CBM progress monitoring in reading and foreign-language learning for secondary-school students
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Citation
Chung, S. (2018, June 26). *CBM progress monitoring in reading and foreign-language learning for secondary-school students*. Retrieved from https://hdl.handle.net/1887/63990

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Issue Date: 2018-06-26

Chapter 1

General Introduction

Introduction

Educators have the important task of providing students with optimal learning conditions so that students can reach their full potential with respect to academic performance. A key element for promoting optimal student performance is implementation of evidence-based interventions; yet, implementation of evidence-based interventions does not guarantee success for *all* students because students respond differentially to interventions.

Deno (1990) addressed the issue of individual differences in responses to interventions, where he contrasted nomothetic and idiographic approaches to special education. A nomothetic approach was a search for generalized laws about human behavior and was characterized by educational researchers' efforts to test the effectiveness of interventions via well-designed randomized controlled trials. An idiographic approach, in contrast, was the search for what worked for individuals, and was characterized by educators' efforts to search for interventions that work for individual children. Deno (1990) argued that both nomothetic and idiographic approaches were important to special education: Thus, although it was important to implement interventions with scientific evidence for effectiveness, it was equally important to recognize that such interventions would not be effective (or equally effective) for all students. Deno (1990) further argued that it was not possible to identify *a priori* how an individual student would respond to a given intervention. He thus rejected the then popular *diagnostic-prescriptive approach* in which a diagnosis was first made in order to identify an appropriate intervention for a given student. He proposed an alternative approach in which interventions were viewed as instructional hypotheses whose effectiveness for individuals were tested via implementation of reliable and valid measures of an individual's learning growth. This approach has come to be known as a *problem-solving approach*.

In the problem-solving approach, it is not the diagnosis, but the student's response to interventions, that determines whether the interventions are appropriate for that student. When the student does not respond to an intervention – that is, when the students is not making sufficient academic improvement – the instructional program is changed. An essential element of a problem-solving approach is the use of data to evaluate the effectiveness of the instructional programs on students' academic growth and to make informed decisions about the need to continue or change those instructional programs. The use of data to inform instructional decisions is also reflected in the educational system in the Netherlands, and referred to as *opbrengstgericht werken* (Dutch Inspectorate of Education, 2015) or data-based decision making (DBDM, Mandinach, 2012). DBDM has been seen by the Dutch Ministry of Education, Culture, and Science, as one of the key elements in improving the quality of students' academic achievement (Dutch Ministry of Education, Culture and Science, 2011). One data-based decision making system often used within a problem-solving approach is Curriculum-Based Measurement (CBM; see Deno, 1985, 2003).

Curriculum-Based Measurement (CBM)

CBM is a procedure designed for use by educators to monitor the growth of students with learning difficulties, to evaluate the effectiveness of instruction on that growth, and ultimately, to make decisions regarding the need to continue or change the instruction. CBM involves frequent (for example, weekly) measurement via alternate-forms on measures in an academic area. For example, a CBM measure typically used in the area of reading is maze selection. A CBM maze-selection is a text in which every 7th word is deleted and replaced with three choices: the correct word and two distractors. Students read silently for 2 minutes, selecting the correct word as they read. The number of correct selections made in 2 minutes serves as a general indicator of the student's level of performance and growth in reading proficiency (see Wayman, Wallace, Wiley, Tichá, & Espin, 2007, and Chapter 2 of this dissertation).

CBM scores are graphically depicted in a progress graph (see Figure 1.1) in which a goal line and long-range goal is drawn. Student's growth is represented by a linear growth line (slope). The educator compares the slope to the goal line to determine whether student's scores from CBM measures produce sufficient growth or improvement over time. If growth is sufficient – if the slope is steeper than the goal line – the goal is raised. If growth is insufficient – if the slope is below or less steep compared to the goal line – the instruction is modified or changed, and the effects of the change are then evaluated via continued data collection. This recursive process of data collection, evaluation, data collection, evaluation is designed to provide educators the means to determine the effectiveness of instruction and to provide them with a tool to build powerful, effective interventions for students who struggle.

Essential Characteristics of CBM and Vital Signs

Deno (1985) specified a set of essential characteristics for CBM measures. First and foremost, scores from the measures had to be reliable and valid *indicators* of general proficiency in an academic area such as reading. Second, the measures had to allow for repeated, frequent measurement; that is, it had to be possible to produce multiple, equivalent forms of the measures so that students could be monitored on a frequent basis, and so that growth could be attributed to learning rather than to form differences. Third, the measures had to be simple, efficient, and inexpensive if they were to be used by educators to frequently monitor student growth. Finally, scores from the measures had to be easy to understand if the results were to be clearly and correctly communicated to parents, teachers and students.
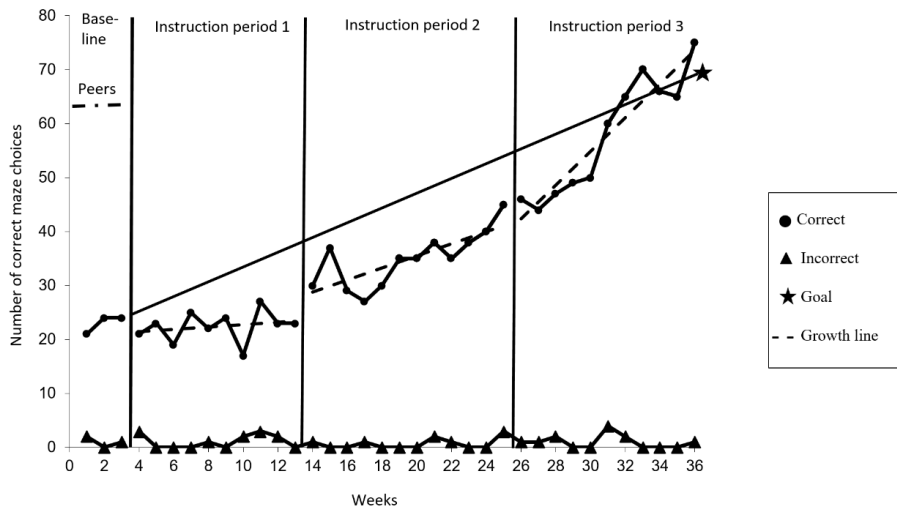
Maze scores from a 7th grade student

