

Assessment for a Growth Mindset.

Jo Boaler & Amanda Confer.
Stanford University

Abstract.

A new method of assessment promises to offer students a changed relationship with their learning, giving advice on ways to improve and growth mindset messages about their learning. This article outlines some of the work of teachers who have moved from old methods of testing and grading to feedback and encouragement that provides students with growth pathways and messages that change their mathematical futures.

The day that I had been dreading –the day of the state test—was here, and although I had tried to shield my students from its stress, I knew they were nervous. I saw my eighth grade Algebra students diligently begin to fill in endless bubbles and quietly took in the scene in this high-poverty school –the lopsided bookshelf by the windows, the old heaters wheezing out hot air, even in May– and watched my students hunched over their papers, persisting through each problem. I felt proud of them for the work they were able to do, but unsettled by the tests themselves that would only reflect a sliver of my students’ knowledge and perhaps damage their relationships with math.

That summer, when my students’ test scores arrived their high marks gave me only fleeting happiness. Neither the pass rates nor the scores broken down by standards told me what I wanted to know as a professional educator: What had my students learned? I shuffled through the endless sheets of assessment data I had from the year. I poured over state test data, district test data, and district unit tests. I was drowning in data, but ironically had no valuable information. Nothing told me what my students had learned or how I might better teach my future students.

Our schools in the United States are increasingly organized around large-scale standardized assessments. Teachers are rewarded (or punished) for the scores of their students; master schedules are formed around remediation or test-preparation courses and our students are sorted into classes with different opportunities based on students’ test scores. Unfortunately, most of the assessments do not assess what is important. Rather than focusing on mathematical problem solving, creativity or persistence, many tests focus on what is easy to test: calculations with a single correct answer. Although the Common Core is attempting to break this mold and broaden the kind of mathematics that we assess and value, many districts, schools and universities continue to rely on narrow assessments. The misalignment between test content and valuable content makes the testing frenzy in our schools illogical. We organize our children’s education around tests that tell us very little, if anything, about what will make them successful.

| The way we assess students plays a large part in the mindsets they develop. Students with a growth mindset are those who believe that intelligence and “smartness” can be gained through time and effort, whereas those with a fixed mindset believe that you can do math or you cannot. Students’ mindsets are extremely important because students with a growth mindset are those who go on to higher levels of achievement, are more persistent in math class and are more likely to take advanced math classes (Boaler, 2014a,b, 2015). When we place an excessive value on test scores or grades we communicate fixed mindset messages to our students. Parents and teachers see children as the words that label them; “high,” “average” or “low.” Students quickly take ownership over their status. For example, students may take on the label of a “C” student and resign themselves to an incorrect belief that this reflects some innate mathematical capability and that working harder will not change that. Alternatively, students labeled as high-achieving encounter crises of confidence when they encounter problems that are hard for them - because they believe that if others see them struggle they will no longer believe they are “smart”.

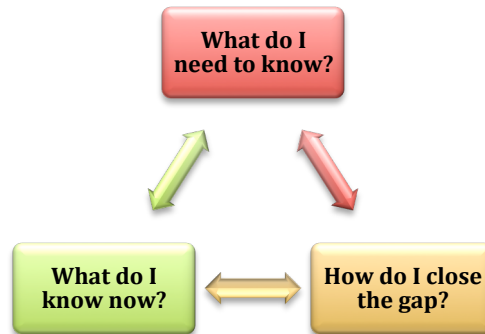
Instead of giving students damaging fixed mindset messages about their potential, teachers can take the opposite approach and offer students a growth mindset pathway through their math learning. Well-crafted tasks and questions, accompanied by clear feedback, offer students a growth mindset pathway that helps them know that they can learn at high levels and, critically, how they can get there. We have worked with teachers who have shifted their methods of assessment from standard tests with grades to assessments that are focused upon giving students the information they need in order to learn accompanied with growth mindset messages. This resulted in dramatic changes in their classroom environments and in students’ achievement. After teachers made the assessment changes students’ math anxiety, formerly commonplace because of the testing culture, disappeared. Instead, classrooms were filled with self-confident students, which led to higher levels of motivation, engagement and achievement.

Assessment for Learning

A few years ago two professors from England – Paul Black and Dylan Wiliam – conducted a meta-analysis of hundreds of research studies on assessment. They found something amazing. They found that one form of assessment is so powerful, that if teachers shifted their practices and used it the impact would be so great it would raise the achievement of a country in international studies from the middle of the pack to a place in the top five (Black & Wiliam, 1998a; Black & Wiliam, 1998b). They published their findings in a small booklet which sold over 20,000 copies in the first few weeks in England. Assessment for Learning is now a national initiative in many countries; it has a huge research evidence base and it communicates growth mindset messages to students.

