

## The Past, Present, and Future of Curriculum-Based Measurement Research

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Thirty years ago, the dominant approach to progress monitoring was mastery measurement. With mastery measurement, teachers specify a hierarchy of instructional objectives constituting the annual curriculum and, for each objective in the sequence, devise a criterion-referenced test to assess mastery. When a student achieves the mastery criterion for an objective, the teacher simultaneously shifts instruction and assessment to the next skill in the hierarchy. In this way, learning is conceptualized as a series of short-term accomplishments, which are believed to accumulate into broad competence. This notion of progress monitoring was represented in popular methods such as the Wisconsin Instructional Design System (see [www.wids.org](http://www.wids.org)) and Precision Teaching (e.g., [www.celeration.org](http://www.celeration.org)).

At about that same time, Stan Deno at the University of Minnesota, with a handful of doctoral students (including Doug Marston, Steve Robinson, Mark Shinn, Jerry Tindal, Caren Wesson, and me), launched a systematic program of research on the technical features, logistical challenges, and instructional effectiveness of progress monitoring. The initial focus of that research program was mastery measurement, but several technical difficulties associated with mastery measurement quickly emerged. For example, to assess mastery of a specific skill, each mastery measurement criterion-referenced test addresses a single skill. Such testing is potentially misleading, however, because many low achievers can read consonant-vowel-consonant words if they know that all words on the page conform to

the pattern; similarly, they can solve addition with regrouping problems if they know that all problems on the page fit that problem type. By contrast, when a test mixes words with different phonetic patterns or mixes math problems of different types (as occurs on high-stakes tests and in the real world), these same students no longer perform the "mastered" skill competently. This questions mastery measurement's assumption that a series of short-term accomplishments accumulates into broad-based competence; it compromises the relation between number of objectives mastered during the year and end-of-year performance on more global assessments; and it can lull educators into a false sense that their students are making progress.

### The CBM Alternative

To address this and other important problems associated with mastery measurement (for a full discussion, see Fuchs & Deno, 1991), Deno (1985) conceptualized an alternative approach for the purpose of progress monitoring: curriculum-based measurement (CBM). Each weekly CBM is an alternate form, representing the performance desired at the end of the year. In this way, CBM circumvents mastery measurement's technical difficulties by requiring students to simultaneously integrate the various skills required for competent year-end performance on every weekly test. As students learn the necessary components of the annual curriculum, their CBM score gradually increases. Also, because each weekly test is comparable in difficulty and conceptualization,

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slope can be used to quantify rate of learning. Slope can also be used to gauge a student's responsiveness to the instructional program and as a signal to revise the student's program when inadequate responsiveness is revealed.

A key challenge in the development of CBM is to identify measurement tasks that simultaneously integrate the various skills required for competent year-end performance. Two approaches have been used. One involves identifying a task that correlates robustly (and better than potentially competing tasks) with the various component skills constituting the academic domain. For example, Deno, Mirkin, and Chiang (1982) first identified passage reading fluency (often termed "oral reading fluency") as a key CBM task by showing how its correlations with valued criterion measures exceeded correlations for other potential CBM tasks. Conceptually, it makes sense that passage reading fluency is a robust indicator of overall reading competence. After all, reading passages fluently is a complex performance that entails a reader's perceptual skill for automatically translating letters into coherent sound representations, unitizing those sound components into recognizable wholes and automatically accessing lexical representations, processing meaningful connections within and between sentences, relating text meaning to prior information, and making inferences to supply missing information (Fuchs, Fuchs, Hosp, & Jenkins, 2001). For this reason, passage reading fluency produces a broad dispersion of scores across individuals of the same age, which results in strong correlations with measures of reading comprehension, decoding, word identification, and vocabulary (e.g., Deno et al., 1982; Marston, 1989; Hosp & Fuchs, in press).

The second approach to designing a CBM task involves systematic sampling of the skills constituting the annual curriculum to ensure that each weekly CBM represents the curriculum equivalently. This method is illustrated by the math CBM system developed in the 1980s (e.g., Fuchs et al., 1997) whereby each weekly test incorporates the same problem types in the same proportion: addition, subtraction, multiplication, and division of

whole numbers and fractions as well as number concepts, numeration, word problems, geometry, money, and measurement. The total test score, which is the indicator of overall math competence in the annual curriculum, is graphed to depict slope (i.e., rate of learning). This second approach to identifying a CBM task also produces strong correlations with valued criterion measures. It offers the added benefit of informing instruction by providing descriptions of individual skill mastery, because each skill in the annual curriculum is systematically assessed on every weekly test (e.g., Fuchs, Fuchs, Hamlett, & Allinder, 1991; Fuchs, Fuchs, Hamlett, & Stecker, 1990).

