Recommendations for Progress Monitoring in Mathematics by CoMMIT (Colorado Metro Math Intervention Team)

This documentation of recommended practices has been compiled in order to provide guidance for districts, schools and teachers in the area of progress monitoring in mathematics. CoMMIT is an informal networking group of mathematics and special education coordinators, specialists, coaches and teachers who gather to learn with and from each other. We (CoMMIT) know as well as anyone that there is a need for guidance around the definition and process of progress monitoring in mathematics. The guidance provided in this paper includes the collective thought of a subgroup of CoMMIT and has been reviewed by a larger group of math and special education professionals in the field.

Assessment should always be as purposeful and as informative as possible with the end goal of student achievement. At the same time, all assessment must be based in data, which can come in many forms.[1] Assessment of daily learning activities can be very valuable and is the most non-intrusive form of assessment. Work samples, observations, and short quizzes collected from daily instruction are key components of a comprehensive body of evidence which does not disrupt instruction. Monitoring progress is systematically collecting and documenting evidence across time with respect to a targeted learning goal.

Math Assessment in an RtI/MTSS System

According to the Colorado Department of Education's Multi-Tiered System of Supports model, there are four types of assessment as they relate to Response to Intervention. They are Screening, Diagnostic, Progress Monitoring and Outcome assessments.

Screening measures serve the purpose of quickly identifying students who are at risk of struggling in mathematics. These assessments should be administered to all students at least once per year and ideally up to 3 times per year.

Diagnostic measures are designed to assess mathematical skills and concepts, with the goal of identifying specific areas of strengths and weaknesses to help focus instruction, intervention and goal setting.

Outcome measures are generally given at the end of the school year to help determine a student's progress relative to grade level expectations. These include statewide assessments as well as cumulative exams.

[1] CoMMIT follows a generally accepted broad understanding of assessment. The Glossary of Education Reform defines assessment as follows. "In education, the term **assessment** refers to the wide variety of methods that educators use to evaluate, measure, and document the academic readiness, learning progress, and skill acquisition of students from preschool through college and adulthood."

Progress Monitoring[2] measures growth across time to answer two primary questions:

1) Is a student making progress relative to grade level standards?

2) Is a student making progress toward their identified intervention goal?

Curriculum Embedded Measures and General Outcome Measures are both types of progress monitoring (Gersten, et. al., p. 41).

Effective progress monitoring meets the following criteria:

i. Evidence is collected frequently and consistently

ii. Assessment is efficient, creating minimal impact on instructional time

iii. Assessment measures the intended content and processes

iv. Results are comparable across time from one point of data collection to the next

The Difficulty with Progress Monitoring in Mathematics

Identifying assessment tools that reliably monitor progress efficiently and frequently has proven difficult. There are at least a couple explanations for this.

1. Mathematics includes a broad scope of content and practices encompassing three pillars of rigor defined within the Common Core: procedural skills and fluency, conceptual understanding, and applications. Effective progress monitoring will monitor student progress across time within each of these pillars.
2. The issue of progress monitoring in mathematics has received relatively little research relative to similar research in literacy. Historically, measures of computational/ procedural fluency have been most readily associated with progress monitoring in mathematics. Concerns related to the progress monitoring of conceptual understanding and problem solving (application) have led to the development of other progress monitoring tools that sample the curriculum (defined by the NCTM Focal Points and/or Common Core grade level expectations) more broadly in an effort to address all three pillars. Some commercially available tools do have significant research base relative to statistical reliability and validity. These General Outcome Measures are valuable in that they can help answer the question, "Is the student making adequate progress relative to a national norm?" This broad sampling approach, however, has not led to the

[2] The National Center on Response to Intervention defines progress monitoring as "repeated measurement of performance to inform the instruction of individual students in general and special education in grades K-8." According to the Center, "Progress monitoring is conducted at least monthly to: (1) Estimate rates of improvement, (2) Identify students who are not demonstrating adequate progress, and (3) Compare the efficacy of different forms of instruction to design more effective, individualized instruction."

development of assessments that help to guide instructional decision-making on a daily basis.