Figure 1.1. Sample of a CBM graph

An important theoretical concept underlying the development of CBM measures is the concept of *indicators* or *vital signs* of academic performance (Deno, 1985; L. S. Fuchs & Deno, 1994). Just as measures such as blood pressure or cholesterol levels are used as indicators or vital sign of general health, scores on CBM measures are designed to be used as indicators or vital signs of a student's academic health. As such, a key question related to the validity of scores from CBM measures is to what extent the scores serve as *indicators* of *general proficiency* in an academic area. If we consider the CBM maze-task described earlier, the key research question with regard to validity is whether CBM maze-scores reflect students' level of performance and growth in general reading proficiency, not whether the scores reflect level of performance and growth in reading fluency or reading comprehension.

There is often confusion surrounding the concept of *indicator*. Many practitioners, and even researchers, incorrectly view CBM measures as tasks designed to measure subskills of reading such as fluency or comprehension, rather than as indicators of general reading proficiency (see discussion in Muijselaar, Kendeou, de Jong, & van den Broek, 2017). However, if scores from the CBM measures are to be used to reflect improvement in an academic area (such as reading) over time, then the evidence must support their validity as indicators of level of performance and growth in that academic area in general. Validity is supported when the level of performance and growth on CBM scores show an expected pattern of relations with performance levels and growth on scores from other measures in the academic area (Cronbach & Meehl, 1955; Espin & Deno, 2016; Messick, 1989).

Gaps in the CBM Research

Over the past 40 years, a large body of research has been conducted on the development of CBM measures in areas such as reading, writing, mathematics, and content-area learning (see reviews by Foegen, Jiban, & Deno, 2007; McMaster, & Espin, 2007; Wayman, et al., 2007). Despite the large research base, there have been noticeable gaps in the research. First, the majority of research on CBM has been conducted at the elementary-school level, with far less research at the secondary-school level (see Espin, Chung, Foegen, & Campbell, in press, or see also Chapter 2; Wayman et al., 2007). Second, the majority of research has focused on what L. S. Fuchs (2004) refers to as the first stage in CBM research, namely the technical adequacy of scores as 'static' measures, where measures are administered at one point in time in order to obtain a rank ordering of student performance level. Much less research has been conducted at Stages 2 or 3. Stage 2 focuses on the technical features of CBM slope/growth trajectories, and Stage 3, on the instructional utility of scores from CBM measures (L. S. Fuchs, 2004). There is a need for additional research in CBM at the secondary-school level, and for research at Stages 2 and 3 (L. S. Fuchs, 2004).

Outline of the Dissertation

The research presented in this dissertation focuses on the development of CBM at the secondary-school level in reading and foreign-language learning, and focuses on both Stages 1 and 2 in CBM research. The focus of the research is the technical adequacy of the scores from CBM measures as indicators of both performance level and growth at the secondary-school level. In Chapter 2, the current research on CBM at the secondary-school level is reviewed. In Chapters 3 through 5, three empirical studies are presented addressing the technical adequacy of scores from CBM measures in reading and foreign-language learning at the secondary-school level.

In **Chapter 2**, a review of the CBM research at the secondary-school level in reading and content-area learning is presented. A description of the CBM measures typically used in reading and the content-area is provided, and research on the technical adequacy of the scores from these measures is presented. The chapter highlights the fact that CBM research at secondary-school level is sparse, especially with regard to studies that included frequent, repeated measurement over the course of several months, perhaps because such studies are time and resource intensive.

Chapter 3 focuses on the development of CBM measures in a content area not previously addressed in the CBM research, foreign-language learning. The technical adequacy from scores on two particular CBM measures are examined: maze selection and word translation. The study examines the extent to which scores from these measures serve as indicators of performance level in foreign-language learning. Various scoring procedures and administration times are compared to determine the most efficient procedure for future research. This study represents Stage 1 in CBM research, which is appropriate given the fact

that the study is one of the first to be done in the area of foreign-language learning. Via the results of such an initial study, promising measures are identified that can then be examined in more time and resource intensive growth studies.

In **Chapters 4 and 5**, our attention turns to reading, specifically, to using CBM to monitor growth in reading for secondary-school students. The studies in these chapters represent Stage 2 in CBM research. The focus of the studies is on scores from 2-min maze measures administered to students on a weekly basis for a period of 23 weeks. In **Chapter 4**, alternate-form reliability, sensitivity, and validity of the scores as indicators of reading performance level and growth are examined. Both linear and nonlinear growth trajectories are considered. In **Chapter 5**, the stability of slopes generated from CBM maze scores, and factors related to the stability, are examined. The factors examined include duration, data collection schedule, and variation in maze scores. The results of Chapter 5 are especially important related to the use of CBM for instructional decision-making.

Finally, in **Chapter 6**, the results of the studies are summarized and discussed within the broader context of CBM research, and future directions are described.