4. Academic Skill Assessment: An Evaluation of the Role and Function of Curriculum-Based Measurements

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In the most meaningful use of the term assessment, important decisions are made daily by teachers based on their assessment of information obtained from student responses to curriculum-related materials. These assessment decisions may include deciding on extra work or deciding to refer a child for learning or behavior problems. The term curriculum-based assessment (CBA) has been used to encompass a wide range of procedures ranging from these daily informal analyses by teachers, to highly structured measurement systems.

Authors' Notes. This chapter and the presentation by the first author at the Buros-Nebraska symposium were based in part on material previously published elsewhere (Lentz, 1988).
used in special education systems. Although well-constructed guides exist for some sets of curriculum-based decisions (e.g., Shinn, 1989), there is inadequate empirical research to assist our understanding of how, or how well, most of these decisions are made.

Recently, attempts have been made to formalize the use of measures of student academic performance, especially in decisions about special education eligibility for students who seriously fail to meet classroom expectations (i.e., Tindal, 1988; Shinn, 1989). At least one type of CBA developed for special education systems, called curriculum-based measurement (CBM) has been the subject of extensive evaluation research (see Tindal, 1988, for a comprehensive review) and interest on the part of special service personnel such as school psychologists (e.g., Shapiro, 1990) and special educators (e.g., Tucker, 1985). Yet, as interest has grown many questions have arisen about what we know about CBA, and we think more importantly, about how we know what we know!

With this paper we have set modest goals. It will be suggested that curriculum-based assessment fits best within a behavioral model of measurement and an examination of that assumption is provided. The discussion of the behavioral assessment model provides a foundation for our review of curriculum-based assessment (CBA) and the manner in which CBA has been developed and used. The approach taken herein is to some degree critical based on our analysis that many questions remain unanswered, questions about the nature of curriculum-based measures themselves and the manner in which the emerging CBA technology has been and will be applied. However, we wish to strongly emphasize our belief that CBA has already had a positive influence on educational practice, especially our understanding of how to help teachers make better decisions in order to enhance academic achievement (see, for example, Fuchs, this volume), and has served an equally important heuristic influence on the field of educational measurement.

We think CBA potentially has much more to offer in improving measurement within the assessment of school based problems. Our analysis suggests that CBA is best understood not as a monolithic assessment procedure, but as a source of data to be considered along with other sources in a comprehensive analysis of academic skills and learning environments. Because of this, CBA must be evaluated as part of, not different from, the entire evaluation process. To date this has rarely been accomplished (see Lentz, 1988, for an exception). We will argue that a choice of specific procedures (e.g., CBA, standardized intelligence or achievement tests, event sampling) to be used during an
assessment should flow from an understanding both of the general assessment model to be followed and the specific assessment questions to be answered for a particular child. In this regard we are particularly interested in the use of CBA data within intervention assistance programs for at-risk students.

There appear to be many questions about the manner in which CBA procedures should and will be implemented in classroom settings. Specifically, we are concerned about the manner in which CBA will be adopted by school psychologists and the entire educational establishment. For example, we foresee a number of problems with piecemeal adoption of structured CBA procedures by a portion of special services staff (e.g., school psychologists but not special education teachers or vice versa). We fear that in the absence of a clear assessment model or evaluation goals, CBA may be used in a manner that diverts attention from other environmental factors (e.g., instructional variables) that may contribute to academic success or failure. For example, if evaluators focus prime attention on CBA data during decision making for intervention planning, then problems may arise because of the overemphasis on student skill or fluency deficits at the expense of examining problems between students' performance and the instructional environment. Publications describing CBM use seem to continue to address placement special education issues (and subsequent IEP development or monitoring) and deemphasize intervention assistance prior to placement (e.g., Marston and Magnusson, 1988).