### Programmatic Research on CBM

Regardless of which approach is adopted for designing CBM tasks, substantiating the tenability of a measure for the purpose of progress monitoring involves three research stages. Investigation of the **technical features of the static score** (i.e., performance level at one point in time) constitutes Stage 1. In Stage 2, **technical features of slope** are assessed to determine whether increasing CBM scores (or slope) are in fact associated with improvement in overall competence in the academic domain (e.g., Fuchs, Fuchs, Hamlett, Walz, & Germann, 1993). Stage 3 concerns **instructional utility**. This is where studies are conducted to determine whether practitioners can use the CBM information to improve instructional decisions and student achievement (e.g., Fuchs, Deno, & Mirkin, 1984; Fuchs, Fuchs, Hamlett, & Stecker, 1991). In thinking about the relationship among these three stages for documenting the adequacy of a progress-monitoring measure, it is interesting to consider whether supportive research at each of these stages is required prior to broad field-based application. Alternatively, it is possible that Stage 1 and 2 evidence constitutes adequacy for monitoring whereas Stage 3 evidence is required before a progress-monitoring tool can claim instructional utility.

**The past.** Over the past 30 years, an impressive body of research has accumulated focusing on all three CBM research stages,

using both approaches for designing CBM tasks. In fact, the Research Institute on Progress Monitoring (Espin & Wallace, 2004) at the University of Minnesota recently described the CBM literature. They and colleagues identified 585 documents, 307 of which were published in journals (121 were unpublished research reports, 131 were dissertations, and 26 were unclassified). Among the 307 published papers, 141 reported empirical studies, addressing questions of technical adequacy, instructional utility, and the logistics of implementation in reading, writing, spelling, and math. This literature also documents how CBM has expanded its initial focus on special education progress monitoring to include universal screening, general education progress monitoring, and learning disability classification within a response-to-intervention eligibility framework.

**The present.** And the research tradition of empirical study continues with this issue of *School Psychology Review*, which gathers five unsolicited CBM investigations. Each of these papers extends the CBM literature in a unique and important way. Shapiro, Angello, and Eckert (2004) investigated whether progress monitoring, broadly defined to include CBM and mastery measurement, has increased over the past decade. Surveying school psychologists about their use of progress monitoring, Shapiro et al. documented that implementation is stable (with half of respondents reporting use), despite a substantially increased focus on progress monitoring within training programs. This suggests the need for school, district, state, and federal leadership to encourage use of research-based practices such as CBM. With incentive provided in No Child Left Behind, it will be interesting to follow developments over the next decade.

The four remaining studies posed technical questions about CBM. Three (Ardoin et al., 2004; Clarke & Shinn, 2004; McGlinchey & Hixson, 2004) focused on the first CBM research stage, where technical features of the static score (at one point in time) are examined. Among these three studies, two focused on the criterion validity of the 1-minute CBM passage reading fluency task. Ardoin et al.

manipulated the CBM end of the correlation, contrasting one versus three passage reading fluency samples (each 1 minute) and contrasting three passage reading fluency samples with and without a CBM maze. Results substantiated the utility and efficiency of one 1-minute passage reading fluency task. To examine the other end of the criterion validity coefficient, McGlinchey and Hixson incorporated a different criterion measure, assessing CBM correlations and decision utility with respect to a high-stakes reading test. With such a strong focus on state accountability systems, this kind of CBM study is critical, and strong evidence for criterion validity was provided. Moving beyond reading, Clarke and Shinn addressed first-grade math, contrasting the reliability, concurrent validity, and predictive validity of four possible CBM measures. Their results provide a basis for additional Stage 1 studies on a greater range of students, including younger children. Stage 2 and 3 investigations are also required. Across these three studies, these researchers posed interesting questions to extend the knowledge base on traditional psychometric questions about technical features of the static CBM score, and results move the literature forward.