Different methods of measuring student progress have strengths and weaknesses, therefore it is the recommendation of national organizations, researchers and this white paper to use more than one method in a system of progress monitoring. The emphasis and frequency of each will depend on the intended audience, the intensity of intervention, and the data based documentation required for educational decision making for each student and situation. No single measure or method currently exists to simultaneously address the breadth of mathematical content and the specific goals of each intervention in a progress monitoring system. Multiple measures should be included in a body of evidence for the purpose of monitoring progress.

Body of Evidence for Progress Monitoring Mathematics

A body of evidence to progress monitor mathematics includes progress data from all three pillars of mathematics: procedural skills and fluency, conceptual understanding, and applications.

Pillar 1: Procedural Skills and Fluency

Procedural skills and fluency includes more than simply the speed with which a student can apply an algorithm or step-by-step procedure. Procedural skills also include the selection by the student of efficient strategies, and the developing ability to apply strategies with automaticity. Measuring efficient strategy use is typically done through either observing the student or interviewing the student about an approach. Timed fluency measures can give an idea of speed, but don't provide data on the development of efficient strategies, which often take more time in the early stages of development. Timed fluency measures can also mask student reliance on inefficient strategies and an underlying deficiency in numeracy. Therefore, a combination of assessment strategies which capture information about strategy development and efficiency is desirable.

Pillar 2: Conceptual Understanding

Conceptual understanding is a measure of the depth of understanding of a mathematical concept. Clues to conceptual understanding can be revealed through carefully analyzed student work, observations and interviews with students as they explain their thinking within a given task. For example, to measure a student's understanding of equality and the meaning of the equal sign, students might be given a task something like 5 + 4 = ? + 3. Analysis of how a student solves this problem can reveal a level of understanding about equality, and this can be evaluated across time. Asking the student to explain their solution to this problem will reveal more about their understanding. Annotated student work samples, interview and

observational notes can add important depth to the progress monitoring body of evidence.

Pillar 3: Application

The application of mathematics is referring to the student's ability to use math concepts to solve contextualized problems that are novel to the student (novel meaning that the problem situation is new to the student). It may be necessary to measure a student's ability to apply mathematics using concepts with which they are fluent in addition to measuring application of concepts on which the student is receiving instruction.

Growth in a student's ability to apply mathematics might be the most difficult to measure using an efficient progress monitoring probe. The best measure of this ability is through tasks that are novel to the student and which challenge the student to apply their mathematical understanding in unique ways. It is difficult to imagine an efficient probe that would evaluate a student's growth in this area. For this reason, structured rubrics that evaluate student growth in this area through observation and the examination of existing class work does not take away from instructional time, but is integrated within instruction.

Comprehensive Body of Evidence

As a documented body of evidence is gathered, attention should be paid to collecting evidence (data) about the student's progress toward all three pillars of math proficiency. This evidence can range along a continuum from informal to formal[3] or structured as well as a continuum from qualitative measures to quantitative measures.

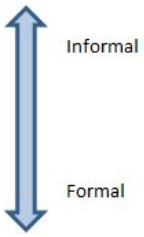
Regardless, any measure should be referenced to widely accepted criteria (e.g. state standards, researched based learning progressions) or norms within a population. Evidence should be reviewed relative to specific learning outcomes within the standards to ensure adherence to them. The review and the selection of methods should be within the parameters established by a school and/or district. Each piece of evidence serves unique and important purposes. While focus may be on a particular tool during a specific intervention, over time a complete body of evidence is necessary to create a comprehensive view of student progress. The intent is to be representative of the various continuums and the three pillars without necessarily needing to be exhaustive.

[3] The National Center on Response to Intervention describes formal assessments as assessments "which have data that support the conclusions made from the test, including evidence of reliability and validity, Also referred to as standardized tests, these tests have been tried before on students and have statistics that support the conclusion that when a student is responding or performing well on the assessment that they are not at risk and that students performing below certain cut scores or point on the assessment are at risk." Examples include, "curriculum-based measures, curriculum-based assessments, pre/post tests, and benchmark assessments." Some less formal types may be teacher-made quizzes, or exit forms that teachers may require of students as they complete a lesson at the end of each day."