Public education does not have an impressive track history of adopting efficacious procedures in a timely or comprehensive manner (e.g., Bickel & Bickel, 1986; Greer, 1983) and we are concerned CBA may be ignored, or perhaps even worse, be used in a manner that perpetuates bad practice. Unfortunately, many of the problems that CBA attempts to address are not simply due to the lack of a better mousetrap. The technology for assessing behavior directly and altering response patterns of children within educational settings has been around for some time (Benes & Kramer, 1989). Even within our own profession, alternative assessment and psychological service delivery models for public schools have been suggested for many years (Gallessich, 1974; Hops, 1971), but school psychologists have not rushed to implement innovative service delivery strategies (Conoley & Gutkin, 1986). The data indicate clearly that most school psychologists know that there are more useful ways to spend their time than administering standardized tests and placing children in special class programs (e.g., Goldwasser, Meyers, Christenson, & Graden, 1983; Kramer & Peters, 1986). There are, however, many incentives for continuing the refer-test-place process.
We must guard against CBA becoming part of the systemic problems which detract from effective psychological services in schools in order to avoid attenuating the potential impact of curriculum-based (or other direct) measures of academic performance. In terms of CBA having a meaningful impact on services for the wide range of children with academic problems, the most important question may be whether CBA will have primary impact on children after they are classified, or whether CBA can become a key factor in assisting at-risk students irrespective of handicapping condition.

In summary, our objectives for this paper include: (a) examination of the behavioral assessment model and the implications of this model for educational measurement; (b) review of the development, utilization and evaluation of CBA procedures; (c) discussion of potential implementation problems with CBA; and (d) suggestions for further conceptualization, development, and implementation of CBA and other direct measures of academic behavior.

EVALUATING CBA: WHICH MEASUREMENT MODEL IS APPROPRIATE

The requirement for practitioners to evaluate and select appropriate assessment methods is clear from both ethical and professional perspectives (e.g., American Psychological Association, 1981). In this regard, a set of guidelines for appropriate test evaluation is available (American Educational Research Association, American Psychological Association, & National Council on Measurement in Education, 1985). However, we believe serious conceptual and practical difficulties face practitioners and researchers in making decisions in regard to selecting, evaluating, interpreting, and using specific assessment methods within an assessment process. Most "traditional" tests have been developed and evaluated using one of several psychometric models that provide frameworks for the collection of data on some quality of a specific test, rather than how useful a test is within an actual decision-making process that nearly always involves multiple information sources. For example, data may be available on the reliability of a test, but not on the reliability or stability of educational decisions made using such a test. MacMahen and Barnett (1985) have provided startling conclusions about the unreliability of decisions made using reliable tests.

Similarly, most psychometric models usually treat functional environmental influences on test performance as some sort of error. Test scores are interpreted within confidence bands derived from studies of variance in sets of test scores and standard extrapolations are
applied to individual scores. For the issue at hand, academic measurement, traditional tests are interpreted as telling us how much of some construct an individual has (reading ability, for example).

TECHNICAL EVALUATION OF CBA

Most recently, the term curriculum-based assessment (or, measurement) has been most closely associated with research conducted at the University of Minnesota (e.g., Deno, Marston, Shinn, & Tindal, 1983; Deno, Mirkin, & Chiang, 1982; Fuchs, Fuchs, & Deno, 1982; Fuchs, Tindal, & Deno, 1984; Germann & Tindal, 1985; Shinn & Marston, 1985), and outcomes of this research have been extensively disseminated. Academic probes of 1-2 minute duration were developed from curriculum materials with the goals of efficiency, simplicity, ease of interpretation, applicability to a wide range of academic decision, and cost being central to the design of the procedures (Deno, 1985). Investigation of the use of curriculum probes has been conducted across a variety of academic skill areas including reading (e.g., Deno, 1985), spelling and writing (e.g., Germann & Tindal, 1985), and arithmetic (e.g., Blankenship, 1985). Although such brief probes were originally conceptualized as a means of progress monitoring, probes have been examined for a number of different assessment functions within the framework of special education decision making.

In his review of direct measurement of academic behavior, Lentz (1988) has examined the functions to be served through the assessment process and the contributions of CBA to each. He suggests that CBM measures have been used for: screening for program eligibility (e.g., Marston & Magnusson, 1985), placement in curriculum levels (e.g., Deno & Mirkin, 1977), and most prominently, progress monitoring (e.g., Deno, 1985). Until recently (see e.g., Fuchs, this volume), little attention has been given to using CBA systems, at least of the type developed at the University of Minnesota, in identification of specific variables as targets for intervention.

