Problem Solving Assessment with Curriculum-Based Measurement

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Assessment occurs when a decision has to be made and someone wants information to inform the decision. The history of education and psychology is replete with evidence regarding the use of assessment to make screening, classification and placement decisions. Within the schools achievement testing has been conducted to provide information for evaluating schools and making system level comparisons. Most commonly, school psychologist assessment activities have been focused on aiding in the process of determining special education eligibility. Those assessments have been severely constrained by rules and regulations that have left very little room for reflective problem solving. While it is not appropriate to abandon role responsibility for classification and placement of students in special and compensatory programs, alternative conceptions exist for how assessment can serve to inform the wide range of decisions that are made while implementing educational interventions. The conceptual model provided here portrays assessment as directed toward problem solving.

Professional Problem Solving

What makes work "professional," is not easy to identify. Historically, advanced training and work that is more mental than physical have defined a professional practice. Another characteristic of work that typically defines professional work is problem solving. For example, physicians address problems in physical health and development. Lawyers focus on legal problems. Engineers solve design problems. Psychologists intervene to reduce behavioral problems. Less obvious, perhaps, is that successful

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professionals in education must also be effective problem solvers. For the professionals in education the central problem is how to foster intellectual and social development.

Problem solving defined

A problem solving conception of educational practice is based in a generic view of problem solving characterized by an individual's response to the environment. Throughout this chapter, the term problem solving is used whenever people act to eliminate a difference between what they currently sense or perceive and alternative conditions that they value. In short, problem solving occurs when people act to reduce the discrepancy between "what they want and what they get." In education, the perceived differences that motivate problem solving are those discrepancies between students' present levels of development and some other expected or desired level development. The approach described in this chapter is based on the idea that problems exist in the eye of the "beholder." A problem exists as long as a discrepancy is perceived, and problem solving refers to the activities undertaken to reduce or eliminate the perceived discrepancies.

A broad conception of problem solving is useful for professionals in education because, when used, it clarifies the focus and structure of the professional role and responsibilities. It is also useful because it avoids the common argument over whether a problem "really" exists. From the perspective presented here, a problem exists whenever a discrepancy is perceived between what a student does and what someone expects the student to do. Given this context, the arguments over problems must focus on whether the discrepancies, once identified, are important.

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Problem solving in America's schools

In most respects, determining whether a problem is important enough to solve is the most difficult step in problem solving. The controversy surrounding high stakes testing in American education is a good example of how subjective arguments can be over whether or not important educational problems exist. Many educators argue that the schools are more effective than they have ever been. In contrast, politicians and some members of the business community believe that the United States is experiencing a major educational crisis. Educators point to increased scores on national assessments, while politicians pass legislation calling for higher performance standards. Clearly, it is not the actual level of achievement that is at the basis of this difference in problem perception. Instead, whether or not that achievement is satisfactory depends upon the standards applied to that achievement. Not only do legislators perceive a difference between current student achievement and the level of achievement that they desire, but they view that difference in achievement as important enough to act on in through enacting legislation.

Individual Problem Solving. The difference in opinion regarding achievement that we observe between politicians and educators is also observable at the level of teacher and parent. Almost anyone consulting with teachers and parents has been confronted with the situation where a teacher viewed a child's progress as acceptable and the parents were unhappy because the saw their child as underachieving. The disagreement, of course, results from a difference in perspective on what the child *ought* to be accomplishing. In situations like this, teachers and parents often have difficulty in

resolving their differences. At the same time, with some consultative assistance, the discussions over whether the child "really" has a problem can become opportunities for constructive problem solving. Constructive problem solving in such situations can require a professional with skills for structuring the communication so that steps can be taken to address the differences in perception. A successful approach to resolving the differences begins with the following three steps:

1. Factual description of the child's *current level and rate of development*
2. Complete specification of the *desired level and rate of development* by parents and teacher
3. Thorough discussion of the *importance of the difference* between the child's current rate of development and the rate desired.

While the first step in clarifying whether a problem exists can be objectively accomplished, and the second step can be accomplished through careful probing, the third step is certain to be entirely subjective. This is so because people necessarily will have different views on which discrepancies are important and how large a discrepancy must be before it is viewed as a problem.

Schooling as intervention

The role of professional educators as problem solvers is best understood when education is viewed as a deliberately conceived "intervention" into children's lives. The intervention of schooling is created by society to produce specific developmental

outcomes. While members of a society often disagree on the outcomes, there should be no question that the primary purpose of schooling is to intervene in children's lives to produce those outcomes. As extensions of our society, then, educators are required to accept the developmental outcomes around which schools are organized, and work toward their attainment. Teachers and parents often do not like or agree with the outcomes that have been specified, but those whose children attend the public schools and those who are public employees are bound by the law and regulations. In the public schools, parents must accept that the state will direct their children toward the state's preferred outcomes and educators must accept the responsibility to organize activities in the direction of those outcomes. Given these circumstances, the "problems" to be solved by educators ultimately are derived from the schools' responsibilities to promote growth and development in the direction of societally mandated outcomes. The term *intervention* underscores the fact that schools are designed to have an impact on what otherwise might be unstructured development.

Problems. In a problem-solving model of schooling, the focus of educational intervention is how to eliminate the difference between students' level of development at any point in time, and the level of development expected by society at some future point in time. The current emphasis on "standards" and high stakes assessment clearly underscores this emphasis on solving the problem of where students *are* and where society *wants them to be*. With full implementation of the *No Child Left Behind* law (Federal Government, 2002), considerable pressure is being applied to both schools and students to assure that any discrepancies between societal standards and student's performance are eliminated. Whether or not this is realistic is not the issue here, of

course. As stated previously, what is relevant is clear is that the public perception of federal and state governments is that a problems exist.

