Math Conferences for Assessing, Teaching, and Learning

2014 NCTM Conference
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What is a Math Conference?

A brief and focused one-on-one conversation between a teacher and a student during which the student shares his/her mathematical thinking and the teacher leads the student to his/her "next step" in learning.

How do Math Conferences compare to Math Interviews and Small-Group Instruction?

Figure 1.1 Comparisons of Math Conferences, Math Interviews, and Small-Group Instruction

Format	Time	Participants	Focus	Function
Math Conference	About 5 minutes	Teacher and 1 student	Student's current work	• Assessment • Feedback • Individual Instruction (Teaching Point)
Math Interview	About 10–15 minutes	Teacher and 1 student	Instructional task introduced by teacher	Assessment
Small-group Instruction	About 15–20 minutes	Teacher and 2–6 students	Group lesson (based on identified needs of the group)	• Group instruction (Focus lesson) • Assessment • Feedback

What is the value of Math Conferences?

- Assessment
    - Formative
    - Student self-assessment
- Instruction
    - Targets cutting edge of students' knowledge
    - One-on-one opportunity to share teaching point
- Feedback
    - Timely
    - Specific
    - Allows students to adjust their thinking and work in its midst to meet learning goals and criteria for success
- Mathematical Communication
    - Students expected to explain their mathematical reasoning
    - Student mathematical reasoning and communication is closely monitored by teacher
    - Teacher modeling of appropriate and precise use of mathematical language
    - Supports CCSS Standards for Mathematical Practice
- Accountability
    - Students learn that just having the right answer is not enough—they must be able to justify it
- Increased Rigor and Depth
    - Intimate conversation with teacher encourages students to pursue more complex thinking and develop a curiosity about math
- Building Relationships
    - Teachers show they care about and respect their students
    - Time to talk with, not at students
    - Builds relationships that tend to maximize student achievement and motivation—especially with poverty student

Figure 1.2 The Structure of a Guided Math Conference

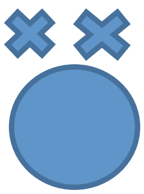
The Structure of a Guided Math Conference
Research Student Understanding and Skills • Observe the work of the student. • Listen carefully as the student responds to questions about his or her work to understand what he or she is trying to do as a mathematician. • Probe to glean more about the student's intentions, comprehension of relevant concepts, and mathematical capability. • The student does most of the talking during this part of the conference.
Decide What Is Needed • Weigh the validity of the student's current strategies and processes. Determine what should be the student's next step in learning. Decide on a specific teaching point and how you will teach it. • Name specifically what the student has done well as a mathematician with an authentic compliment, linking it directly to the language of the standards, and remind him or her to continue to do this in future work.
Teach to Student Needs • Use demonstration, guided practice, or explicit telling and showing to correct or extend a student's understanding and ability to successfully complete the task. • Have the student briefly practice what was taught and explain what she or he has learned to ensure initial understanding.
Link to the Future • Name what the student has done as a mathematician and remind him or her to do this often in the future. • Have the student share a reflection on the mathematics learned.

(Adapted from Calkins, Hartman, and White 2005)

When can Math Conferences be conducted?

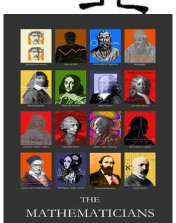
- As students enter classroom
- At the beginning of Math Workshop
- At the end of a small-group lesson
- Set aside one day a week
- Be creative about using bits of time during the day that arise

Strategies for Effective Conferring



Create a setting that invites conversations.

Listen actively—paying close attention, showing you are listening, providing feedback, and deferring judgment.

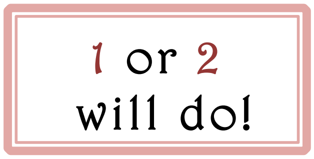


Communicate as a fellow mathematician.

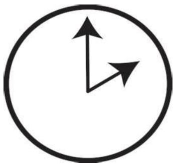
Strive to understand the thinking of the student.

Respond to student's verbal and nonverbal cues.

Build on student strengths.



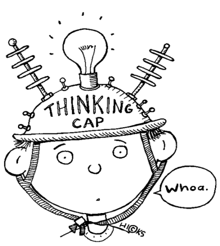
Limit the number of teaching points.



Keep conferences brief.

Encourage students to do most of the talking.

Avoid power struggles.



Encourage students to think more deeply and with more complexity.

Use conferences strategically being aware of the impact on neighboring students listening in.

Five Strategies for Effective Guided Math Conferences for Assessment

To make Guided Math conferences effective as a formative assessment tool for both teachers and students, teachers should consider these strategies:

1. **Help students develop a clear understanding of their learning goals and how they will know when they meet those goals.**

   Before teachers can convey learning expectations to students, they must have a clear understanding of what they are in their own minds. What is required for a student to master a given standard? What is the evidence of success? Can the overarching learning goal be broken down into smaller, more manageable chunks? If so, what exactly should be the immediate target for the student with whom they are conferring? What if he or she achieves that goal? What is the next learning goal?

