In this article, the authors describe the use of curriculum-based measurement (CBM) reading measures within a response-to-intervention (RTI) framework. They examine the characteristics of the measures to illustrate their technical adequacy for use at each tier in an RTI model. Finally, they look at the use of the measures at Tier 3 (special education services) with respect to informing instruction and satisfying the legal requirements of the Individuals with Disabilities Education Improvement Act of 2004.

Consensus regarding the need for reform in special education has emerged among several national panels and reports and among many educators (Fletcher, Coulter, Reschly, & Vaughn, 2004). One area of great controversy, however, concerns the identification of students with specific learning disabilities (SLD). With the reauthorization of the Individuals with Disabilities Education Act of 1990, titled the Individuals with Disabilities Education Improvement Act (IDEIA) of 2004, districts across the United States now have the option of using an alternative means of identifying SLD, known as response to intervention (RTI). Interest in RTI has increased greatly; currently, many districts are examining or piloting RTI models (Fuchs, 2006).

Traditional assessment procedures used for identifying students with SLD have relied on several criteria; chief among these is the documentation of a significant intrapersonal discrepancy between ability and achievement (IQ–ACH). Although widely used in districts and states across the United States, this method of identification has garnered a considerable amount of criticism for its lack of treatment validity (Gresham & Witt, 1997; Reschly, 1988), for its arbitrariness, and for the myriad psychometric issues involved with the operationalization of this discrepancy (Fletcher et al., 2002). Further, as noted by Vellutino and colleagues (2000, p. 235),

IQ–achievement discrepancy does not reliably distinguish between disabled and nondisabled readers… Neither does it distinguish between children who were found to be difficult to remediate and those who are readily remediated, prior to initiation of remediation, and it does not predict response to remediation.

Other concerns with this model include the variability in methods used across the United States to determine significant discrepancy (Mercer, Jordan, Allsopp, & Mercer, 1996; Reschly & Hosp, 2004) and that its use often results in a delay of services (Reschly, 1988). For example, students are typically in third grade before a discrepancy is severe enough to qualify a student for services, prompting some researchers to call it a “wait to fail” model.

In contrast, RTI relies on the implementation of interventions and the collection of data over time; students who do not respond to high-quality, intensive interventions are those who may be considered for special education services. The following example uses a three-tiered RTI model. The first tier includes screening of all students in the general population. Students' scores at this tier are compared to normative data (e.g., benchmarks, norms) taken by the district or school. Those students who are performing below normative expectations are moved to the second tier. At Tier 2, interventions become more intensive and data collection on student progress becomes more frequent. Students failing to make adequate progress at this level of services are considered for special education services, Tier 3. Tier 3 represents the most intensive level.

Progress Monitoring in Reading

Using Curriculum-Based Measurement in a Response-to-Intervention Model

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of services and includes individual goalsetting and continuous progress monitoring toward these goals.

Few professionals argue over the need to ensure that students receive effective instruction in general education or the provision of more intensive early interventions prior to special education eligibility determination. Many researchers, policymakers, and advocates disagree, however, on the number of tiers (3 or 4) and eligibility criteria following these early interventions (Reschly, 2005). Discussion of the issues just described and other implementation concerns (e.g., staff capacity, length of time for interventions), as well as the philosophical and definitional issues related to disabilities, are beyond the scope of this article. The reader is referred to Bradley, Danielson, and Hallahan (2002) and to other articles in this series for further information.

Inherent in the paradigm shift from IQ–ACH discrepancy (IQ and ACH administered at a specific point in time to index a student's performance) to an RTI model is the reliance on measures that are technically adequate, can be administered frequently, and are sensitive to student growth. One measurement approach that meets these criteria is curriculum-based measurement, or CBM. CBM was designed for individual progress monitoring of student performance to enable special education teachers to evaluate the effectiveness of their instructional interventions and make timely modifications to accelerate student achievement (Deno, 2003); however, it has been used for a variety of purposes in both general and special education.

Currently, there are CBM measures in reading, mathematics, and writing, as well as in secondary-level content areas (Deno, 2003; Espin, Busch, Shin, & Kruschwitz, 2001; Espin, Shin, & Busch, 2005) and in computer applications (Fuchs, 1998). CBM reading measures are the most widely used and researched of the CBM measures. CBM measures of reading have also been shown to demonstrate the technical features necessary to enable educators to collect student data over time and to make meaningful educational decisions related to students’ performance. Further, difficulty with reading is a primary reason for which students are referred for special education (Donovan & Cross, 2002). As such, the purpose of this article is to describe two CBM reading measures—read aloud and maze—and to illustrate their use in a three-tiered RTI model. Particular emphasis is given to the description and use of CBM reading data in the third tier of the RTI model: provision of special education services.