Outcomes. An examination of the standards set by state and federal governments easily leads to the conclusion that literacy and numeracy, are the most fundamental outcomes toward which schooling is to be directed. This conclusion is supported by observation of time allocation to subject matter doing the school day. Particularly in the elementary school years, far more time is allocated to fostering development in reading, writing, and arithmetic. At the secondary level, language, literature, and mathematics are consistently required of all students. In addition to the prominence of literacy and numeracy in curriculum organization, evidence of the primary nature of these two sets of outcomes can be obtained from emphasis in national assessments of student achievement. For example, the National Assessment of Educational Progress (NAEP) contracted for by the federal government focused first on national trends in reading, writing and math achievement. As greater attention has been given to setting standards, science has been added to the outcome emphasis placed on literacy and mathematics.

Outcomes related to personal, social, and physical development, apparently, will be left to families and schools as secondary considerations. Standard setting, then, is the process of making the public's values explicit. In doing so, standards setting clarifies and establishes the priorities that will be assigned to the problems of ordinary educational intervention. In this model, the term problem solving is not reserved solely for efforts to promote change in atypical development. Problem solving, and the problem-solving model provides a framework for reflecting on the nature of schools, the purpose of schooling, and for the nature of professional work in the schools.

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Problem solving through general and compensatory education

Two major types of intervention occur in education. The first, that we call general education, already has been described previously as the mainstream instructional program created for all children. A second, smaller set of interventions are the various special and compensatory education programs created for students from diverse cultural and economic background and for students with disabilities. Different from the general education interventions, this second set of interventions is intended for smaller subsets of the student population. These two general types of intervention create somewhat different roles and responsibilities for psychologists and educators in problem solving. Much of that difference stems from the fact that interventions in special and compensatory programs are characterized by increased intensity since they occur when a student's response to the ordinary interventions of the general program is not satisfactory.

INTENSIFICATION OF EDUCATIONAL INTERVENTION

Until quite recently, the idea that educators functioned as problem solvers would have seemed inappropriate. The primary reason for this is that schooling was viewed as an "opportunity" for students to learn and grow rather than a place where educators deliberately engineered environments to increase growth. In the earlier, "agrarian," model of education the emphasis in teaching was on the teacher's responsibility was to create the climate for growth. The general education program was to function as the

fertile field prepared to nourish children's growth. The assumption was that students grew at different rates because it was "in their nature", not because educators were failing to prevent or overcome those differences. The classroom was a place where children were "free" to learn at their own rate, achieving to the level of their individual capabilities. Once the field was prepared teachers were expected to "weed and feed", but differences in growth rates were assumed to be the natural outcome of organic differences. In this model, the expectation was that the distribution of academic achievement would inevitably result in an approximation of the normal curve. While it might be possible to see the role of educators as problem solvers in the agrarian model, accepting a normal distribution in achievement as appropriate – even inevitable - tends not to motivate assessment directed toward individual problem solving. In the agrarian model, assessment is used to decide on who are the "best" and the "brightest" fruits of the field that merit further academic nurturing.

Over the past several decades, a "sea change" has occurred in society's charge to America's schools. The change was made explicit at the end of the century by the "Education 2000" challenge introduced during the administration of President George H. W. Bush. In that document, and in many state initiatives since that time, the challenge presented to American educators was to create schools in which "all children" would learn. The assumption was that schools should be a place where "equity and excellence" could be expected for all students. This idea that " all" students could achieve at a high level if the schools would function properly led to "standards based" reform efforts virtually all states. Standards based reform begins with the setting of criterion-referenced outcomes by political entities – typically state legislatures. Once the outcomes are

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specified, mandates are established compelling school districts to assure attainment of those outcomes for "all" of their students. Often, positive and negative incentives are attached to success and failure for both school districts and students. These same ideas have now been codified in law through the No Child Left Behind (NCLB) legislation passed during the first administration of George Bush. The original regulations that flowed from NCLB offered no surcease from the demand that the schools educate all children to a high standard of proficiency. Further, the assessment requirements were designed to assure that educators would see as a problem achievement of less than high standards by all students.

An important effect of this sea change for American education was to alter the role responsibilities and expectations for everyone working in the schools. The pressure of meeting existing standards replaced the luxury of a relaxed approach where it was possible to sit back and "watch the garden grow". Educators everywhere are now pressured to find those "evidence-based practices" that will provide them with the means to overcome inadequate growth rates. The idea that all students are capable meeting the same standards and that educators are responsible for attaining that ideal represents a significant departure from the normal curve model that was the basis of educational practice. In American education, the model of industrial engineering has replaced the agrarian approach to schooling. Problem solving is a primary responsibility of all educators in the current educational environment.

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COMPENSATORY PROGRAMS AS INTENSIFIED PROBLEM SOLVING

Students do not grow at the same rate physically, nor do they grow at the same rates academically. When governmental agencies arbitrarily set standards for "acceptable" performance in different curriculum domains the differences in student's rates of development inevitably results in some students failing to meet the standards. In response, schools create special and compensatory education programs designed to intensify problem solving beyond those organized as part of the general curriculum. Compensatory programs such as Title 1 and those for English Language Learners contain relatively larger numbers of students all receiving a common approach to improving their school success. As standards based reform was implemented, additional remedial programs had to be created to intensify problem solving for those students who failed to achieve standards. Beyond these compensatory programs, special education programs are provided for a smaller number of students whose developmental problems are even more intractable. . During the 60s, 70s and early 80s, the efforts to solve the problems presented by this smaller number of students were organized through a continuum of options or "Cascade of Services" (Deno, 1970). The levels described in this administrative model consisted of different types of programs where special educators served decreasing numbers of students. Since these special educations programs added significantly to the cost of education, determining eligibility for special education programs dominated the assessment responsibilities of school psychologists.

With the passage of NCLB, the demand increased for all educators to intensify problem-solving efforts. NCLB requirements have also heightened attention to the achievement problems for students in all types of compensatory programs. An increased

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focus on making adequate academic progress with even the lowest achieving students has replaced the historic preoccupation with the procedural requirements that were necessary for determining eligibility for these programs. It is now clear that special and compensatory programs exist to improve developmental outcomes for the students in those programs.

