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Linking Principles of Formative Assessment to Classroom Practice

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A balanced classroom assessment system includes both formative assessment and summative assessment. Stiggins and Chappius (2006) refer to summative assessment as "*Assessment of Learning*." If we consider an analogy to plants, summative assessment is the process of simply measuring the plants. It might be interesting to compare and analyze measurements but, in themselves, these do not affect the growth of the plants. They refer to formative assessment as "*Assessment for Learning*." Formative assessment is the equivalent of feeding and watering the plants appropriate to their needs, and directly affecting their growth. While Stiggins notes that it is important to know how proficient students are at a certain point (summative), it is just as important to monitor students' learning and involve them in assessment as an ongoing and integral process (formative).

An emerging body of evidence suggests strongly that we need to be more intentional in our use of formative assessment practices. In fact, a seminal research review by Black and Wiliam (1998) found that improving formative assessment resulted in profound achievement gains for all students, with the largest gains for lowest achievers. The recently released report from the National Mathematics Advisory Panel (2008) provides further support. The Panel found that "teachers' regular use of formative assessment improves their students' learning, especially if teachers have additional guidance on using the assessment to design and to individualize instruction" (p. xxiii, Major Finding #25). The Panel noted that formative assessments in mathematics (1) lead to increased precision in how instructional time is used in class, (2) assist in identification of specific topics and instructional needs, and (3) should be an integral component of instructional practice in mathematics. One of their major recommendations is for teachers to make "regular use of formative assessment, particularly for students in the elementary grades" (p. 47).

The purpose of this article is share how one district, the Milwaukee Public Schools, is beginning to be more intentional in linking classroom practice to principles of formative assessment in the area of mathematics. We will describe the ten principles that have been crafted through the *Milwaukee Mathematics Partnership* (MMP) and give some examples of how the principles are guiding classroom practice.

Ten Principles of Formative Assessment

We have been on a journey over the past several years in moving the district toward implementation of formative assessment in mathematics. We began by developing district learning targets based on state standards for student learning and then created classroom assessments (i.e., constructed response items) aligned to the targets. Next we created a protocol for collaboratively looking at student work from these assessments (Bedford, Hollinger, & Huinker, 2006). This was followed by the creation of district curriculum guides that showed the alignment of the learning targets to the curricular materials (i.e., textbooks) to the classroom assessments and that suggested a pacing schedule for the school year. This provided some organization and suggestions to guide implementation of the mathematics curriculum, but the focus was still more at the level of the district or the school, not the classroom nor the students.

Teachers still wondered what to do with the classroom assessments: When to give them? Should they be scored? How to use the results? It appeared that the classroom assessments were too often being used as summative measures of student learning, rather than as formative information to guide daily instruction decisions and move student learning. We realized we needed greater understanding and more guidance on formative assessment.

We went back and studied the work of Paul Black and Dylan Wiliam (see Black & Wiliam, 1998; Black, Harrison, Lee, Marshall, & Wiliam, 2003, 2004), Rick Stiggins and colleagues (Chappuis, Stiggins, Arter, & Chappuis, 2005; Stiggins, 2006; Stiggins, Arter, Chappuis, & Chappuis, 2004), and Shirley Clarke (2001). We then recognized that our work had mainly emphasized only two principles of formative assessment. We were struck by that our perspective had been so narrow and realized we needed to be more intentional and specific in providing a structure of principles that would support *Assessment for Learning*.

Building from the work of Rick Stiggins and colleagues (Chappuis et al., 2005), we modified their list of principles and arrived at a list of ten principles of formative assessment in mathematics. These are listed in Figure 1. We are now unpacking these principles in district-wide professional development and assisting teachers in linking them to classroom practice. In many ways, we feel like our journey has just begun, even though we have been involved in this work for several years. In the past, we dabbled at the periphery of assessment practices, mainly increasing our use of constructed response items and wondering what to do with the results. Now that we are using these principles as a framework, we are centered on the classroom and students and the interactions of teachers and students.

What follows is an explanation of the principles with some examples of how the principles are guiding classroom practice. We have grouped the principles into three areas, as shown in Figure 1, to emphasize the core purpose of each set of principles and the connections among them.

Ten Principles of Formative Assessment

Teacher and Student Articulation of Math Learning Goals

(1) Prior to teaching, teachers study and can articulate the math concepts students will be learning.

(2) Teachers use student-friendly language to inform students about the math objective they are expected to learn during the lesson.

(3) Students can describe what mathematical ideas they are learning in the lesson.

(4) Teachers can articulate how the math lesson is aligned to district learning targets, state standards, and classroom assessments, and fits within the progression of student learning.

Teacher Focus on Using Assessment Information to Guide Teaching

(5) Teachers use classroom assessments that yield accurate information about student learning of math concepts and skills and use of math processes.

(6) Teachers use assessment information to focus and guide teaching and motivate student learning.

Student Focus on Using Assessment Information to Move Learning

(7) Feedback given to a student is descriptive, frequent, and timely. It provides insight on a current strength and focuses on one facet of learning for revision linked directly to the intended math objective.

