening Passage Preview + Goal Setting + Reward	M: 0% I: 25% F: 75%	M: 0% I: 50% F: 50%
Repeated Readings + Performance Feedback + Reward	M: 0% I: 67% F: 33%	M: 33% I: 67% F: 0%

Table 8

Increased Reading Fluency Level

Increase from Frustrational to Instructional			Increase from Instructional to Mastery			Increase from Frustrational to Mastery			No level Change		
	Percent	N		Percent	N		Percent	N		Percent	N
Word Supply	60%	3	RW + Positive practice	100%	1	Word Supply + RW	100%	1	Listening Discussion	100%	9
Sentence repeat + RW	50%	1	RR Fixed Rate	43%	3	LPP* + RR* + PF* + RW*	83%	5	Silent Discussion	100%	8
LPP	37%	7	RR + PF + RW	33%	1	LPP + RR + Easy Material	68%	2	Rapid Oral Presentation	100%	18
Reading to Read	33%	1	RR + Goal Set + LPP	25%	1	LPP + RR + PF	67%	4	RW	100%	4
Assisted Reading	33%	1	RR Improvement	25%	1	Sentence Repeat + RW	50%	1	Goal Set	100%	4
LPP + RR + easy material	33%	1	LPP + RR	8%	1	RR and PF	50%	3	Goal Set + RW	100%	4
RR + PF + RW	33%	1	LPP + RR + RW	20%	2	LPP + RR + RW	40%	4	Slow Oral Presentation	94%	17
LPP + RR	31%	4	RR + PF	17%	1	LPP + RR	39%	5	Taped Words	89%	8

RR + Goal Set + LPP	25%	1	LPP + RR + PF	17%	1	RR Fixed Rate	14%	1	Silent Preview	82%	8
RR + LPP + RW + Goal	25%	1	LPP + RR + PF + RW	17%	1	Taped Words	11%	1	Phonic Analysis	80%	4
LPP + RR + RW	20%	2	Silent Preview	6%	2	LPP	5%	1	Drill	75%	3
RR Fixed Rate	29%	2	LPP	5%	1	Drill	0%	0	RR + goal set + RW + LPP	75%	3
RR Improvement	25%	1	RR + LPP + Goal + RW	0%	0	Phonic Analysis	0%	0	Reading to Read	67%	2
Drill	25%	1	Drill	0%	0	Slow Oral Presentation	0%	0	Assisted Reading	67%	2
Phonic Analysis	20%	1	Phonic Analysis	0%	0	Listening Discussion	0%	0	LPP	53%	10
RR and PF	17%	1	Slow Oral Presentation	0%	0	Silent Discussion	0%	0	RR + Goal Set + LPP	50%	2
Silent Preview	12%	4	Listening Discussion	0%	0	Rapid Oral Presentation	0%	0	RR Improvement	50%	2
LPP + RR + PF	17%	1	Silent Discussion	0%	0	RW	0%	0	Word Supply	40%	2
Slow Oral Presentation	6%	1	Taped Words	0%	0	Goal Set	0%	0	RR + PF + RW	33%	1
Listening Discussion	0%	0	Rapid Oral Presentation	0%	0	Goal Set + RW	0%	0	LPP + RR	23%	3
Silent	0%	0	RW	0%	0	Word Supply	0%	0	LPP + RR +	20%	2

Discussion									RW		
Taped Words	0%	0	Goal Set	0%	0	Reading to Read	0%	0	RR + PF	17%	1
Rapid Oral Presentation	0%	0	Word Supply + RW	0%	0	Assisted Reading	0%	0	RR Fixed Rate	14%	1
RW	0%	0	Goal Set + RW	0%	0	Positive practice + RW	0%	0	Word Supply + RW	0%	0
Goal Set	0%	0	Word Supply	0%	0	RR + PF + RW	0%	0	LPP + RR + PF + RW	0%	0
LPP + RR + PF + RW	0%	0	Sentence repeat + RW	0%	0	RR + Goal Set + LPP	0%	0	LPP + RR + easy material	0%	0
Word Supply + RW	0%	0	Reading to Read	0%	0	RR Improvement	0%	0	LPP + RR + PF	0%	0
Positive Practice +RW	0%	0	Assisted Reading	0%	0	Silent Preview	0%	0	Sentence repeat + RW	0%	0
Goal Set + RW	0%	0	LPP + RR + easy material	0%	0	RR + LPP + goal set + RW	0%	0	Positive Practice +RW	0%	0