SOCIETAL PRIOITIES IN PROBLEM SOLVING

In the problem solving approach presented here, a "problem" is said to exist whenever expectations for performance exceed current capabilities. In this view, "problems exist in the eye of the beholder". Whenever the schools or teachers are not satisfied with student achievement, a problem exists. At the simplest level a problem exists when a teacher expects a student to read a story and answer questions and some students do not do so. The problem exists regardless of whether the teacher's expectation is too high or the level of student performance is too low. No attribution of cause is necessary. Similar problems can be easily imagined for story writing when students do not have the necessary writing skills and for completing mathematical story problems when the teacher is unaware of the computation skills required for doing those problems. Whenever student performance is perceived to be discrepant from expectations, a problem is said to exist. Clearly,

Person-centered disabilities and situation-centered problems

Before considering how priorities are established among problems, an important distinction must be made between an academic disability and an academic problem. The

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term “academic disability” is used to refer to the relative incapability of a person to perform on common academic tasks. In the foregoing examples, the students who are relatively unskilled in reading and computational math would be considered to have academic disabilities if their performance in these domains was extremely low. In this sense, then, academic disabilities are centered in the individual. The term “academic problem,” in contrast, is used to refer to differences between what the person can do and what the environment requires to the person to be successful. In the reading and math examples previously described, problems exist because the conditions set by the teacher exceed what the students can do. From those examples, we cannot determine whether the students are academically disabled or whether the teacher’s expectations are unreasonably high. Thus, we can say that an academic problem exists, but we cannot say that the appropriate solution for those problems lies in increasing student ability, altering the teacher’s expectations, or making adjustments in both. In this perspective, we can see that problems are defined contextually in terms of the discrepancy between performance and environmental demands. Academic problems, then, are centered in the situation, while academic disabilities are centered in the person.

The Role of Cultural Imperatives

A useful approach for understanding how priorities among academic problems are established is the framework provided by idea of "cultural imperatives" (Reynolds & Birch, 1977). Cultural imperatives are the implicit or explicit standards of conduct or performance imposed on anyone who would become a member of a culture. One example of an imperative in American culture that increasingly produces conflict is the

requirement that all citizens speak English. As the United States becomes more culturally and linguistically diverse, the demand that citizens speak one language has been challenged. Even as the challenge has been raised, however, school districts in some States are legally required to provide all of their instruction in English. While imperatives like speaking English are codified in law, other imperatives are not explicitly formal and legal. The expectation that adults should be independent, for example, is sanctioned socially but not legally. Inculcating many socially sanctioned but not legally required cultural imperatives is a primary charge of the public schools. Controversy has existed for some time over what constitute the cultural imperatives of American society that are to be transmitted by our schools (cf., Hirsch, 1987). As NCLB was implemented, and states were required to establish curriculum standards political conflict ensued. Those conflicts over what students should be required to learn can be interpreted as cultural struggles generating from different values orientations over what are the imperatives of American culture.

One thing that becomes clear when conflict over cultural imperatives occurs is that while agreement can be obtained at a general level, disagreement exists when specificity is required. For example, widespread agreement exists that "basic skills" should be given high priority. Different viewpoints emerge, however, when efforts are made to specify the basic skills that must be learned by all students, However the conflicts are ultimately resolved, one thing seems quite clear in examining the cultural imperatives toward which schooling is directed. Substantial instructional time has been, and is, allocated to teaching functional skills in reading, written expression, and

arithmetic. At the very least, we can say that reading, writing, and arithmetic are cultural imperatives in the early school years.

Cultural electives. As we attempt to establish priorities among academic problems it is important to recognize that there are aspects of culture that may be valued by a majority of people in a society but are not required of all members. These valued, but optional, aspects of individual development are cultural electives. Playing a musical instrument is a good example of a cultural elective since it is widely valued, but not required for successful membership in American society. Since instrumental performance is an elective, opportunities to learn how to play an instrument are sometimes provided by the schools, but basic instrumental skill is not required for promotion through the grades. The distinction between reading as a cultural imperative and the playing of a musical instrument as a cultural elective is at the heart of establishing priorities among problems to be solved. First consideration in problem solving is inevitably given to cultural imperatives. Clear evidence of this fact is the effect of the standards based reform movement made explicit in NCLB. As outcomes become written into law, they serve to establish what the body politic view as cultural imperatives.

The Role of Normative Standards in Problem Definition

The distinction between cultural imperatives and cultural electives provides only a partial basis for identifying those problems important enough for organizing problem solving efforts in the schools. A second criterion that must be added is the size of the difference between what a culture requires in its imperatives and what a member must do to be considered "at risk" for violating cultural expectations. How much must

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performance differ from the performance standards set by the culture for an individual to be considered seriously disabled? From an empirical, psychological point of view, the answer has been found in the normative behavior of the members of the culture. In this view, establishing important differences requires development of empirical norms that largely, but not exclusively, determine the performance standards imposed by the culture. For example, commercially developed achievement tests are based on the use of norms that provide a framework for judging performance in reading, written expression, and arithmetic. The standards are established by measuring student performance at different points throughout the school year to determine the distributions of performance for same-aged cohorts. Students who widely diverge from their peers at the low end of these distributions are those typically thought of as disabled.

While academic disabilities are normatively defined, academic problems are situational and depend on the performance expectations in that situation. Thus, judgments that a discrepancy is serious reside in, and are conditioned by, the contexts within which a student's behavior occurs. This perspective means that teachers not only make judgments based on their experience with broad cultural norms, but also based on the behavior of students in the context of their classrooms and schools. The local frame of reference will always affect and individual's judgment. This point is important to remember when choices must be made among problems to be solved.