There are two types of assessment – formative and summative. Formative assessment informs learning and is the essence of Assessment for Learning. Formative assessments are used to discover where students are in their learning so

that teachers and students can determine what they need to do next. The purpose of summative assessment, however, is to summarize a students' learning; to give a final account of where a student has reached as an end point. One problem in the United States is that many teachers use summative assessment formatively, that is they give students a score or grade when students are still learning the material, rather than at the end of a course. In Assessment for Learning, students become knowledgeable about what they know, what they need to know and ways to close the gap between the two places. Students receive information about their flexible learning pathways that contributes to their development of a growth mathematics mindset (see Boaler, 2015).



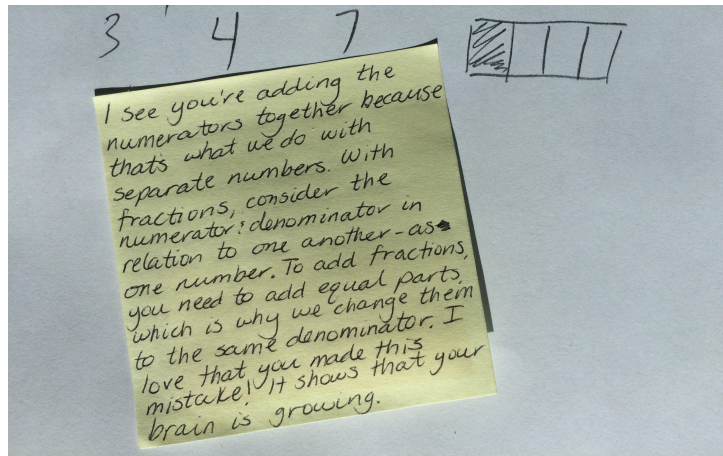
One of the greatest outcomes of an Assessment for Learning approach is that it transforms students' perceptions of themselves. Formative assessments help students think about mathematics as a growth subject where there is a path towards greater understanding. It shows children their own path forward and avoids the inherent fixed messages of test scores and grades.

Grades Versus Diagnostic Comments

Achievement increases when teachers stop grading students –which communicates fixed messages –and instead give diagnostic comments, showing what students have done well and what they still need to work on (Butler, 1998, Boaler 2015). When students receive a grade, they compare it to others around them, with half or more deciding that they are not as good as others. This is known as “ego feedback,” a form of feedback that has been found to damage learning. In studies of grading researchers have produced consistent results. Study after study shows that grading actually *reduces* the achievement of students (Boaler, 2015). Ruth Butler, for example, found that both high-achieving (the top 25% GPA) and low-achieving (the bottom 25% GPA) students suffered deficits in performance and motivation when graded, compared with students who received only diagnostic comments (Butler, 1998).

When you change from giving students grades to giving them diagnostic comments you are giving them a great gift: your knowledge, ideas and feedback on their mathematical development. When this is phrased positively with growth mindset messages, students' learning pathways transform. For example, a teacher might see that a student does not understand how to add fractions, and instead of giving a low

score on an assignment the teacher can highlight and even celebrate the mistakes (see Boaler, 2015).



Ellen Crews is an incredible and dedicated teacher who worked in a challenging school that was under “program improvement” (PI). When Ellen started teaching at her school the administrators were focused on testing, as is typical with schools given a PI label in California. Test questions and chapter tests mirrored standardized assessment questions with multiple-choice answers.

Ellen realized the testing cultures was causing anxiety among students and she took steps to make changes in her classroom. Her first move was to stop giving chapter tests and replace them with smaller assessments. She stopped using the words “test” and “quiz,” and called her mini-assessments an opportunity to “Show What You Know.” The multiple-choice questions were taken out and students were asked to write out their answers to mathematics questions. Ellen also stopped preparing students for the district’s benchmark exams, instead giving them without any warning to avoid the build up of anxiety, telling students, “Just do the best you can and don’t worry about it.” The students’ scores on tests did not decline, despite Ellen’s lack of focus on them, and student confidence increased. Importantly, as Ellen told me, students started enjoying math class.

But Ellen, like other reflective and caring teachers, was not satisfied and took further steps to improve. The next year, she and her colleagues stopped grading altogether, and instead used a rubric with mathematical statements. When the math team stopped giving scores and instead gave diagnostic feedback, students began to read and interpret the feedback and ask questions about their learning. At first Ellen realized that she was spending too much time on diagnostic feedback as she was regularly giving feedback to all of her 110 students, so she learned to write feedback more occasionally, when it was most helpful to students. This is the perfect approach to diagnostic feedback. It takes more time than a check or grade, but it

does not have to be given as regularly. Occasional feedback, given at professionally judged times of importance, is an invaluable gift to students.