The fact that CBM investigations have produced more direct and cost efficient methods (as compared to traditional standardized testing) for eligibility decisions or monitoring educational progress cannot be denied. Indeed, the data obtained in the Minnesota investigations suggest that curriculum-based probes “are as psychometrically sound as standardized achievement tests, are much simpler to administer, and are much less expensive” (Lentz, 1988, p. 98). CBA data have been used to differentiate among exceptionalities and place children in special programs (Marston & Magnusson, 1985; Shinn & Marston, 1985).
Others have advanced methods of developing local norms for CBA data (Shinn, 1988) with the suggestion that these data can be used to assist in the identification and placement of children in special programs.

Although each of these articles address issues of interest and importance, we see much reason for concern both in the general approach suggested by this research and the specific manner in which CBA is utilized in these investigations. As discussed above, we are not comforted by the fact that CBA procedures fulfill many traditional psychometric assumptions (e.g., reliability and validity). We are just as troubled by our perception that a prime interest appears to be in the use of CBA data to assist in placement of children within special programs.

Although CBM has primarily been evaluated within a traditional psychometric model, there are several notable exceptions. Fuchs and her associates (e.g., Fuchs, 1989) have provided convincing evidence that using CBM for systematic goal setting, progress monitoring, and decision making about instructional change can enhance student achievement in reading, math, and spelling. This strand of research seems best conceptualized as research into the validity of an intervention, the intervention being making data-based decisions, and also seems most related to a behavioral assessment model.

Initial CBM research appeared to accept implicitly the premises of a traditional psychometric model, with studies of internal consistency (Fuchs, Fuchs, & Deno, 1982), test-retest reliability (Marston & Deno, 1981), and concurrent validity (Deno, 1985) predominating; however, few studies appear to have examined decision reliability or validity of CBM. For example, the stability of placement decisions made with CBM data across assessors, time, or even different eligibility rules have not been closely examined. Unfortunately, some data (e.g., Derr & Shapiro, 1989) have suggested that these factors may affect eligibility decisions.

There have been a number of other recommended uses of CBA that would not appear to fit within a traditional measurement paradigm. For example, Lentz and Shapiro (1986) and Shapiro (1990) have outlined the use of curriculum-based written products and CBM type probes during problem analysis for planning interventions, or in assessing environmental influences on academic problems. Likewise, Gable and Hendrickson (1990) provide guidelines for using student performance measures in specific instructional planning. However, there appears to be no empirical evaluation of these suggestions. Further, given the purpose of these suggested procedures, the traditional measurement model does not offer an appropriate framework for evaluating assessment adequacy.
The behavioral assessment model has been presented as a viable alternative to traditional trait-oriented measurement models that once dominated (Haynes & Wilson, 1979; Hersen & Bellack, 1981). During the last two decades many direct observation procedures that are conceptualized as behavioral assessment have been used in classroom research and assessment (e.g., Kazdin, 1984) and there are a number of academic assessment systems, including CBA (e.g., Deno, 1985; Haring & Eaton, 1978; White & Liberty, 1976) that to some degree correspond to the behavioral assessment model in terms of assumptions about measurement and the functions of assessment.

Traditional approaches to measurement have often used behavior as signs or signals of some underlying condition that the individual has, whereas behavioral assessment is more interested in the individual's actual behavior, that is, what the individual does (Hartmann, Roper, & Bradford, 1979; Haynes & Wilson, 1979). This reluctance to infer beyond the behavior itself or to consider behavior as a sign of some abstract construct of diffuse state is a defining characteristic of the behavioral assessment model. In addition, behavior is considered to be to some degree situationally specific and considerations of reliability and validity of assessment procedures must be made relative to actual behavior in natural settings (e.g., Cone, 1981; Hartmann et al., 1979).

The behavioral assessment model has led to the development of many measurement procedures that have found extensive application in education and psychology. Specific applications of behavioral assessment have included selection of clients, identification of target behaviors, determination of controlling variables, selection of treatment procedures, and monitoring and evaluation of treatment efficacy (Nelson & Hayes, 1981). In order to accomplish the tasks described above, behavioral assessment emphasizes direct, repeated measurement of behavior and controlling variables in the environments in which the behavior of interest occurs. Of course, it is true that the ideal of direct and repeated measurement in the environments of interest may not always be possible; however, this assessment model offers the potential for direct linkage between assessment and intervention.