The standards based reform movement clearly illustrates how standards other than those derived from prevailing norms influence problem identification. This call for reform was driven by the view that the normative performance of American students was markedly decreasing or inferior to the norms or other cultures. In the early 1980s, the

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schools were sharply criticized for apparent decreases in the national averages on the Scholastic Aptitude Test (SAT). Further, considerable alarm was created by evidence that students from Japan were superior in their mathematical performance to students in the United States. The result was a call to reject the normative criteria in favor of higher standards on cultural imperatives.

Academic disabilities contribute to the existence of academic problems, but they are not the sole basis for the existence of those problems. A lack of reading skill becomes a problem only when the standards for success in the environment require a level of reading skill not possessed by the individual. A reading disability becomes a problem when the teacher expects the students to study text they cannot read or when a person is required to read directions in order to assemble a bicycle. Since these problems are created in relation to environmental demands, they are situation-centered rather than person-centered. Handicaps, then, are ecologically defined since they can be described only in terms of the network of social and physical environmental relationships of which the individual is a part.

Establishing priorities among problems

Problems have been defined here as situation-centered performance discrepancies. Although such a definition is useful as a starting point for intensifying problem solving, two issues need to be addressed when allocating resources: (1) the situation-specific nature of problems and (2) the myriad of expectations that define performance as discrepant.

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Since performance discrepancies are always defined with reference to specific situation, people performing the same in two different situations might be viewed as having a problem in one situation (e.g., the school) but not the other (e.g., on the job). Students who do not compute well enough to complete word problems successfully in their math class may experience no difficulty in accomplishing the computation required for working in a fast-food restaurant. Indeed, most of us who might have been poor math students in school are not mathematically handicapped in our daily lives. It is also common to find differences in the acceptability of the same academic skills between schools or classrooms. For example, a student whose performance in reading might have led to eligibility for a compensatory education in a high-achieving suburban school district, upon transferring, might be placed in a top reading group in a low-achieving urban school. Even within the same school, a student's behavior is likely to be judged differently by different teachers from one grade to the next. Indeed, evidence exists that it is quite normal for a student to be identified as having a significant behavior problem during the elementary school years (Balow and Rubin, 1978). This situational character of educational problems makes it difficult to determine whether a problem is sufficiently important for precious supplementary time and money to invested in their solution.

A second issue related to performance discrepancies in problem solving is the myriad, and seemingly arbitrary, academic and social behavioral expectations faced by students. In general, teachers expect (1) compliance to reasonable requests (2) attention and participation in class (3) completion of independent classwork and homework, (4) self-direction on projects, and (5) development of accuracy and fluency on a variety of curriculum skills. When the specific expectations within this general set of expectations

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are identified, however, some seem less important than others. Students are often held accountable for completing activities that are included in curricula even when no clear empirical rationale can be developed for requiring the activity. When considering both the wide range of expectations and the situation-specific nature of many problems, it becomes clear that some set of criteria, or system, must be used to establish priorities among problems as efforts to intensify problem solving proceed.

Norms, Standards, and Consequences in Establishing Priorities

In the history of educational and psychological testing, norms have weighed heavily in the judgment of student performance. Indeed, "problems' have traditionally been identified through establishing the difference between an individual's level of performance and the mean performance for age and grade. When this normative perspective is used to define problems, the magnitude of a student's problem is established by scaling the normative difference. A subtext always missing in this approach to identifying problems, however, is a consideration of the consequences of the failure to achieve expectations. If nothing else, the standards based school reform movement that relies on benchmark testing makes it abundantly clear that academic problems can be criterion-referenced as well as norm-referenced. Even more clearly the movement has revealed that it is the magnitude of the consequences associated with failure to meet expectations that establishes the significance or importance of academic problems. High stakes have been attached to success and failure, and students can be denied grade promotion or even a high school diploma. Schools can be labeled as substandard and placed on probation, school districts can be required to pay for

supplementary programs. In this climate, priorities among academic problems are a function of the consequences attached to prevention, elimination, and continuation of those problems. Priority for academic problems with less significant consequences gives way to priority for problems defined by law and regulation.

The raised stakes for schools and teachers has made it easier to collaboratively establish priorities among academic problems with teachers. Though we might not all agree with the politics and the outcomes of the standards-setting process, arguments over priorities among problems decrease once standards have been established. Where standardized tests were once ignored, educators now are constrained to focus on achievement outcomes. Academic problems directly related to state standards now are given highest priority.

THE INCREASED NEED FOR PROGRESS MONITORING

The dramatic increase in pressure on the schools to document student attainments has resulted in a much sharper focus on assessment procedures. Without some means to establish that students are attaining the standards, of course, there can be no accountability. The key approach to establishing accountability has been to increase the number and types of assessments used to ascertain attainment of outcomes. Different states have taken different approaches to developing assessment procedures for establishing accountability, Initially, some states based their procedures on alternative approaches to assessment like performance sampling and portfolio assessment. With the broader range of assessment requirements introduced through NCLB, the emphasis on traditional objective test item formats for basic skills in reading, writing, and arithmetic

have become more practically feasible. Now, many states have either developed or contracted for the development of new achievement tests that meet NCLB requirements. One remarkable aspect of this movement has been that, in many cases, the procedures developed to meet accountability standards were implemented without extensive technical work on their reliability and validity. Thus, many students, and many schools, are being held accountable through assessment procedures of uncertain technical adequacy.

In addition to developing tests to meet the accountability requirements of high stakes assessment, educational agencies have also recognized the need for, and potential of, regular and frequent progress-monitoring procedures. The need for progress monitoring stems from the fact that those being held accountable for student achievement on standards tests would like to be able to forecast likely student's success on the standards tests. Obviously, being able to anticipate outcomes creates opportunities to make corrections to forestall or minimize any negative consequences. Thus, interest has increased in the potential of progress-monitoring procedures for formatively evaluating educational programs for the purpose of increasing the likelihood of program success.