*Note: *LPP = Listening Passage Preview, RR = Repeated Readings, RW = Reward, and PF = Performance Feedback*

Discussion

Recently, researchers have demonstrated benefits of the RTI process for reading assessment including increased preventative systematic supports and academic performance for at-risk identified students, and reduced referrals for Special Education services and testing costs (O'Connor et al., 2005; Scanlon et al., 2005; Simmons et al., 2008; Torgesen et al., 2001; Torgesen et al., 1999; Vadasy et al., 2006; Vanderheyden et al., 2006). However, few interventions have been used to collect RTI assessment data in the current RTI studies. One major concern when developing an RTI program is knowing the availability of interventions with optimal intensity level and how these interventions may influence RTI outcomes. Intensity of an RTI intervention may be based on dimensions such as amount of time and frequency of sessions, amount of personnel and resources, and number of instructional components. Studies exist, that examine a variety of interventions that may be selected to enhance academic performance with optimal intensity levels when using an RTI approach. The present review of the literature on reading interventions attempted to address issues regarding the effectiveness and intensity of available intervention options. The following section discusses several of the findings and suggests potential options for RTI programs for students with reading disabilities and for future research.

One of the requirements of an RTI model is the use of scientific, researched-based interventions for reading comprehension. This review explored the availability of empirically based reading interventions that can be utilized within an RTI approach to assist in the identification of students with learning disabilities using CBM procedures. Findings based on CBM assessments were selected due the ability to assess behavior change with intervention within a short period of time (Shinn, 2007). Results suggest that schools have many options for

individual reading interventions that have been empirically validated using CBM. Thirty-one different or combined interventions were identified in the studies reviewed. This suggests that schools have the ability of meeting one of the major goals of the RTI model, in that, differentiated instruction and remedial opportunities can be successful in the general education setting.

Although many interventions were investigated, few participants were included in each study. In addition, student populations represented in the empirically validated interventions were limited with the majority of participants being male and elementary aged. These studies are consistent with the finding that children at risk for long-term learning disabilities can be identified in Kindergarten and long term difficulties prevented by the application of early intervention (Vellutino, et al., 2006) and, therefore, support the early intervention prevention focus of RTI programs. However, little support is provided for intervention options for struggling older students. Alternatively, the inclusion of a high percentage of students already identified with a disability (59%) limits conclusions about intervention choices and expected growth for those at-risk students who are identified in the RTI process when problems first emerge. Of the thirteen Special Education disability categories, only two categories were represented by the participants: Learning Disabled and Emotionally Disturbed. Although this may be reflective of the groups most affected by reading disabilities, these studies are not representative of students who have difficulty with reading and would benefit from interventions and support due to problems with behavior, inattention, intellectual deficits, or other such areas. Given the limited number of subjects, results are not yet confirmed across specific student populations or subtypes of students (e.g., minorities, at-risk, English Language Learners). These

findings highlight the need for more intensive progress monitoring studies to explore effects of interventions on diverse student populations.

