Assessment and Mathematics

The CCSS for Mathematics “define what students should understand and be able to do in their study of mathematics. Asking a student to understand something means asking a teacher to assess whether the student has understood it. But what does mathematical understanding look like?” (Common Core State Standards Initiative, 2012, p. 4). This is the question that guides teachers as they work with students to improve their mathematical thinking.

Formative assessment in math, as in any discipline or activity, should give students the feedback they need when they need it in order to improve. The National Council of Teachers of Mathematics (2013) describes the role of formative assessment:

> Through formative assessment, students develop a clear understanding of learning targets and receive feedback that helps them to improve. In addition, by applying formative strategies such as asking strategic questions, providing students with immediate feedback, and engaging students in self-reflection, teachers receive evidence of students’ reasoning and misconceptions to use in adjusting instruction. (p. 1).

In the mathematics classroom, formative assessment serves several critical purposes by:

- Activating and engaging student thinking
- Challenging prior conceptions and awakening curiosity
- Encouraging continuous reflection
- Posing alternative points of view
- Providing a stimulus and environment for mathematical discussion
- Helping students identify what they have learned and not learned
- Encouraging students to ask better questions and think more thoughtfully about answers
- Prompting mathematical inquiry
- Building concept development and transfer
  (Keeley & Tobey, 2011)

A classroom environment that supports formative assessment may require a shift from the traditional view of mathematics instruction, which has several deeply held traditions that typically focus on a teacher presentation beginning with a review of the previous day’s homework, the introduction or extension of a mathematical concept, assigned “problems” or “exercises,” and practice work to be completed at home.

For formative assessment to fulfill its promise to enhance learning, classrooms must be:

- **Learner-centered environments** where “careful attention is paid to the knowledge, beliefs, attitudes, and skills students bring to the classroom.”
- **Knowledge-centered environments** where “teachers know what the goals for learning are, the key concepts and ideas that make up the goals, the prerequisites upon which prior and later understandings are built, the types of experiences that support conceptual learning, and the assessments that will provide information about student learning.”
Assessment-centered environments where students have multiple opportunities to express, examine, and revise their thinking.

Community-centered environments where “students learn from each other and continually strive to improve their learning.” (Keeley & Tobey, 2011, p. 8-9)


1. Teachers study and clearly articulate the math concepts students will be learning before teaching them.
2. Teachers present the math objectives of a lesson to students in kid-friendly language.
3. Students can articulate the mathematical ideas they are learning.
4. Teachers can explain how the math lesson aligns to standards and fits into the progression of student learning.
5. Teachers conduct classroom assessments that give them accurate information about what and how students are learning math concepts and skills.
6. Teachers design instruction based on assessment data.
7. Teachers give students feedback that is “descriptive, frequent, and timely,” provides insight on current strengths, and links directly to the intended math objective.
8. Students use this feedback to improve their learning.
9. Students analyze samples of strong and weak work to study the criteria by which their work will be assessed.
10. Students monitor their learning over time and communicate with others about what they understand and what areas need improvement (p. 2).

To be mathematically literate, students must see that “Mathematics is a language used to describe the relationship between objects, events, and time. Learning math requires that a student interacts with a system of symbols just as a person interacts with alphabetic symbols, syntactical and semantic rules when reading a book” (Fore, Lawson, & Martin, 2007, p. 324).

Eliciting and attending to the language students use when discussing and writing about mathematical concepts is a critical form of classroom assessment. Group discussions and discovery of mathematical problems helps students learn how to express their thinking and gives teachers insight into their learning (Anthony, 2013).

The specific language of the CCSS for Mathematics can form the basis for self- and peer assessments, such as rubrics and checklists. The standards can also be very useful as observational checklists for teachers to use on mobile devices while students are working on group projects.

Example Adaptation of Mathematics Standards

Find probabilities of compound events using organized lists, tables, tree diagrams, and simulations (Statistics and Probability, Grade 7, Investigate chance processes...).

Observational Checklist

- Demonstrates that the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.
Represents sample spaces for compound events (e.g., organized lists, tables, and tree diagrams).
- Designs a simulation to generate frequencies for compound events.
- Conducts simulation effectively.

References