EVALUATING BEHAVIORAL ASSESSMENT

Within the behavioral assessment model, measurement data have been conceptualized along several dimensions. First, data can be analogue or natural. In the former, data on actual behavior are collected, but in settings that are not naturally where the behavior occurs, for example, role-play tests. Natural data are collected within the actual
settings of interest. A second dimension is whether measures are direct or indirect. In both, behavior is of prime interest, but in the former, data are collected concurrently with the occurrence of target behavior (for example, direct observation of behavior), but in the latter, data are collected retrospectively (for example, behavior checklists).

In behavioral assessment, the accuracy of measurement (direct relationship to criteria characteristics of ongoing behavior) and relationship of data to functional controlling variables and critical behaviors in natural settings are prime criteria for evaluating measurement utility. Because a prime purpose of a behavioral assessment is to measure environmental (and other) variables that maintain current target behaviors (or inhibit acquisition of more appropriate behaviors), assessment procedures must be evaluated in terms of how well they accomplish this purpose. Only if assessment data provide such information, can intervention plans be directly linked to assessment information.

Some CBA data are direct and natural, such as work samples, curriculum embedded tests, and measures of oral responding during class activities. Other types of CBA data, for example, that included under the rubric of curriculum-based measurement (e.g., Tindal, 1988) are direct and analogue in nature; behavior is measured directly but under contrived conditions (not as part of “naturally occurring” academic behavior in the classroom). The developers of CBM seem to have conceptualized CBM probe data as a “sign” or construct of academic skills or achievement, similar to traditional achievement tests in this aspect, and to have evaluated it primarily in this traditional regard (e.g., Tindal, 1988). If CBA data are used in academic assessment oriented towards intervention planning, then evaluation of their adequacy would seem best derived from a behavioral assessment model and related assumptions. Even as used in progress monitoring (repeated measures of direct analogue measures), CBM would seem more related to the purposes of measurement within a behavioral measurement model.

CBA has not been clearly and consistently related to ecologically valid criteria (Martens & Witt, 1988). For example, are positive data series obtained through repeated CBA reading probes consistently related to improvements in children’s oral reading in instructional reading groups? Do teacher’s perceptions of change in the way children meet classroom expectations correspond to CBA data? When there is a lack of correspondence between CBA data and teacher perception of change (or actual classroom behavior), what then? How consistent are CBM measures gathered across different raters and different settings?
In the next section, we examine further the limitations of more traditional approaches to assessment and consider more completely the advantages of conceptualizing academic assessment and CBA within a behavioral assessment model.

**ACADEMIC ASSESSMENT WITHIN A BEHAVIORAL ASSESSMENT MODEL**

Trait-oriented approaches to educational measurement have not proven to be very productive. Although schools continue to spend a great deal of time assessing constructs such as intelligence and mental processes (e.g., auditory memory, simultaneous and sequential processing), the treatment utility of such approaches remains elusive (e.g., Arter & Jenkins, 1979; Kramer, Henning-Stout, Ullman, & Schellenberg, 1987; Witt & Gresham, 1985). Inferences about global tendencies (e.g., attention, impulsivity) that have often been made based on subject behavior during testing have not been shown to be any more useful than our attempts to measure intelligence or cognitive processes.

Trait-oriented procedures, relying on norm references for quantitative measurement, have been criticized in ways that are related to the differences between traditional and behavioral assessment models. Norm-referenced approaches:

> do not offer absolute measures of academic behavior; rather, the meaning of derived measures comes from a student's relative standing in a norm group. They are also difficult to use in a frequent, repeated fashion and are thus not useful for progress monitoring. The lack of direct relationship between achievement tests and what is actually taught to children has also been highly criticized . . . . (Lentz, 1988, p. 83)

As will be seen, CBM has depended on being norm referenced for a variety of purposes, including screening, placement, and goal setting (Tindal, 1988). However, because of the nature of this type of CBM measure, it appears much more sensitive to interventions, and more useful in repeated progress monitoring than standardized achievement tests. Other approaches to academic assessment also approximate the requirements of a behavioral assessment model. For example, the content of criterion-referenced tests closely resembles academic behavior required in classrooms. Although performance on a criterion-referenced test is not a direct measure of classroom responding, responses on these
tests could be considered analogue measures. A serious concern with criterion-referenced tests is that of variable quality, which further limits the extent to which these instruments approximate classroom behavior (Tindal, Fuchs, Fuchs, Shinn, Deno, & Germann, 1985).