The US Department of Education has made education agencies more aware of the importance of frequent progress monitoring by requiring its use in evidence-based programs. In its invitation to apply for the Reading First grants (2001) the Department required that all applications incorporate progress-monitoring procedures on the basis sufficient evidence existed that success in attaining positive achievement outcomes in beginning reading increased when progress-monitoring data were used to formatively evaluate programs. Apparently, progress monitoring has achieved a status something

akin to the "well checks" conducted by health care providers to monitor children's health and development. In education, as in health, regular and early inspection enables detection of students whose growth rates place them at risk for failure to meet eventual standards.

Successful implementation of progress monitoring can create more and clearer occasions for educational professionals to engage in problem solving. The early identifications of discrepancies between desired and projected levels of accomplishment indicate that risk exists and a need exists to intensify problem-solving efforts. To accomplish this, however, requires the availability of progress-monitoring procedures that provide data of sufficient reliability and validity that problem-solvers can effectively use those data to formatively evaluate programs. It is in this environment that growth-monitoring procedures like Curriculum-based Measurement (CBM) (Deno, 1985; 2003) have become of particular interest.

INTENSIFIED PROBLEM SOLVING AS ACTION RESEARCH

In earlier writings on the role of school psychologists and special educators as problem-solvers (Deno, 198X), the focus was on using single-case; time-series research designs (Glass, Willson, & Gottman, 1975 Kazdin, 19XX) as the basis for formatively evaluating individual student programs. The use of single case research procedures to intensify problem solving adds systematic empirical evaluation of alternative interventions introduced into student programs. The primary assumption on which this systematic empirical problem solving approach was recommended was that its application produces cumulative improvements in student programs. That improvement

occurs because the evaluation procedures are formative rather than summative. The application of single case research designs to formatively evaluate programs places educators squarely in the role of action researchers who are attempting to discover "what works" when they attempt to improve programs.

As with any idea, the roots for viewing educational reforms as experiments are old and deep. Donald Campbell (1969) advanced the empirical problem solving approach presented here more than 35 years ago in his presidential address to the American Psychological Association. In that address, he proposed that societal reforms be conceived as experiments whose effects need to be tested rather than assumed. When that proposition is applied to education it becomes clear that changes in students' programs implemented to prevent or eliminate problems can, and should, be carefully empirical tested using empirical procedures. In addition, empirically testing reforms helps to ensure that the precious resources allocated through compensatory programs do indeed lead to the reduction of those problems for which the resources have been allocated. Finally, the emphasis on empirical testing is consistent with one of the most desirable principles in NCLB – the need to use evidence to make educational decisions.

Problem solving as Hypothesis Testing

Single case research designs are created to test hypotheses regarding functional relationships. Were we able to predict with certainty precisely what interventions would be successful, evaluation would be unnecessary. Unfortunately, and despite the call to use only "evidence-based programs" in education, we cannot say with certainty that any one program will be effective for all students. For that reason, we must recognize that

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any problem-solving alternative can never be more than an operational hypothesis about what will affect student performance. We owe to the students into whose lives we are intervening that those operational hypotheses should be tested to either confirm or disconfirm our predictions.

The literature on problem solving is convincing in documenting that more effective problem solvers generate many possible plans of action prior to attempting a solution (Johnson & Johnson, 1982). Alternative plans of action are important for two reasons: first, selection of a "best solution" requires consideration of alternatives; second, our hypotheses regarding how to solve problems frequently are disconfirmed by the progress-monitoring data. Successful problem solvers are able to develop many action hypotheses directed toward solving the same problem. To solve academic problems, educators must generate and consider the application of alternatives. No “one size fits all” is possible nor should be assumed.

Perhaps the most obvious illustration of the need, and the opportunity, to consider problem solution alternatives occurs when students are declared eligible for special education and Individual Education Plans (IEP) are developed. During the IEP development process, a problem solving team should be able to reflect on potential alternative action hypotheses or reforms that could diminish the academic problems that have led to the student to be placed in special education. Unfortunately, limited resources too often now make it impossible to consider potentially effective alternatives. And, too often, pressures from well meaning advocates result in conflict and rigid thinking in situations that require flexible thinking. When done right, compensatory programs like

special education can become the basis for consideration, selection, and application of problem solution hypotheses intended to eliminate important performance discrepancies.

A PROBLEM SOLVING MODEL AND PROBLEM SOLVING ASSESSMENT

Systematic efforts to intensify problem solving can benefit from the use of a problem-solving model. A clear and practical problem-solving model useful in education is the IDEAL problem-solving model described by Bransford and Stein (1984). That model consists of five steps: (1) **I**dentifying the problem to be solved, (2) **D**efining the problem, (3) **E**xploring alternative solutions, (4) **A**pplying the chosen solution, and (5) **L**ooking at the effects. The basic steps are common to most problem solving models. Its primary contribution to problem-solving assessment is that it clarifies and sequences the five major decisions that must be made in problem solving. Since assessment is conducted to provide information for decision-making, educational problem solvers need to be aware of the problem solving decision they are making and the types of information most helpful in making the decision.

Assessment and Evaluation. The IDEAL Model presented in Table 1.1 illustrates the relationship problem-solving steps, the type of assessment required, and the evaluation decision that corresponds to each problem-solving step. In the model, assessment is distinguished from evaluation to clarify that the purpose of assessment is to provide descriptive information, typically numerical, whereas, the purpose of evaluation is to make a decision. In assessing performance discrepancies, we seek objective, reliable, and precise data that can contribute to decision making. Evaluations of those discrepancies involve consideration of data; however, they also require a weighing of

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values, laws, regulations, resources, and the probable personal and social consequences of selecting different courses of action. The point cannot be emphasized too strongly that while data from measurement can inform and direct decisions, they neither dictate nor determine those decisions. People will, and must, bring their values and their subjective judgments into decision-making.