**CBM Reading Measures**

**Read Aloud and Maze**

There are standard administration and scoring procedures for the CBM measures. The read aloud measure, sometimes referred to as oral reading, CBM-R, or R-CBM, is the most commonly used of the two CBM reading measures. Students are presented with a text passage and asked to read aloud for 1 min. At the end of 1 min, the educator scores the number of words that the student read correctly (Marston, 1989; see Figure 1). In the maze task, students are given a reading passage in which every seventh word has been deleted and replaced with two distractors and the correct word (Deno & Espin, 1989; Fuchs & Fuchs, 1992; see Figure 2). Students read silently and choose the correct word when they encounter a word choice. Scores are based on the number of correct word choices chosen in the allotted time. Read aloud is administered individually to students, whereas the maze may be given individually or in groups.

Although these reading measures differ in the methodology used to collect student data, it is important to understand that both act as general outcome measures for reading. General outcome measures have standardized administration and scoring criteria and assess proficiency in a global, or longitudinal, manner (Fuchs & Deno, 1991). For example, in reading, long-range goals are set and progress is monitored in the same materials and metric (e.g., words read correctly) across months or across the academic year. This is in contrast to other forms of measurement, wherein academic behaviors are broken into component subskills and progress is monitored to a mastery criterion; when a student reaches mastery on a particular skill, another skill, goal, and metric are undertaken (Fuchs & Deno, 1991). Progress in a general outcome measurement approach reflects improvement in overall proficiency. Thus, in the case of reading, progress toward this goal shows that a student is becoming a better reader overall.

**Technical Adequacy**

The key to success of an RTI model is the availability of measures suited for frequent progress monitoring to index student performance over time. To be meaningful and useful for decision making, the measures must have adequate reliability and validity. If either of these technical characteristics is lacking, educators cannot conclude that changes in the scores on the measures actually reflect changes in student performance. In the case of the read aloud and maze measures, reliability refers to the relations between scores on alternate forms of the measure. If the correlations are high between these alternate forms, one can be confident that the scores truly reflect a change in a student’s performance, as opposed to some other measurement artifact. Research on the reliability of the read aloud measure has shown that the measure has strong reliability, with correlation coefficients ranging from .82 to .97 (Marston, 1989). The maze measure also shows strong reliability, with correlation coefficients ranging from .61 to .91 (Shin, Deno, & Espin, 2000). Overall, both CBM reading measures have been shown to have strong alternate
form reliability, which makes them appropriate to use for monitoring student progress over time.

Examining the validity of CBM reading measures entails examining the extent to which the CBM measures act as indicators of general reading proficiency (Fuchs, Fuchs, Hosp, & Jenkins, 2001). Essentially, to serve as general outcome measures, the CBM reading measures must correlate in expected ways with other measures of reading proficiency. The criterion-related validity of the read aloud measure with other reading proficiency measures, such as standardized test scores and teacher ratings of reading performance, has coefficients ranging from .63 to .90 (Marston, 1989). These correlations drop somewhat for students at the secondary level when expository text is read ($r = .52$–.57; Espin & Foegen, 1996).

At the elementary level, the correlations among the maze measure and total reading scores on individually administered achievement tests and tests of reading com-

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<th>FIGURE 1. Example of a CBM read aloud measure (teacher copy).</th>
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A Weekend at the Lake

Austin woke up early on Friday morning. Even though he had gone to bed late the night before, he was too excited to sleep. Today he got to go to the lake and visit his Aunt Jenny. He did not get to see his aunt very often, and spending a weekend at her house meant he would spend almost all of his time in the water. Aunt Jenny had a beautiful sand beach on her property equipped with the kind of toys Austin loved. His favorite toy, however, was the tire swing. Austin had helped his aunt make the tire swing a couple of years ago. Although, initially, Aunt Jenny had not been too thrilled with the idea, Austin had begged and pleaded until she had given in and let him design the swing. The tire had come from an old tractor Aunt Jenny had sitting at the back of her property. The tractor had not worked for years, so Austin figured the tire was fair game for the swing. The rope had come from Aunt Jenny’s sailboat. She hadn’t sailed the boat in years and had given him permission to salvage the rope that was used to hoist the jib sail. The rope was very long and allowed the swing to sail far over the water. Austin usually landed in water over his head, which helped alleviate some of Aunt Jenny’s fears about Austin getting hurt while using it.