The intention here is not to create more assessments for a student, but rather to begin viewing existing student data and artifacts through the lens of Progress Monitoring. There may be a need for additional assessments once a team analyzes existing data, however in order to minimize impact on instructional time existing evidence should be used to the extent possible.

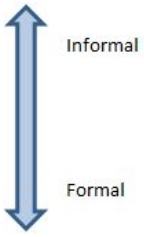
Samples of Qualitative Evidence

Anecdotal notes
Analyzed student work samples
Exit tickets
Structured observations
Interviews (structures, protocols)



Samples of Quantitative Evidence

Scored student work
Rubrics
Unit quizzes and tests
Global Outcome Measures/
Curriculum Based Measures



The Progress Monitoring body of evidence must inform programming and instructional decision making, and document for all stakeholders the student's progress toward the individualized goals.

Progress Monitoring and Identification of a Specific Learning Disability

With the passage of the Individuals with Disabilities Education Act (IDEA) 2004, states were allowed to include an identification process for Specific Learning Disabilities which includes a response to scientific, research based interventions as an element for identification. Many states have adopted this approach, either as the sole process for identifying an SLD, or as an option for this identification.

Response to Intervention for math includes, in part, an assessment of the child's current level of performance in

Progress Monitoring and Identification of a Specific Learning Disability

"Data-based documentation of repeated assessments of achievement at reasonable intervals, reflecting formal assessment of student progress during instruction, which was provided to the child's parents."

34 CFR 300.304-306
IDEA Regulations
http://idea.ed.gov

either math calculation or math problem solving[4]. It also involves including the child in a scientific, research based intervention designed to address targeted area of concern (math calculation and/or problem solving), along with "repeated assessments of achievement at reasonable intervals," i.e., progress monitoring. throughout the intervention.

Federal law further defines the nature of these repeated assessments as, "reflecting formal assessment of student progress during instruction." The nature of "formal assessment" and the meaning of "reasonable intervals" are not further defined in the law. Many definitions of formal assessment exist, but an element common to most is that formal assessments have data that supports the conclusions drawn from the assessment. This is generally reflected in studies of validity and reliability.

The requirement for formal assessment of student progress during instruction should inform progress monitoring at all levels. Formal measures should not be introduced only when a student is being evaluated for a possible disability. Rather, an effective progress monitoring system would include formal measures at tier 2.

CoMMIT does not support the idea that the nature of progress monitoring changes when a student is referred for a special education evaluation. A body of evidence, including assessment of student artifacts generated within learning activities, should always be used to evaluate progress, with each element of this evidence given appropriate weight in instructional decisions. Progress monitoring is primarily a measure of the effectiveness of instruction, and an evaluation of the body of evidence should result in instructional adjustments regardless of the tier of instruction. The legal requirements for the identification of a Specific Learning Disability, however, highlight the increased necessity for formal measures as a student moves through the tiers of instruction.

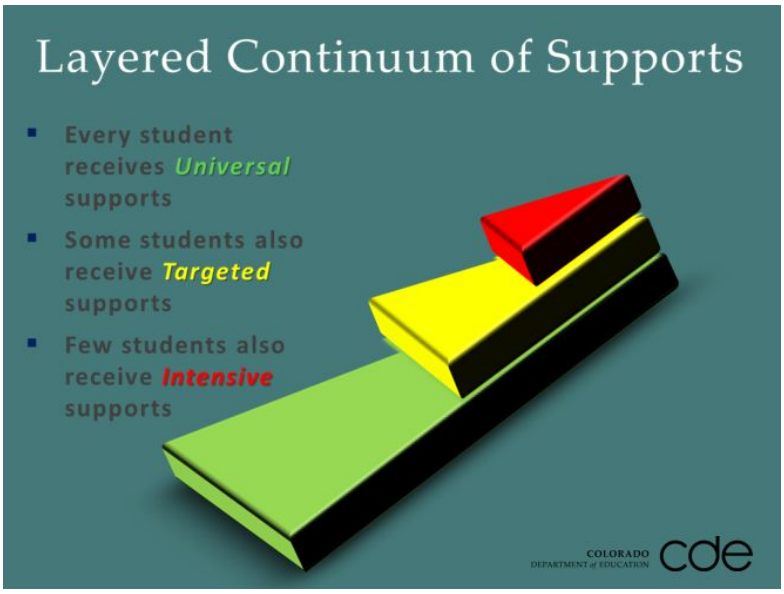
Progress Monitoring Within the Tiers of Instruction