TABLE 1.1 A Data Based Problem solving Model

Problem solving steps	Assessment procedures	Evaluation Decision
1. Problem identification	Observing/ recording academic performance	Does a problem exist?
2. Problem definition	Quantifying the perceived discrepancy	Is the problem important?
3. Designing intervention plans	Exploring alternative goals & solution hypotheses	What is the best solution hypothesis?
4. Implementing intervention	Monitoring fidelity of intervention & data collection	Is the solution attempt progressing as planned?
5. Problem solution	Re-quantifying the discrepancy	Is the original problem being solved through this attempted solution?

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The Problem Solving Model and Special Education. Although not central to this chapter, we can see that the problem solving steps, assessment procedures, and evaluation activities represented in Table 1.1, correspond to the steps usually identified as requirements in providing special education service to students through special education. Typically, students are referred to special education; the referral is screened to determine the need for further assessment; if appropriate, assessment for determining eligibility follows; if the student is eligible for service, an IEP is developed including annual goals, short-term objectives, evaluation procedures, and the service to be provided; the IEP is then implemented, and student progress toward IEP goals monitored; finally, the success of an IEP is reviewed periodically and annually to determine program success.

THE ROLE OF CBM IN THE PROBLEM SOLVING MODEL

The perspective on problem solving provided thus far establishes the following:

- Problem-solving is a characteristic of professional behavior
- Problems are defined by the discrepancy between what someone wants and what someone gets
- Schooling is an intervention organized to reduce the discrepancy between what society wants children to become and where children are when they come to school
- Compensatory programs are created to intensify interventions for groups and individuals whose rates of development do not meant societal standards.
- Progress monitoring can be a useful mechanism for increasing the success of educational interventions

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- Federal and state mandates have clarified priorities among problem by making cultural imperatives more explicit.
- Educational problem-solving should be viewed as action research where interventions are hypotheses to be empirically tested

The remainder of this chapter will illustrate how CBM is being used to solve a wide range of problems perceived in education.

Standardized Curriculum-Based Measurement Procedures

The curriculum-based measurement procedures advocated for use in problem solving assessment were developed to quantify student performance in reading, written expression, spelling and arithmetic. These procedures are the product of a systematic research and development program that established the technical adequacy of the data collected through applying these measurement procedures to student performance (cf. Deno, 1985; 1986; 2003). The fact that these procedures are standardized rather than *ad hoc* assures a database for problem solving that is sufficiently reliable and valid. The issue of technical adequacy is especially important when comparisons are made between an individual student and the performance of that student's peers. The reliability and validity of data are also important when comparisons are made of the same student's performance at different times such as before, during, and after various attempts to solve a problem. In general, any time the data obtained from two or more measurements are compared, the reliability of those measurements is an important issue. Further, any time a

question arises as to whether or not a performance discrepancy is important, the validity of a particular measurement or set of measurements must be established. It is not possible to be confident that any of the myriad performance discrepancies that could be identified through measuring a student's performance on somewhat arbitrarily selected curriculum tasks would be sufficiently important to attempt problem solution.

An early Response to Intervention (RTI) Model. In 1977, Deno and Mirkin (1977) presented a problem-solving assessment model entitled “Data-based Program Modification. (DBPM)” The basic premise of that model was that modifications in student programs could be tested by collecting progress monitoring data reflecting student growth in relation to changes implemented to increase student academic and social development. The model was created as a tool for educators to evaluate the success of their interventions and to determine the level of special education service required to solve the problems precipitating referral and initial assessment. The DBPM model was complete in that it included specification of the observational data to be used for evaluating problem-solving efforts. At the same time, the technical adequacy of the assessment procedures had not been empirically investigated, nor had the potential effectiveness of using those procedures to improve programs been tested.

To address the issues of technical adequacy and the effectiveness of the DBPM model, a program of research was conducted between 1977-83 through the Institute for Research on Learning Disabilities at the University of Minnesota. An important result of that program of research was the development of standardized procedures for monitoring student progress in reading, spelling, and written expression. That use of those procedures to formatively evaluate instruction was experimentally examined leading to

the conclusion that teachers could successfully increase achievement using those procedures (Fuchs, Deno, & Mirkin, 1984). At the same time, the progress monitoring procedures became known as Curriculum-based Measurement (CBM) (Deno, 1985). Subsequently, the use of CBM in assessment to conduct educational problem solving was presented as an alternative or supplementary approach to addressing problems using conventional standardized achievement testing (Deno, 1986; Shinn, 1989; Deno, 1995)

The technical adequacy of the CBM approach to progress monitoring distinguishes it from other curriculum-based assessment (CBA) models. The technical adequacy of CBM has enabled problem-solvers to use the data derived from CBM with confidence in both their reliability and validity. To achieve technical adequacy, the procedures have been standardized to the level that they include specification of *what to measure, how to measure, and how to score and interpret* the data on student growth. While it is beyond the scope of the present chapter to describe the technical adequacy and development of the standardized CBM procedures, an illustration of the *core skill* used for standardized CBM in reading is shown below:

- **Core Skills: Reading**, The primary skill used to monitor progress and make instructional in reading is *reading aloud from text.* Often, this is referred to as "oral reading fluency;" however, the use of that term confuses the purpose of that task for evaluating intervention effects with a characteristic of good readers (i.e., oral reading fluency). More recently, *recognizing words deleted from text*, (the "maze" procedure) and, for beginning readers, *reading isolated words* has been added as a core skill for reading measurement.

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The core reading tasks are used with standardized administration procedures to obtain samples of performance on those tasks. The performance samples are then scored to produce data with known technical adequacy (Shinn, 1989).

Standardized CBM data can be used to inform key decisions in the IDEAL problem-solving model. To illustrate, Steps 1, & 5 of the IDEAL model require decisions regarding the existence of a problem. As illustrated below for reading, each of these questions can be informed by CBM data:

Question #1: Does a problem exist (in reading)?

> **CBM information:** Data reflecting the difference between current level & slope in reading aloud from text, and the desired level & slope in reading from that text

Question #5: Is the original problem being solved through the attempted solution?