(8) Students actively and regularly use descriptive feedback to improve the quality of their work.

(9) Students study the criteria by which their work will be evaluated by analyzing samples of strong and weak work.

(10) Students keep track of their own learning over time (e.g., journals, portfolios) and communicate with others about what they understand and what areas need improvement.

Figure 1. Principles of Formative Assessment for Mathematics

Teacher and Student Articulation of Math Learning Goals

(1) Prior to teaching, teachers study and can articulate the math concepts students will be learning.

(2) Teachers use student-friendly language to inform students about the math objective they are expected to learn during the lesson.

(3) Students can describe what mathematical ideas they are learning in the lesson.

(4) Teachers can articulate how the math lesson is aligned to district learning targets, state standards, and classroom assessments, and fits within the progression of student learning.

The first four principles focus on making the mathematics explicit to both teachers and students. Prior to teaching, teachers study the mathematical concepts and ideas students are learning. The purpose is to revisit one's own understanding of the mathematics, identify the essential ideas students are to learn, and examine how the mathematical ideas are developed across a sequence of lessons. Teachers use their own curricular materials and other resources to support their understanding of the mathematics and the pedagogy they will use to teach the mathematics. As they study, independently or with their colleagues, they are clarifying expectations for student representations and oral and written justifications as evidence of student learning.

Once the math concepts are clarified, teachers focus on articulating, in student-friendly language, the specific math objective for each lesson within a sequence. For example, "*Today we're going to be learning to use benchmarks of 0, 1/2, and 1 to help us learn about the size of fractions*." It is important to post, in writing, the daily goal as a focus for the lesson and to engage the students in considering the objective (Clarke, 2001). "*Students, take a moment to read the math goal for today and re-state it in your own words to your partner."* Teachers may then ask students to articulate the math objective in their own words to the whole class. *"Please share with the class what it is you think we are going to be learning about today."*

Sharing the math objective, for a minute or two, puts a frame around the math lesson. Teachers have found that posting the math objective in writing on the board or chart paper, has helped to keep themselves and the students more focused on the mathematical ideas, as opposed to working through a series of activities as presented in a lesson. Throughout the lesson, teachers keep the math explicit by asking students to state what they are learning as they work through the math activities and share in the discourse of the lesson. Often times, as students make these connections, they will refer to the posted goal of the lesson.

These four formative assessment principles have pushed teachers to study daily classroom lessons from a perspective of being able to explicitly state the mathematical ideas and the development of those ideas. Key questions are: What is the math? How should I phrase this math goal for my students? What do I expect my students to be able to say about the math they are learning? Teachers also examine how a sequence of lessons should move students along a trajectory of learning as aligned to district learning expectations for students and state standards.

Teacher Focus on Using Assessment Information to Guide Teaching

(5) Teachers use classroom assessments that yield accurate information about student learning of math concepts and skills and use of math processes.

(6) Teachers use assessment information to focus and guide teaching and motivate student learning.

Implementing the first four assessment principles prepares teacher to use assessment information to guide teaching. Once the mathematics being developed is explicit, the next step is the use of classroom assessments. The fifth assessment principle states that classroom assessments need to yield accurate information about student learning. Stiggins (2006) explained that to be accurate an assessment must be designed to serve a specific and predetermined purpose, be related to expected success criteria, and be sensitive enough to detect and reveal student understanding. The assessment information should provide sufficient detail to focus and guide teaching and to motivate and guide student learning.

To focus teachers on implementation of these two principles (#4 & #5), the MMP developed a "Classroom Assessment Summary Report" (see figure 2 at the end of this article). We encourage teachers to work together as grade-level groups in (1) selecting common classroom assessments to administer at key points during a unit of instruction, (2) explicating the mathematical expectations of the task, (3) analyzing student work from the assessments through filters of student reasoning and misconceptions, and (4) making decisions on next instructional steps.

For example, a group of fifth-grade teachers have selected some common classroom assessments to give at intentional points of an instructional unit on fractions. A teacher reflected, "*In the midst of our fraction unit, we gave a task to assess students' understanding of using benchmark fractions to think about size of fractions. We had identified the use of benchmarks as a very important idea as students continue developing their ideas on fractions. For the common assessment, we carefully picked some fractions and asked our students to place them on a number line and explain their reasoning for each placement. We then got together to look at the student work and identified areas were our students were being successful and areas in which they were struggling. It really helped me to think this through with my colleagues and we made some modifications to the next few lessons that we were planning to teach."*

Before teaching a sequence of lessons or an instructional unit, teachers select common classroom assessments and identify mathematical expectations. To obtain accurate information, they discuss what mathematics (i.e., concepts, skills, processes) they are targeting with the task and how understanding will be evidenced in the student work. They then write out these expectations for student learning on the report form. This step is critical because the expectations for students will subsequently guide instruction and the feedback given to students.

After administering the common classroom assessment, teachers get together to look at the student work from across their classes to examine student understanding aligned to the mathematical expectations of the task. They might use a protocol for analyzing student work or sort the papers according to successful reasoning and misconceptions. They use the report form to help them summarize information about what students understand in light of the expectations and what misconceptions exist. Now they discuss next steps for instruction and modify lesson plans as needed to move students' understanding.