A comprehensive progress monitoring body of evidence varies within the different tiers of support. At Tier 1 the body of evidence might simply include student work samples (analyzed based on specific evidence outcomes within standards), curriculum embedded measures, data from screening measures, quizzes, and tests within units of instruction. As the tiers become more intensive, the body of evidence might also include a General Outcome Measure.

As the continuum of supports are layered to provide additional instruction, the Body of

[4] It is our view that math calculation aligns with the description of Pillar 1 above, including more than simply speed and accuracy of math fact recall and application of a prescribed algorithm. Math problem solving includes both Pillars 2 and 3 described above.

Evidence will be layered to include more formal, targeted and specific progress monitoring. Progress monitoring across all tiers is an ongoing part of all instruction and should occur on a daily basis. Formal progress monitoring in tier 2 should occur at least monthly and may become more frequent as the intervention becomes more targeted and specific. The additional layers of assessment do not necessarily replace the Tier 1 assessments, rather they are meant to supplement or compliment. As a student requires tier 3 instruction, they may or may not experience a change in progress monitoring depending on the changes to instruction. The content of tier 2 and 3 progress monitoring should be appropriate to the specific intervention goals for that student and include formal progress monitoring data. Assessments should be tailored to the specific interventions students receive, and should be frequent and specific enough (targeted to skill and instruction level) to measure small increments of growth.



Intervention Goal Setting

The goal-setting process is integral to the design of a progress monitoring plan. Goal setting is often done by breaking apart the content of the grade level mathematics to examine the learning progressions and prerequisite skills and concepts necessary for access to the grade level content. Tier 1 progress monitoring, therefore, should seek to measure progress relative to grade level content, while Tier 2 and 3 progress monitoring seeks to measure progress toward the prerequisite skills and concepts defined within a learning progression[5].

Goal-setting must be informed by diagnostic assessment to identify mathematics-related learnings the student has in place, and any misconceptions or misunderstandings he or she might have. Goals are most effective when they follow the SMART goal format: Specific, Measurable, Attainable, Relevant, and Time bound. Specificity should reflect the three pillars (fluency and procedures, conceptual development, and application) outlined above. Defining the measurable aspect of the goal prescribes the progress monitoring body of evidence that will

[5] Learning progressions are narrative documents describing the progression of a topic across a number of grade levels, informed both by research on children's cognitive development and by the logical structure of mathematics.

be collected and documented. Attainable goals take into consideration the history and characteristics of the learner involved. Relevant goals are tied to the state standards for mathematics, (at or off grade level) and and focus on critical aspects within a learning progression. The duration of a goal will vary by tier, with tier 2 goals typically ranging from 1 to 8 weeks, and tier 3 goals extending out to one year.

Summary

Progress monitoring in mathematics is a complex topic. In this paper we have argued that, to accurately measure progress in a topic area as broad as mathematics, a comprehensive body of evidence is required. This body of evidence will include a wide range of tools. Much of this evidence can be collected through student artifacts generated through instructional activities. Formal progress monitoring is required as a student moves closer to a possible evaluation for a Specific Learning Disability.

There are many important decisions that schools and districts will need to make around progress monitoring. This paper provides guidance around some of those decisions. Once the decisions are made at a leadership level, professional development will be critical to building a comprehensive system of progress monitoring in mathematics.

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