> **CBM information:** Data on the degree to which the current level & slope in reading aloud from text indicate that the original discrepancy is being reduced or will be eliminated

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CBM has been used to solve a wide range of educational problems. Those applications are illustrated in the paragraphs that follow. The illustrations begin with the more common applications of CBM and move to more recent applications and extensions of its use.

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Improving individual instructional programs

The primary purpose of developing CBM was to create a simple set of assessment procedures that teachers could use to formatively evaluate the instruction they were providing to individual students. The hypothesis that drove this development was that teacher's using formative evaluation procedures would affect higher rates of achievement than teachers who did not use systematic formative evaluation. The formative evaluation model using CBM as the database is represented graphically in Figure 1. As can be seen in the figure, individual student performance during an initial baseline phase is plotted

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Insert Figure 1 here

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and a goal is established. A progress line connecting the initial level and the goal establishes the rate of improvement necessary for the student to achieve the goal. A change in the student's program is introduced and indicated by the first vertical line. Continued measurement of that student's performance after the intervention reveal that a leveling off of performance follows the initial improvement. A second change is made in the program and improvement occurs. This systematic approach to setting goals, monitoring growth, changing programs and evaluating the effects of changes is the formative evaluation model. Research on the achievement effects of using this approach has revealed that teachers using systematic formative evaluation based on CBM produce greater achievement of their students (Fuchs, Deno & Mirkin, 1984; Fuchs, et al, 1989; Fuchs et al, 1991; Shinn & Hubbard, 1992; Espin & Wallace, 2003).

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Increased ease of communication

While the effectiveness of CBM in increasing both teacher and student awareness of goals has already been discussed, it is important to point out that the CBM graph with its multiple references creates opportunities for clearer communication. It has now become common practice for teachers to use the CBM data in parent conferences and at multi-disciplinary team meetings to provide a framework for communicating individual student status Professional educators and parents easily use the CBM data graph since little or no interpretation of the scores is necessary (Shinn, et al, 1993). This contrasts sharply with the complexities related to communicating the results of commercially available standardized test scores. A simple illustration of both the ease and effectiveness of communicating around CBM data can be found in the results of the teacher planning study mentioned earlier (Fuchs, Deno & Mirkin, 1984). In that study students as well as teachers were asked whether they knew their annual reading goals and were asked to specify those goals. Those students whose teachers were using CBM and formative evaluation not only expressed that they knew those goals but were able to accurately specify their target reading scores.

Screening to identify students academically "at risk"

An increasingly common use of CBM is to screen students who are "at risk" for academic failure. As mentioned previously, since CBM procedures are standardized they can be used to contrast individual performance to that of the group. The use of local norms is common for this purpose, but norms are not required. CBM can be easily and quickly used to assess the performance of a group of students and to identify the lowest

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achieving, at risk students in the group (Marston & Magnusson, 1988; Shinn, 1995) in the area reading with the inclusion of the maze task that allows for group administration (Deno, et.al. 2002). In the study by Deno and colleagues all of the students in a large urban elementary school were given three standard CBM maze passages and their performance was aggregated within and across grades. The lowest 20% of the students on the CBM maze measure in each grade was considered sufficiently at risk to require progress monitoring every other week with the more conventional CBM oral reading measure. Identification of high-risk students in this manner has now become commonplace among schools practicing CBM.

Evaluating classroom "prereferral" interventions

The cost and the consequences of special education are recurring issues in the literature of special education. Of particular concern is the possibility that student's are being referred and placed in special education when they might succeed in regular class programs with greater accommodation by classroom teachers. One approach to addressing this issue is to require that classroom teachers conduct prereferral interventions to establish that such accommodations are insufficient. One problem with this approach has been that little useful data has been available to appraise the effects of those prereferral data. Since CBM data are sensitive to the effects of program changes over relatively short time periods, they can be used to aid in the evaluation of prereferral interventions. The use of CBM in evaluating prereferral interventions is the first component of the "The Problem Solving Model" (Deno, 1989) that has been implemented at both the state and district levels (Shinn, 1995; Tilly & Grimes, 1998).

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The Problem Solving Model enables general and special educators to collaborate in the early stages of child study to determine with some validity that the problems of skill development faced by a student are more than "instructional failures." Documentation that the problem is not readily solvable by the classroom teacher becomes the basis for special education eligibility assessment.

Alternative special education identification procedures

Widespread dissatisfaction exists with traditional approaches to identifying students for special education that rely on standardized tests of either ability, of achievement, or both (Reschly, 1988). Despite this dissatisfaction, few alternatives have been offered to replace those more conventional procedures. Over the past twenty years, the use of CBM within a systematic decision framework has been explored as a basis for developing alternative identification procedures (Marston, Mirkin& Deno, 1984; Marston & Magnusson, 1988; Shinn, 1989). Recently, the use of CBM to test student's "responsiveness to intervention (RTI)" (Fuchs & Fuchs, 1998) has gained favor recently within policy-making groups. The RTI approach is an extension of prereferral evaluation and the Problem Solving Model to evaluate increased levels of intensity in instructional intervention. As each level of intervention is introduced, CBM data are continually collected to examine the responsiveness of a student to that intervention. For example, if a student fails to increase his rate of growth in response to several regular classroom interventions, then a period of "pull out" instruction from a special education resource teacher might be instituted and evaluated. If a student succeeds when receiving instruction from the resource teacher, then his responsiveness to that treatment establishes

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his need for special education. Some evidence has now begun to emerge that the alternative approaches to eligibility determination that are rooted in the Problem Solving Model have created an entirely different perspective on the concept of disability (Tilly, Reschly, & Grimes, 1999).

