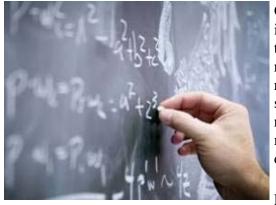# Formative Assessment in the Math Classroom
Encouraging students to invest in their own learning
Christi Cole

Fig. 1 – Math problem solving.

One of the most frustrating things a student can do in my class is receive a returned paper, look at the grade, and throw it in the recycling. Perhaps the learning is in the doing, so the returned paper is inconsequential, but if there are errors, the returned paper is a learning opportunity. What I really want students to understand is that math involves editing and revision, it's rarely perfect on the first try. In my search to motivate students to explore this revision process I have delved into the current trend of formative assessment.

Education as a whole, and math in particular, has been moving toward a more student-centered approach. Lorrie Shepard in her article "The Role of Assessment in a Learning Culture," wrote that there is an "emergent, constructivist paradigm in which teachers' close assessment of students' understandings, feedback from peers, and student self-assessments would be a central part of the social processes that mediate the development of intellectual abilities, construction of knowledge, and formation of student identities." In other words, teachers are redistributing the responsibility for learning and teaching to focus more on the student, allowing the student to have a role in both how they are taught and how they are evaluated. Two years ago, professional development at my school centered around formative assessment, focusing on just this principle. And, just as all good PD should, it started me thinking about how I organize my classroom. I examined my grading, my grade book and my feedback to students, and I made some changes.

If you talk to multiple people, including education researchers, you may find multiple definitions of formative assessment. For the purposes of my classroom, I identify formative assessment as anything that helps me to observe student learning and informs my instruction and improves their learning. Formative assessments help students to identify their strengths and weaknesses and target areas that need improvement. In addition, they help me to see where students are struggling and adapt my teaching to address problems immediately. Formative assessments are generally not graded, or have very low grade impact.

In contrast, summative assessment is used to evaluate student learning at the end of a unit or time period. It is usually attached to a point value. For years, In my classroom I used primarily summative assessment. Daily assignments were given a grade by me, projects were evaluated by me, quizzes were given a grade by me and exams were graded by me. Although students participated in the doing of the work, they never evaluated their own work. This has changed as I've moved to a combination of formative and summative assessment.

Therefore my students still have unit exams, and submit their assignments to be evaluated at the end of a unit. However, I wanted to find a way to encourage students in the revision process. First, I completely changed my grade book to reflect a student's progress per unit, organizing my grading categories by content, congruent triangles and parallel lines for example, rather than more general categories like homework, classwork and tests. Students could then see how they were progressing in a topic versus testing or homework. Then I went to work on my daily assignments.

I believe in daily practice in math. Currently, instruction and discussion of new topics take place in the classroom and assignments, perhaps begun in class, are completed subsequently outside of class. When

students bring their assignments in on the day they are due, they take a few minutes at the beginning of class to ask questions, check solutions with a collaborative group and then self-evaluate their homework.

At the top of every assignment is a space to mark which problems they need to correct. To evaluate their

work, they use a rubric that includes the following terms: exceeding expectations, meeting expectations, approaching expectations and not meeting expectations.

It's been interesting for me to be able to see how students self-assess their understanding versus how I assess their understanding on a daily basis. Middle school students generally do not have a good ability to evaluate themselves. We spend a few days at the beginning of the year assessing sample work, deciding how you can assess your understanding, looking at the difference between conceptual and arithmetic errors and giving feedback. It's generally easier for students to do this for someone else, than do it for themselves. It takes practice, but it's a useful skill and one that allows them to find their areas of weakness and hopefully strengthen them.

One of my students reflected on their ability to self-evaluate, "At first, I didn't understand how to check my own work. I thought things were either right or wrong. Now I'm able to tell if I just made an arithmetic error and actually understand the concept or if I need help understanding the concepts." I believe the use of formative assessment has allowed me to encourage this self-evaluation, which is creating a more self-aware student, someone who can figure out how to build their understanding without having to always seek my evaluation.

After their evaluation, I collect it, examine their work and either record their self-evaluation or change it and add to problems they need to fix if necessary. This examination allows me to see if there are topics on which the entire group is struggling, or if an individual is struggling with a particular topic. This informs my teaching for the following day. I return the work the next day and students have until the end of the unit to revise their work, seeking help if they need it.

The expectation is that students will then take the assignment and revise it before turning it in at the end of the unit for a summative assessment. I have found that my students no longer check their grade when the paper is returned, because it was self-assigned. However, they do look at the problems that were missed, knowing that they can revise their work and increase their understanding. Before this system, I had very few students who revised their assignments, now, I have very few who do not.

One of my students said, "it takes the pressure off math homework. I try every problem but know that I will have time to fix my mistakes before I get a grade on it. It helps me to learn the material." I was concerned at first that I would have more students who did not turn in their work because it wasn't "worth" anything. However, I actually have more students who submit their work and I think it's due to exactly what the student above said: some of the pressure surrounding the assignments has been relieved. I believe that students better understand that the assignments are for their learning benefit, and not just for a grade and not just for me to get a grade in the grade book.

Fig. 2 – Engaged students as teachers want to see them.

In addition I feel that students have a better understanding of the material at the end of a unit. They've corrected homework along the way, solidifying the concepts and learning from their mistakes. One of my students explained, "I feel like I have a better understanding than I used to. I actually take the time to look over my work so that I don't make the same mistakes on the unit exam."

Changing my instruction from primarily summative assessment to a mix of formative and summative has allowed my students to become more self-aware and in charge of their own learning. I believe that they see more purpose in the daily work they are doing and engage more in the revision process. One of my students summed it up for me, "I like doing the math homework because it's fun to try out the problems. I'm not worried about the grade I'm going to get on the assignment the first time so I may take more risks." If I have a student telling me that they like doing the math homework, I think my experimentation with formative assessment is successful.