Hintze and Christ (2004) took a different approach, also with important findings. They pursued Stage 2 CBM research questions by focusing on technical features of slope for the passage reading fluency task. They compared measurement error when CBM passages were (a) controlled to represent grade-level difficulty versus (b) randomly selected from graded readers. This comparison corresponds to (a) increasingly popular reliance on generic CBM passages, which are designed to reflect year-end difficulty material at the various grade, versus (b) more traditional reliance on passages drawn randomly from students' basals (hence, the term *curriculum* within CBM). Hintze and Christ found that controlled (generic) passages reduced measurement error, leading to increased sensitivity and reliability of the CBM slope.

**The future.** In light of these five important extensions to the CBM literature, it is interesting to consider where scholarly atten-

tion has been focused and where that attention might productively be allocated during the next decade. Minnesota's Institute for Research on Progress Monitoring (Espin & Wallace, 2004) has already specified an important and ambitious research agenda for expanding CBM's focus to additional grades and to address the needs of students with more severe disabilities. In the remainder of this introduction, I offer three comments about additional lines of inquiry.

First, recent CBM research may focus disproportionately on Stage 1, where technical features of the static score are examined. Such interest may be related to CBM's increasing popularity as a universal screening device (where questions about the static score, either in relation to concurrent or predictive criterion measures, are essential). At the same time, universal screening can be accomplished with a wide range of tools, whereas CBM's unique contribution resides in its capacity to model learning (over time) and to inform instruction. Of course, a focus on the static CBM score (Stage 1) is an important first step in validating a CBM system. Stage 1 attention is also predictable because questions about reliability and validity of the static score represent traditional psychometrics, a set of methods and concepts with which most researchers are familiar and comfortable. Also, systematic exploration of Stages 2 and 3 is more laborious, requiring ongoing data collection for Stage 2 and additionally necessitating practitioners' data utilization for Stage 3. Nevertheless, to advance CBM in important ways and to capitalize on CBM's unique contribution for modeling progress and enhancing instruction, additional attention to Stages 2 and 3 is required.

Second, in this "age of the computer," it seems useful to explore the potential for technology to expand CBM's reach, by making data collection and management more efficient, by supplementing CBM graphed analyses with instructionally informative diagnostic profiles, and by designing teacher and student feedback systems that enhance CBM's instructional utility. Some research involving CBM applications to increase efficiency and expand instructional

helpfulness has already been accomplished (e.g., Fuchs, Fuchs, & Hamlett, 1994), but additional strategies for using technology innovatively and inventively should be pursued.

My last comment is meant to underscore the distinction between CBM and single-skill measurement. Deno conceptualized CBM to circumvent the technical difficulties associated with single-skill measurement. To avoid those difficulties, CBM tasks are multidimensional, requiring students to simultaneously integrate the various skills required for competent year-end performance on every weekly test. In fact, the CBM tasks shown to satisfy Stage 1, 2, and 3 issues require relatively broad competence (e.g., passage reading fluency involves decoding, sight word recognition, vocabulary knowledge, comprehension, etc.; word identification fluency involves decoding, sight word recognition, vocabulary knowledge, etc.; CBM math involves competence across many skills).

Yet, some recent measures, which have been labeled CBM, appear to represent single-skill measurement (e.g., letter naming fluency; number naming fluency; fluency in decoding consonant-vowel-consonant words; fluency in solving addition with regrouping problems). This seems unfortunate, especially because few studies document that single-skill measures can be used to model global learning over time (Stage 2 research) or whether they are useful to teachers in improving instruction (Stage 3 research). For such relatively narrow single-skill progress-monitoring measures, it is possible that, despite strong criterion validity of the static score, growth over time may correspond poorly with overall learning of the broader academic domain. Moreover, in response to long-term progress monitoring on a single skill, teachers may narrow their instructional focus, to the detriment of the progress-monitoring system's instructional utility. Such issues require empirical examination. To date, moving CBM beyond single-skill measurement toward multi-dimensional assessments of academic competence has helped forge a useful approach to progress monitoring, and CBM researchers should remain sensitive to this critical distinction.

## CBM: The Validated Alternative?

Despite these and other challenges, a vast empirical CBM literature, which now includes the articles in this *School Psychology Review* issue, documents that much has been learned. Now seems a good time to ask how much corroborating evidence is needed before school leaders and professional organizations feel compelled to require research-based forms of CBM as a specific approach to progress monitoring. In 1985, Stan Deno wrote the now classic article, "Curriculum-based measurement: The emerging alternative." Thirty years after Deno's conceptualization of CBM in the early 1970s and hundreds of studies later, it may be time to redesignate CBM progress monitoring as the "validated alternative."

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