Recommending and evaluating inclusion

As increased emphasis has been placed on inclusion of students with disabilities in regular classrooms, and as laws and regulations have required schools to assure access to the regular class curriculum, the need to evaluate the effects of these changes on the academic development of students with disabilities has increased. CBM has proved to be a very useful tool for those accountable for the progress of students with disabilities as they seek to provide education of these students in the mainstream curriculum. The general strategy employed when using CBM to evaluate inclusion has been to collect data before and after integration into regular class instruction, and then to continue monitoring student progress to assure that reintegration of students is occurring "responsibly" (Fuchs, et al, 1996**,** Powell-Smith & Stewart, 1998). The results of the research in this area provide clear evidence that both special educators and classroom teachers can use CBM to provide ongoing documentation of student progress and signal the need for increased intensification of instruction when inclusive programs are unsuccessful.

Assessing English Language Learning (ELL) students

A particular problem confronting schools in the United States is the dramatically increasing proportion of students whose first language is not English and who are still

learning to speak English while already learning to read and write in English. Commercially available standardized tests have not been useful because they have not included the full range of languages represented in ELL students within their norm samples. More significantly, many achievement tests draw heavily on background knowledge of the American culture in structuring questions. Among other problems that exist because of the lack of technically adequate procedures is how to distinguish ELL students who are having difficulty learning because of their lack of proficiency in English from ELL students whose struggles also stem from special disabilities. Several studies have explored the use of CBM to overcome the problems of assessing ELL students and to monitor their growth in mainstream classrooms. Baker and others (Baker & Good, 1995; Baker, et al, 1998) have focused primarily on using CBM reading scores of Spanish speaking ELL students to evaluate their progress in regular class programs. That research establishes levels of reliability and validity for the CBM procedures with ELL students in both their native and English languages that is comparable to native speakers of English. Further, longitudinal analyses reveals that students who begin with comparable proficiency in English often grow at very different rates. The apparent technical adequacy of CBM has led at least one urban school system to use CBM procedures for developing norms across reading, writing, and arithmetic on their ELL students (Robinson, 2001). CBM also has been used to predict differences in the success rates of middle school ELL students on state assessments as a function of their level or reading proficiency (Muyskens & Marston, 2002). Additionally, research has been conducted using CBM with students in countries where languages other than English is spoken. The evidence from that research indicates that the procedures and tasks to be

used for measurement need to be consistent with formal differences in the language. For example oral reading can be used to measure growth in other phonetic languages like Korean, but the maze procedure appears to be more appropriate for measuring growth in an iconic language like Chinese (Yeh, 1992).

Predicting success in early childhood education

The criterion validity of CBM oral reading scores has been sufficiently established to become an important criterion for establishing the predictive validity of pre-reading measures and the effective of early literacy interventions. With the ascendant interest in the role played by phonological skills in learning to read, the utility of scores from measures of phonological skill has been established by examining their accuracy in predicting beginning oral reading scores (Kaminski & Good, 1996). As cited earlier in (Good, Simmons and Kameenui, 2001), evidence has developed that CBM oral reading performance at the end of first grade is a significant indicator of subsequent reading success. Research in this area has established important linkages between measures of phonological skill in Kindergarten, oral reading performance in grades 1-3, and success on state assessments. The evidence has become sufficiently persuasive that the federal government has, essentially, required projects funded under the Reading First grant program to include CBM oral reading data as a requirement for monitoring program effects. Finally, similar growth measures have been developed to assess preschool development and predict early literacy (Priest, et al, in press).

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Assessing students who are deaf

A problem paralleling the problems associated with assessing ELL students is the problem faced by educators seeking to assess deaf student's progress at developing competence in written English. As with ELL students, deaf students must learn to read and write English despite the fact that they do not speak English. The problems differ, however, in that deaf students, generally, never learn to speak English, and will not be able to use sound-symbol correspondence in learning to read and write. For that matter, they will not be able to use spoken English vocabulary referents to assist in comprehending text. Commercially available standardized tests, generally, have been of no use in assessing the achievement of deaf students. Recently, research using the CBM written expression measure that was developed for hearing students has revealed that the same measure can be used to assess the written expression competence of deaf students, as well (Chen, 2002). Assessing the competence of deaf students reading English has required a different approach. Oral reading is not possible with deaf students who do not speak English, and using American Sign Language (ASL) is not an option because the ASL signs do not correspond word-by-word to English. An effort has been made to have students sign Exact English rather than ASL, but this has not proved to be useful. More promising has been the use of the CBM maze task to measure the reading of deaf students. Since that task requires only that students read text silently and make correct maze choices, the requirements for deaf and hearing students on this task are the same. Recent research on using the maze task with deaf students has provided evidence of the validity and utility of the measure (Chen, 2002; Deno, et al, 2002).

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Summary

The perspective in this chapter has been that a key role function of professional educators is problem solving. The primary function of the schools is to effect student development, and first responsibility of educators is to create environments that facilitate that development. Successful performance of those primary role functions will be defined by the extent to which students attain cultural competence in a timely manner. Problems occur when rates of growth and levels of attainment fall below what is expected. Increased efforts to assess students are a manifestation of intensified problem solving. Successful problem solving assessment will always include a careful explication of the expectations for performance as well as the measured levels of that performance. Problems are always defined by this difference between actual and desired performance and exist in the "eye of the beholder" of that problem. The importance of any problem will be established only in part by examining the degree of difference between actual and desired performance. More complete determination of the priority to be given to a problem by examining the immediate and long term consequences to the student should the problem continue or be resolved.

Identifying important problems that must be solved by the schools has become easier as federal and state legislative mandates have made societal expectations more explicit through high stakes testing. One rational response to the accountability demands has been to increase the development and use of progress monitoring procedures that enable educators to anticipate and prevent problems. Curriculum-based Measurement (CBM) exists as one technically adequate approach for taking a more functional problem

solving approach to the prevention and solution of educational problems. In the present chapter, the use of CBM in problem solving assessment has been described. Evidence exists that professional educators can increase their problem solving effectiveness through the use of progress monitoring of student development and by systematically responding to those data as they reflect student growth.

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