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Prehension range from .80 to .89 (Fuchs & Fuchs, 1992; Jenkins & Jewell, 1993). Correlations at the secondary level between the maze measure and daily test scores, comprehension questions, and a comprehensive posttest on expository material are somewhat lower than correlations found with elementary-age students but are still in the moderate to moderately high range (.56–.62; Espin & Foegen, 1996). Beyond these static correlations (in which the reading measures were correlated with criterion measures at one point in time), studies have also shown that both measures are appropriate for modeling student growth over time and can differentiate student growth patterns for students with high, average, and low levels of achievement (Fuchs & Fuchs, 1992; Fuchs, Fuchs, Hamlett, Waltz, & Germann, 1993; Shin, Deno, & Espin, 2000). These results support the validity of the reading aloud and maze measures as valid indicators of student performance and progress.

Beyond the typical psychometric properties of reliability and validity, both the read aloud and maze measures are characterized by other features that make them desirable for use in an RTI model. The measures are administered using a standardized protocol to minimize error in the student data (Deno, 1992). The measures are also time efficient. Administration times for the read aloud and maze measures are 1 min. and between 1 and 3 min., respectively. Finally, students whose teachers monitor progress and make instructional decisions based on the data achieve at higher levels than those students whose teachers do not (Fuchs, Fuchs, & Hamlett, 1989a, 1989b). Taken together, the research on the technical characteristics for the read aloud and maze measures strongly supports their use for monitoring student progress. It also makes them a viable option for use in an RTI model in which longitudinal data collection is necessary to make accurate placement decisions. In following section, we will illustrate how CBM could be used at each level of a three-tiered RTI model, with particular attention given to the most intensive level of the model (Tier 3).

**Use of CBM Reading Measures in a Three-Tiered RTI Model**

**Tier 1**

At Tier 1, CBM reading measures are collected on all students in the general education setting. Collecting these data serve two functions:

1. It allows examination of whether the instruction provided is adequate to expect that students will progress as readers.
2. It allows classes, schools, or school districts to collect normative data on all students’ levels and rates of reading growth (Fuchs, 1995; Fuchs & Fuchs, 1998).

From these data, students could be identified as being at risk for reading problems by examining their performance and rate of growth. According to Fuchs and Fuchs (1998), students who are discrepant from their peers in both current performance and rate of growth would be candidates for more intensive remediation at Tier 2 of the RTI model.

**Tier 2**

Students who are moved from the first to the second tier of an RTI model are those who are found to be in need of more intensive instruction to make adequate reading progress. At this tier, small-group, intensive instruction is provided in an attempt to affect both a student’s performance and rate of progress. This instruction, although intensive, is provided by general educators in an attempt to determine if adaptations to the general curriculum or learning environment can be made so that student performance can be increased (Vaughan & Fuchs, 2003). At this tier, monitoring with CBM reading measures is done frequently (several times per week). Decisions based on the effectiveness of the instruction for affecting student performance and growth is accomplished by examining a student’s CBM data and comparing them to that of his or her classmates. After 10 to 15 weeks, students whose performance improved, in terms of absolute levels of performance and rate or slope, are returned to Tier 1 of the model. Those students who do not respond to the intensive, standardized instruction may be considered for special education placement at Tier 3 of the RTI model.

**Tier 3**

For those students who do not make adequate progress at Tier 2 of the RTI model, an assessment to determine eligibility for special education is warranted. Students who meet the eligibility requirement for learning disabilities (LD) are then moved to the third tier of the model. This tier is synonymous to special education services. At this tier, CBM measures are used to (a) set performance goals, (b) develop appropriate Individualized Education Program (IEP) goals, and (c) monitor ongoing student performance in relation to the instruction being provided. An example of a student’s CBM reading graph may be found in Figure 3.

Use of CBM reading measures for students at this tier will also help educators meet several of the regulations stipulated in IDEIA. Specifically, the use of CBM reading measures allows educators to set measurable annual goals for students and to accurately monitor progress toward those goals. Furthermore, special educators are required to inform the parents of a student’s progress toward meeting the stated annual goal as often as parents of students
without disabilities receive feedback on their children's performance (Yell & Stecker, 2003). Therefore, the ability to monitor a student and provide timely feedback on his or her performance to parents is paramount in order for educators to comply with IDEIA. CBM reading measures allow educators to address all of these requirements in a time-efficient and standardized manner.

Setting Appropriate Goals for Students. Using CBM reading measures during IEP development allows educators to write measurable and ambitious student goals. Once the goal has been determined, it is a simple process to convert the student CBM goal into an appropriate IEP goal. Several options are available to educators when using CBM reading measures for setting these goals (see Fuchs & Shinn, 1989). Options for determining an appropriate annual goal include (a) using benchmarks to identify desired end of the year performance, (b) using average weekly progress rates, or (c) using an intraindividual framework for calculating the annual goal (Fuchs & Shinn, 1989). Because the students at Tier 3 are not typically developing readers and are discrepant from their peers in current performance level and rate of growth, using end-of-the-year benchmarks or average weekly progress rates may not be appropriate. Therefore, we will focus on using an intraindividual model to calculate the annual goal.