Ellen now says that many more of her students put effort into math, and they strive hard to do the very best they can. In the years following the changes made in Ellen's teaching and assessing, district wide professional development supporting these changes helped the grades of the students moving from middle to high school significantly improve and failure rates in high school algebra halved.

Self and Peer Assessments

The essence of the Assessment for Learning approach is the communication to students of where they are in their learning and where they need to be. Self-assessment and peer assessment are the main two strategies for helping students become aware of the math they are learning and their broader learning pathways. In self-assessment, students receive explicit statements about learning content and goals they should aim towards. Students reflect on where they are, which encourages them to take ownership over their learning

Unit 3: Exploring Slope		
Essential Questions:		
➤ What is a rate of change?	➤ How do we use rates of change in the real world?	➤ How do graphs show different rates of change?
Learning Targets <i>Rate your own knowledge of each learning target. Remember that your rating can (and will!) change over time.</i>		
<i>I can explain what points on a graph mean in the context of a problem.</i> This means that I can identify the points on a graph and explain what the points represent. For example, I could use a labeled axes to figure out that the point (0,1) might represent that at 0 time, Ms. Confer was 1 foot away from her house.		
Hmm, that's new ←————→ I Got This!		
<i>If I'm given a graph, I can write down a description of which direction and how fast a person is walking.</i> This means that I understand how to read a graph well enough to tell a story about it.		
Hmm, that's new ←————→ I Got This!		

The statements should communicate mathematics content such as “I understand the difference between mean and median and when each should be used” as well as mathematical practices such as “I have learned to persist with problems and keep going even when they are difficult.” If students start each unit with clear statements about the mathematics they will learn, they start to focus on the broader landscape of their learning journeys – they learn what is important, as well as what they need to work on to improve.

While peer assessment is similar to self assessment, it differs in that teachers give students criteria to use for assessing other students' work rather than their own. Peer assessment has been shown to be highly effective, in part because students are often much more open to hearing criticism or a suggestion for change from another student, and peers usually communicate in ways that are easily understood by each other. One method of peer assessment is the identification of "two stars and a wish." Students are asked, with or without criteria, to look at their peers' work and to select two things done well and one area to improve upon.

Other methods for encouraging students to reflect on their own understanding and improve upon it include:

1. Reflection Time

An effective way for students to become knowledgeable about the ideas they are learning is to provide time for reflection. Ask students at the end of a lesson to reflect using questions such as these:

- What was the big idea we worked on today?
- What did I learn today?
- What questions do I have about today's work?

2. Exit Slips

This is a piece of paper you give to students at the end of class that asks them to write about what they learned that day. Before they leave the room they answer the question and give it to you. This is another opportunity for students to reflect, improve their learning and provide the teacher with valuable information on students' learning and ideas for upcoming lessons.

3. Students Write Questions and Tests

Ask students to design their own assessment questions for other students. The act of writing a good question will help students focus on what is important, and allow them to be creative in their thinking, which is itself important. Students enjoy the task of writing a mathematics assessment and, at the same time, engage in critical thinking.

Grading Advice

Many teachers, unfortunately, are required to grade, as it is a non-negotiable in their district or school. Hopefully teachers are only asked to provide grades at the end of a course, not within a course. While taking the course, students only need specific information on ways to learn better, which should be provided through formative assessment. The following is some advice on ways to grade fairly while communicating positive and powerful growth messages.

1. Always allow students to resubmit any work or test for a higher grade – this is the ultimate growth mindset message, communicating to students that you care about learning, not just performance.

2. Share grades with school administrators but not with students. If your school requires grades before the end of a course, this does not mean that they need to be given to students. Instead give students verbal or diagnostic written feedback on ways to improve.
3. Use multidimensional grading. While many teachers believe in the breadth of mathematics and may value multidimensional mathematics in the classroom, they may only assess students on whether they get correct answers to procedural questions. When they need to give grades, the best teachers assess using student work. For example, they may provide feedback about how students justify their reasoning, make connections between ideas or apply knowledge. These teachers may also give students exemplars of work that show many dimensions of quality and can be used by the student during work time

Conclusion

Changing from traditional methods of assessment to Assessment for Learning is a big step for teachers, but it is one of the most important. Teachers who use Assessment for Learning are faced with an incredible opportunity: to provide students with information on their learning, rather than their achievement, to encourage responsibility among students, and to give students powerful growth mindset messages about mathematics and learning that fill them with self hope and belief.

This article shares ideas from Jo Boaler's new book: *Mathematical Mindsets: Unleashing Students' Potential through Creative Math, Inspiring Messages and Innovative Teaching* (2015): Jossey-Bass: New York

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