Initial reading level is an additional indicator of the type of students and reading problems that students were exhibiting prior to intervention. In the studies reviewed, the majority of participants (69%) were identified as reading on a frustrational level prior to intervention. Interestingly, 22% and 9% of the students were identified as reading at an instructional and mastery level. This questions what is defined as students at risk for reading difficulties and in need of reading interventions. Another issue of RTI implementation is the limited research on the performance level criteria that effectively identifies at-risk students who need additional intervention support and identifies students who are responding to intervention and will continue to adequately respond over time. An anticipated benefit of RTI is to increase low reading performance to a more acceptable instructional or mastery range within a reasonable period of time. One noteworthy finding of this review is that growth was obtained with all but one of the interventions, however, not all interventions led to an increase from one reading level to the next. Specifically, the majority of students (85%) showed increased reading rates between the last baseline session and final treatment session, although the amount of growth ranged between 1 to 93 WCPM. In contrast, few students (36%) increased reading performance to a higher reading level as defined in this study. Of the students who started at the frustrational level, 59% showed no score change, 17% increased score to an instructional level, and 13% increased score to a mastery level. Of the students who started at the instructional level, 69% showed no score change and 31% increased score to a mastery level. This contrast in reading performance has important implications to research on appropriate decision rules in defining "adequate" responsiveness. Clearly, students who increase performance level within grade level

would indicate a positive RTI. VanDerHeyden, Witt, and Gilbertson (2007), for example, demonstrated that brief two to three week RTI interventions implemented with students performing at a frustrational level increased math and reading scores within an instructional range. Moreover, implementation of the RTI program with identified at-risk children reduced the number of referrals for Special Education evaluations as compared to evaluations conducted two to three years prior to the program. Decision-making would be less clear if a student showed growth but did not change level. To date, there remain unresolved issues regarding how to ascertain what level or rate of growth indicated that a student will continue to progress as expected without additional intervention support (Silbert & Hintz, 2007). An important issue that will influence the success of RTI is the reliability of judgments of adequate progress that leads to sustained adequate growth over time without further support and judgments of inadequate progress with decisions eventually leading to effective support in the least restrictive environment (Fuchs, Fuchs, & Compton, 2004; Shinn, 2007).

Evaluation of intervention effects on reading rates was selected as study inclusion criteria given that reading rates indicate a student's general reading ability and may used to evaluate a student's response to intervention within a few weeks (Shinn, 2007). However, there are also a number of additional socially validated outcomes that are important outcomes to review that are important to educators when making educational decisions such as gains within peer average, changes in reading grade, increased high stakes testing scores, or avoided Special Education services. Very few studies in this review examined these types of outcome data in addition to changes in reading fluency. Additionally, the lack of follow-up data in most studies makes sustainment of growth over time unclear. Further research would be beneficial to determine how

much growth may be considered adequate to determine that an intervention is successful and sufficient progress is being made by the student and sustained over time.

With respect to the selection of the more effective interventions from the available intervention options, all 31 interventions increased performance for at least one student, but 11 interventions revealed negative growth for one or more participating students. Further, 6 of the 31 interventions did not demonstrate a change in level for at least one student (reward + goal setting, goal setting, reward, rapid oral, silent discussion, listening discussion). Based on overall means of student growth, the more successful reading interventions used a combination of instructional components. A review of interventions with the highest means suggests that interventions using modeling, practice, and feedback are effective in increasing reading rates in students. Practice and modeling components were used most frequently using listening passage preview, repeated reading, word supply, and sentence repeat. Combining the effective instructional components with reward contingent on increased performance was also one of the more effective interventions. Alternatively, the least effective intervention in this review, with an average of less than 3 WCPM growth over time, were contingent reward and goal setting provided alone or in combination. This finding is not surprising if most students were experiencing reading problems due to a skill deficit. It is important to note, that most studies did not determine when the function of the problem was due to a performance deficit problem requiring motivational strategies or a skill deficit problem requiring instruction. Duhon, et al. (2004) demonstrated that this distinction helps leads to a hypothesis that can be used to select an effective intervention. For students identified as having a performance deficit, motivational strategies such as contingent reward and goal setting would be effective. Alternatively, this type of intervention was not effective for students with skill deficits.