In general, to set an annual CBM goal using the intraindividual framework, a student's present level of academic achievement and functional performance (PLAAFP) is determined by collecting multiple weeks of baseline CBM data. The progress rate from a student's PLAAFP is multiplied by a weekly improvement rate that the IEP team deems is challenging, yet appropriate, for the student. The product of the PLAAFP and weekly growth rate is then multiplied by the number of weeks that CBM monitoring would occur. In the case of an annual IEP goal, the number of weeks in the school year would be used. Finally, the product of the growth rate and number of weeks of monitoring is added to a student's median score obtained during baseline. The sum of these numbers is the desired annual goal for the student. Once the annual CBM goal is calculated, it becomes a simple procedure for an educator to use that goal to create an annual IEP goal.

Using CBM to Write Measurable Annual Goals. The purpose of an IEP goal is to evaluate student progress to determine if a special education program is meeting his or her needs. Although the importance of well-written annual goals cannot be understated, many educators continue to write goals that do not align with a student’s assessment data and that lack measurable outcomes (Bateman & Linden, 2006; Fuchs & Shinn, 1989). IEPs that lack educationally relevant and measurable goals do not meet the standards set forth in IDEIA and therefore may open up special educators to litigation. Using CBM measures to develop these annual goals, however, assures that a goal aligns with a student’s PLAAFP and assures that progress toward the goal can be accurately measured.
Although IDEIA does not specify the format an annual goal should take, we will use the format proposed by Mager (1962) and expanded on by Yell and Stecker (2003). They proposed an instructional goal format that includes (a) the target behavior or the behavior to be measured; (b) condition, that is, the circumstances under which the behavior will be measured; (c) the student’s name; and (d) the criteria for acceptable performance. If CBM measures were used to create a goal based on these criteria, the target behavior would be the student reading aloud a CBM passage or silently reading a maze passage. The condition would be reflected in the level of the CBM passages being used with the student and the length of time he or she had to read it. The criterion in the model would be synonymous to the annual CBM goal developed for the student (see Figure 4 for examples of reading goals developed using the Mager format and CBM data). In sum, melding CBM data with an appropriate model for developing goals can help assure that annual IEP goals comply with IDEIA and that the outcomes being measured are relevant to a student’s educational program.

**Monitoring Student Performance.** Once an annual CBM goal is calculated and an appropriate IEP goal is written, the IEP team frequently (several times per week) collects data on a student’s performance and graphs these data relative to the goal. The graph visually represents both the expected annual goal as well as the anticipated weekly growth rate by using a line running from the median baseline performance to the calculated annual goal. This goal line allows educators to compare current student data to the anticipated weekly growth rate. When sufficient student data have been collected over a period of time, an educator can apply standard, decision rules for determining the effectiveness of instruction. If a student’s growth rate is insufficient to meet the projected goal (typically after several weeks of instruction), an instructional change is necessary to accelerate student performance. In this way, new instructional methods can be instituted as necessary in an attempt to maximize the impact of the instruction being provided to the student so that he or she will meet the annual goal.

![Figure 4. Examples of annual goals written using CBM data.](http://aei.sagepub.com)

![Figure 5. CBM graph indicating instructional changes.](http://aei.sagepub.com)
Conversely, if a student’s rate of growth is significantly steeper than the goal line, so that the student is on target to meet or surpass the stated annual goal, the educator should implement the data decision rule to raise the goal. In this case, the goal is raised to parallel the slope of the initial goal line but at a higher performance level (the weekly growth rate stays the same, but the goal line is shifted upward). See Figures 5 and 6 for examples of these data decision rules.

By using these data decision rules, an educator is attempting to create instructional programs that provide the maximum instructional benefit for a student. By frequently monitoring a student’s progress, a special educator is able to report ongoing progress toward the annual goal to the student’s parents and to determine whether the student is making sufficient progress to meet his or her annual goal. These features of CBM make it ideal to meet the reporting requirements of IDEIA.

Conclusion

The paradigm shift that occurs as districts move from the IQ–ACH discrepancy to an RTI framework requires different tools to assess and monitor student performance. Not only must the tools be technically sound, but also they must enable educators to make informed decisions on student progress over time. CBM measures in reading are well-suited for use in an RTI framework. Further, implementation of CBM reading measures at the RTI tier corresponding with special education services can help ensure that educators are addressing requirements set forth in IDEIA. By setting appropriate goals and using CBM data to inform instruction, educators are more likely to achieve the maximal results for the students they serve.

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NOTE

For more information on the rationale, history, or development of CBM, see Deno (1985, 1992, 2003).

REFERENCES


**FIGURE 6.** CBM graph indicating a raise in the long-range goal.