Curriculum-related academic assessment and intervention systems have been specifically and purposefully developed to overcome many of the problems identified with norm-referenced achievement tests. For example, data-based instruction (Haring & Eaton, 1978), precision teaching (White & Liberty, 1976), and curriculum-based measurement (e.g., Deno, 1985) all assess academic skills and employ direct observation and measurement procedures. These procedures focus on academic skills, target the goals of classroom instruction, and often use materials taken directly from the classroom curriculum. They differ from criterion-referenced tests in that they involve brief, timed, and frequently administered probes of precisely defined academic behavior. As discussed above, although the measurement stimuli used in these systems are taken directly from classroom curriculum, the conditions under which stimuli are administered may not mirror natural classroom conditions and in some cases the data derived from assessments have been used to make inferences about global constructs (e.g., Deno, 1985; Marston & Magnusson, 1985).

SUMMARY

The only structured CBA procedure with any notable empirical evaluation appears to be that of CBM (Shinn, 1989; Tindal, 1988). From a behavioral assessment perspective, the evaluative data base seems lacking in several important aspects. First, the influences of situational assessment (assessor, instructions, materials, etc.) are not well understood, especially as to how such variables may influence decisions. Recent research (Derr & Shapiro, 1989) raises serious questions about assumptions that, for example, performance on CBM probes is best conceptualized as if it were a traditional achievement test. Second, the relation of CBM measures to natural academic performances and natural environmental variables is not clear. In terms of planning classroom interventions, or of changing existing interventions, this is unsatisfactory. (The efficacy of using CBM progress monitoring to know when to change interventions seems supported [see Fuchs, this volume]. However, what or how to change is not necessarily derived from the use of CBM.) Evaluation of CBA/M within a behavioral assessment model would help address such concerns. Third, the use of CBM probes in improving diagnosis (i.e., easier matching of
interventions for typical problem patterns) is basically unexplored.

RECOMMENDATIONS AND FINAL CONSIDERATIONS

The continued evaluation of CBA, especially CBM, within a behavioral assessment model could address a number of intriguing and important questions. It should be acknowledged that a behavioral concept of a skill, especially in regard to basic academic skills, has not been fully explored or even well developed in a practical sense. This is important because CBM would seem to offer, if used with more direct measurements, some broad assessment of current student “skills” especially as related to the reasons that a student is not meeting naturalistic classroom expectancies (see, e.g., Lentz & Shapiro, 1986). For example, during an initial assessment of a particular student’s academic problems, use of various CBA measures (including CBM probes or other curriculum-based measures) in conjunction with environmental measures could allow a decision about whether any presenting problem is related to lack of student behaviors (abilities, skills, etc.) or a failure of the academic environment to support adequate performance in required classroom/curriculum activities. Likewise, CBA/M would seem potentially useful in the analysis of variables contributing to overt classroom behavior problems. (Is the student able to access normal classroom rewards for academic performance? Is a lack of skills contributing to inappropriate behaviors?) The recommendations discussed below are intended to suggest the types of research needed to allow the fullest utilization of CBA/M in the process of solving educational problems.

Situational assessment variables and effects on CBM data. From a behavioral assessment perspective, CBM performance is not a matter of true and error components; rather, the influence of setting, assessment conditions, assessor, materials, etc., should be directly assessed. Further, these effects can and should differ across subjects. Derr and Shapiro (1989) have provided evidence that the performance of students on CBM reading probes is significantly influenced by setting, assessor, and instructions. Such influences can impact nearly all the decisions made using CBM and additional research needs to be conducted across the variety of CBM type probes, to determine how decisions may be affected.