In the Milwaukee Public Schools, classroom assessments are often referred to as CABS, which stands for "Classroom Assessments Based on Standards." The CABS are constructed-response items that are aligned to district learning targets and state standards. Students are usually expected to provide a written response that includes words, numbers, equations, and/or diagrams. At the early grades, teachers might use a checklist or anecdotal record. The CABS that have been developed through the MMP are available online to download and use. (Click the CABS quick link on the home page, www.mmp.uwm.edu, or go directly to: www4.uwm.edu/Org/mmp/_resources/cabs.htm.)

Student Focus on Using Assessment Information to Move Learning

(7) Feedback given to a student is descriptive, frequent, and timely. It provides insight on a current strength and focuses on one facet of learning for revision linked directly to the intended math objective.

(8) Students actively and regularly use descriptive feedback to improve the quality of their work.

(9) Students study the criteria by which their work will be evaluated by analyzing samples of strong and weak work.

(10) Students keep track of their own learning over time (e.g., journals, portfolios) and communicate with others about what they understand and what areas need improvement.

It is common practice for teachers to conduct assessments, examine student work, keep records, and track student progress. This final set of formative assessment principles puts a focus on students using assessment information. When students regularly self-assess, monitor, and communicate their own progress, their confidence in themselves as learners and their motivation to do well grows along with their improved performance (Stiggins, 2006).

Revisiting the fifth grade teachers, the identification of student strengths and misconceptions was also used as the basis for writing descriptive feedback to their students. *"This group of students need to work on knowing when a fraction is greater than or less than one-half, especially when the denominator is an odd number."* The teachers then looked together at individual student papers and wrote feedback on ways the work could be improved. One teacher commented, "*I would like to have whole class discussion on what makes a good explanation when talking about the size of fractions and the use of benchmarks."* They selected two student work samples with correct placement of the fractions but unclear explanations and two samples with clear explanations. After removing the student names, they showed samples one at a time to the class. "*After you read this explanation, restate what this student is saying. What questions would you like to ask this student? What suggestions might you have for making the explanation clearer*?" Following the discussion, the students reviewed the written descriptive feedback they had received individually and then revised their work.

The feedback we give to students is more impactful than many of us realize. Feedback can be supportive of moving student learning forward or it can hinder learning due to it negative influences on student motivation (Black et al., 2004; Stiggins, 2006). Hattie and Temperly (2007) reported that feedback works to support student learning when it focuses on aspects of the student's work rather than on the student as a learner and is descriptive of that work, revealing to the student how to do better the next time, rather than being evaluative ("here is how to improve your explanation" rather than "good work" or "80%"). The feedback should relate directly to the intended learning targets, pointing out both strengths and weaknesses in the work. It is most helpful if the feedback focuses on one aspect of the work that can be improved. Students then need to be given opportunities to use or apply the feedback as soon as possible. This might involve revising the current work or applying the information to a similar task.

It is helpful for students to study the criteria by which their work is evaluated. In a whole class discussions, students can analyze samples of strong and weak work prior to develop a vision of what good work looks and what are specific ways to improve the work. This analysis of work samples could occur prior to students reviewing the teacher feedback or prior to self-assessing their own work on established criteria related to the math objectives.

This brings us to the final principle of formative assessment, the involvement of students in monitoring their own learning. What students think about and do with assessment information is as important, and perhaps more important, that what we, as teachers, do with it. When the mathematics learning objectives are clear to students, we can help them learn to engage in self-assessment, goal setting, and identification of their own strengths and areas for improvement.

Closing Thoughts

With the articulation of these ten principles of formative assessment, our journey is now more focused on ways to link these principles to classroom practice. We are moving toward viewing assessment as something that is not done *to students* but rather *with students*. We begin by studying the mathematics and translating the math objective into student-friendly language. Students are expected to be able to describe the mathematical ideas they are learning. Teachers are expected to be able to articulate how the math objective fits within the progression and trajectory of student learning. Next teachers identify classroom assessments related to the mathematics and then use the information from student responses to make instructional decisions. In the past, we stopped at this point. Now we know we need to continue the journey and invite students to be more active participants in the assessment process. We are now learning more about ways to provide students with descriptive feedback and to incorporate ways for them to use and apply the feedback. We are also exploring the use of portfolios in the math classroom. We invite you to also join us on the journey of using formative assessment.

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Classroom Assessment Summary Report

(attach a copy of the classroom assessment to this report)

School: **Teacher(s):**	**Date:** **Grade Level:** **_____ Regular Education ____ Special Education**
State Mathematics Content Standard(s): ❑ A. Mathematics Processes ❑ B. Number Operations and Relationships ❑ C. Measurement ❑ D. Geometry ❑ E. Statistics and Probability ❑ F. Algebraic Relationships **Mathematics Assessment Framework Descriptor:**	**Mathematical Expectations of Students on the Task:**
Students' Successes:	**Students' Challenges:**
Next Steps for Instruction:	

Figure 2. Classroom Assessment Summary Report