One advantage of having an array of effective intervention options allows schools to select the intervention that fits the schools specific administrational needs that would increases the likelihood that intervention would be used correctly. Accurate implementation of interventions by teachers is one of the more significant concerns of RTI. A majority of teachers who seek assistance with intervention and participate in intervention training still have difficulty implementing interventions with acceptable fidelity (Gilbertson, Witt, LaFleur, & VanDerHeyden, 2008; Noell & Gansle 2006; Noell, et al., 2005; Wickstrom, Jones, LaFleur, & Witt, 1998*)*. Thus, the practicality of intervention implementation was examined by reviewing the percentage of interventions that were successfully implemented in classroom settings. Results showed that interventions were conducted successfully in a variety of settings (home, resource classroom, regular education classroom, other school location) with a variety of examiners (teacher, parents, peers). However, the majority of interventions in this review were administered within the school but in a location outside of the classroom. Only 4 interventions were conducted in the classroom setting (Silent Preview, LLP, Listening Discussion, and Silent Discussion). Moreover, a researcher rather than the classroom teacher conducted intervention sessions in most studies. Four interventions were conducted by a Regular Education or Special Education teacher (Listening Discussion, Silent Discussion, Repeated Readings, and Assisted Reading). While this finding suggests that there may be flexibility as to location and examiner in any given intervention, these findings limit the evaluation of the educators and staff capability in effectively implementing and maintaining intervention integrity in a classroom or small group setting. This suggests that effective implementation in the classroom setting by the general education teacher still remains a significant concern in implementing RTI. Without sufficient evaluations of integrity and social acceptability of educators who would implement such RTI

assessments, the intervention ease, feasibility and accuracy of implementation cannot be ascertained. As only 11% of interventions occurred within the regular education classroom, it is unclear if it is feasible for the interventions identified in this review to be provided within the classroom and without researchers to assist.

Adequacy of school resources, such as available time, provision of space, materials, and technology to implement intervention and monitor progress, cause significant challenges to implement an RTI method of assessment. In this review of the literature, the intensity of intervention in terms of time, frequency, and assessment administration for each proven intervention was examined to review which interventions may be most useful for determining intervention responsiveness within a reasonable period of time. The majority of interventions in the studies that reported session duration were completed within twenty minutes or less, with only 16% being administered in more than twenty minutes. All interventions were conducted no less than twice per week, with the majority being administered four to five times weekly. Of the 189 students who showed positive growth with intervention, 69% had intervention for 4 to 5 weeks. It is interesting to note that 87% of the students who had negative outcomes in studies that reported duration of sessions were given interventions during a 15 minute or less session given 4 to 5 times a week.

Additionally, administration requirements of CBM assessments to track reading progress were considered in this review to monitor the intensity of intervention requirements. CBM was administered frequently with CBM administered during each session in 99% of the interventions. While many RTI researchers suggest more frequent monitoring at Tier two and three, the suggested frequency of monitoring is not daily but monthly or weekly (Fuchs & Fuchs, 2007; Glover & DiPerna, 2007; Martson, 2005). Overall, interventions that are administrated 4 to 5

times a week for 15 to 20 minutes with CBM administrated every session, and provided mainly on an individual basis may be the most common effective intervention intensity level based on studies in this review. However, future studies would be beneficial to compare effectiveness of interventions based specifically on these variables. In addition, given the limited studies conducted in the classroom without researcher assistance, it is unclear if staff and time requirements to implement this level of intensity would be supported or would limit the use of the more effective interventions due to acceptability, feasibility, and cost effectiveness. A critical area of further research that is emerging in the literature are comparison studies on the effect of less intense intervention administration and monitoring procedures on training needs, resource allocation, accurate use and reliable meaningful decision making outcomes (Bonfiglio, Daly, Persampieri, 2007; Wanzek & Vaughn, 2008).

In summary, a promising benefit of the RTI approach is the replace the traditional refer-test-place model of identification and eligibility assessment in Special Education to intervene-test-intervene-place (VanDerHeyden et al., 2004). Frequent monitoring of student response to intervention serves to replace the traditional "wait to fail" to test traditional model. Many successful, empirically-based, reading interventions have been identified that schools may use to assist in the identification of students with learning disabilities within a short period of time using CBM procedures. However, many studies are still needed to explore the effects of interventions on individual students, the definitions of what is considered at-risk for learning difficulties, what is considered sufficient growth, administration requirements, and the exploration of outcome data.

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