Environmental influences on CBM performance and the relationship of CBM measures to “naturalistic” academic behaviors. Research should be
extended to examine how CBM probe performance (an analogue measure) is related to student performance on natural academic tasks, such as oral reading in reading group, seatwork across subjects, spelling across different types of written assignments, and performance on classroom tests. In some ways, this would compare two types of CBA, assessment from normal academic products, and performance on CBM probes. Gable and Hendrickson (1990) have provided a good guide for analyzing error patterns in student work in regard of identifying intervention targets. Would error patterns apparent on classwork match error patterns from CBM probes? Further, the variables that are functionally related to such performances need closer examination in order to more clearly understand how use of CBM enhances the analysis of presenting academic problems. Information from such research is required before a clear understanding of the linkage between academic assessment and intervention planning, especially in regular classrooms, is possible.

**CBA/M measures and the identity of homogeneous groups of academic problems.** Additional research may allow us to identify homogeneous groupings of referred children in order to maximize selection of appropriate interventions. The identification of “classes” of presenting problems that allow selection of empirically effective matching interventions is perhaps the most important goal of any diagnostic effort. For example, students with different levels of performance on CBM probes, different performance on “natural” classroom tasks, and different patterns of impinging classroom variables could be grouped conceptually and their response to different types of intervention clarified. Research results may even allow good decisions about *levels* of CBM probe performance, given types of classroom environments, that are necessary for success in regular classrooms without additional resource or “pull out” assistance. This type of research is badly needed to advance the technology of classroom interventions for the use of practitioners.

**Generalization from academic interventions: From special to regular classrooms and within either type of classroom.** Related to the research discussed immediately above is the issue of how changes in CBM measures used in progress monitoring generalize to academic behaviors in the natural classroom environment. If it is what teachers see that initiates referrals for academic assistance, then what we do about the problems must ultimately impact on such observations. Making decisions about the efficacy of academic interventions using repeated CBM measures should be examined from the “consumer” end, in terms of whether our decisions are directly related to improvement in the
behaviors about which teachers were initially disturbed. Research into this issue would involve concurrent measurement of natural classroom responding (including curriculum required daily responses) and CBM probes. Additionally, assessment of which classroom variables functionally affected this relationship would advance our understanding of generalization, and the development of generalization technology.

The stability of progress monitoring decisions. As stated, CBM has been well established as a progress monitoring system that can enhance student achievement. One problem that we have observed in our own use of CBM has been the widely different variance of individual students. Students with extreme variation on probe performance may well produce data series that result in unstable decisions about changing decisions; for example, they may require more or more frequent data points before a decision can be made about the need for change in instruction or goals. From a behavioral assessment perspective, these issues would be seen as idiosyncratic, but empirical guides for different performance patterns could be developed. Guides around number of probes across what amount of time appear to be generally lacking (see, e.g., Shinn, 1988), and such research would be useful for all users of CBM.

If districts adopt CBM procedures to replace typical evaluation procedures within the special education process there are, we believe, clear benefits. As has been concluded (e.g., Tindal, 1988), CBM appears more consistent across the wide range of necessary decisions, use of CBM in progress monitoring appears to enhance achievement (Fuchs, 1989), and CBM may improve program evaluation in special education (e.g., Tindal, 1989). If professionals such as school psychologists adopt CBM and other CBA procedures during academic assessment we also believe that children would benefit and we have suggested research to enhance the validity of decisions made in such assessments. However, if the traditional refer-test-place procedure remains virtually intact and CBM data replaces other “gatekeeping” data, then there may be little effect on children outside of special education, and only then to the extent that structured progress monitoring occurs. Although continued CBA research within the placement process, especially regarding decision stability would be helpful, research into CBA/M from a behavioral assessment perspective would greatly enhance intervention assistance efforts for all “at risk” students. Finally, such research would also illuminate the efficacious selection of interventions within special education programs.

The goals and objectives established for this paper were clearly stated at the outset. In our examination of academic skill assessment it
has been argued that the behavioral model is most appropriate for use understanding functional relationships between assessment data and environmental conditions. The discussion suggests that CBM procedures have often been used and interpreted within a traditional measurement model, although other research more consistent with the logic expressed herein has begun to appear. Although direct observation and measurement of classroom behavior is expensive, we argue that measurement of natural classroom events are the standard against which less direct measures (e.g., CBM probes) be evaluated. There is much to be learned about the relationship between performance in the natural context in which academic performance occurs and CBM data.

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