   When teachers are clear in their own thinking about the desired learning goals and evidence of learning, they are able to reinforce them with students during these one-on-one discussions about the work in which they are presently engaged and lead them to set goals for themselves.

2. **Guide the conversation with questions to elicit evidence of student learning, both content and process, and/or misconceptions and gaps in foundational knowledge and skills.**

   Open-ended questions prompt students to explain their work or justify their reasoning and encourage them to reflect on their own thinking processes. Even those of us who are experienced teachers have to guard against assuming we know how our students think. Sometimes, we examine a student's work and from our past experiences make snap judgments about what the student was thinking. We may assume that arriving at a correct solution from a very capable student is evidence of understanding. Or we may see a common error and assume the student holds a common misconception that often leads to that error. While these assumptions may be true in some cases, good questions that reveal the student's mathematical reasoning may expose hidden misconceptions; alternative, but valid, ways of approaching the mathematical work employed by the student; or simple computational mistakes when otherwise the mathematical reasoning of the student is fully justified.

3. **Encourage students to reflect on their mathematical understanding so that they assume ownership of their learning.**

   Research shows that when students actively engage in monitoring and regulating their own learning, the rate of learning increases dramatically (Carr and Biddlecomb 1998). These students monitor their thinking to determine whether they have met the established criteria for mastery. In effect, they begin to give themselves descriptive feedback and apply strategies to repair their mathematical comprehension, when necessary. Allowing students time to pause and think during conferences makes it more likely that they will thoughtfully reflect on their own learning and check their progress toward their learning goals (Gregory, Cameron, and Davies 2011).

4. **Provide specific feedback to let students know both what they are doing well and what will move them forward in their mathematical learning.**

   It is both motivating and affirming for students when they hear exactly what they have done well, in which ways their mathematical thinking is valid, or in which ways they have grown mathematically, as opposed to no feedback or to more generic compliments like "good work" or "you have the correct answer." The positive feedback students receive may even surprise students and make them aware of aspects of their work that they did not realize was done well. Positive recognition encourages young mathematicians to continue to do whatever they have done well and to work to garner more compliments on their work by doing the best they can. It also creates a nurturing learning environment in which students are ready to consider feedback that will lead them to their next steps in learning. The "next step" feedback is what promotes student growth as mathematicians. Because it occurs as they work, students are able to immediately reconsider their approach and/or extend their thinking.

5. **Use the information gathered during the conference to identify a teaching point to move student learning forward.**

What ultimately defines formative assessment is the way in which we use it to drive our instruction. Formative assessment and teaching are complementary processes, one supporting the other (Sammons 2010). The specificity of information attained through this type of assessment is crucial in steering us as we make day-to-day teaching choices. Information about learning needs identified during conferences may be used immediately as a teaching point during the conference or later when planning small-group lessons or even large-group experiences. Because of the value of this assessment data, it is important to develop and maintain a readily accessible system of anecdotal notes to document what has been discussed during conferences. Notes should also include what was taught in response to observed learning next steps.

Empowering Young Mathematicians with Effective Feedback

As alluded to in the previous section, feedback plays a major role in formative assessments—whether these assessments are conducted by teachers or are student self-assessments. Effective feedback may lead to increased achievement by providing recognition of quality work, to intervention if errors or misconceptions are present, or to teacher guidance that points students toward their next steps in learning. At its best, feedback motivates students to manage their progress toward clearly articulated learning goals and places the emphasis on learning rather than on simply attaining a good grade.

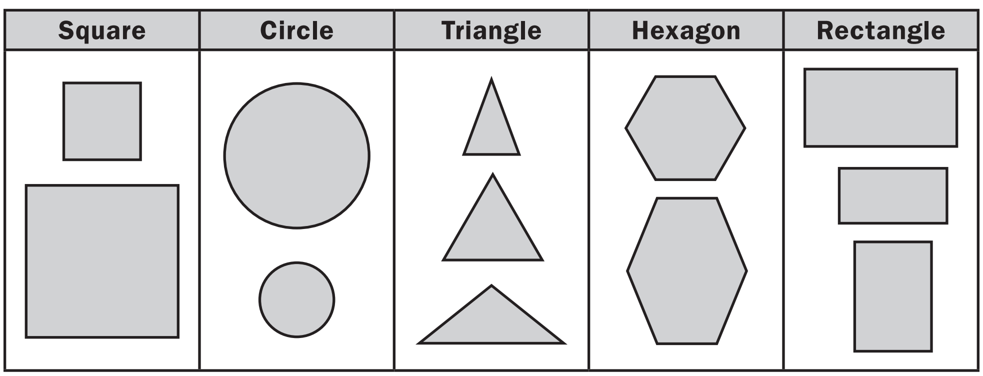
What Is Feedback?

Most of us are familiar with the irritating and often screeching feedback noise produced when a microphone is too close to a speaker. The jarring output is part of a positive feedback loop in which the sound from the speaker is amplified by the microphone to increase the sound of the speaker, which in turn is amplified again, looping over and over. This is *not* what constitutes positive or effective feedback for learners!

Teachers may also use comprehension conferences to lead students to think more deeply about the mathematics with which they are working. The one-on-one nature of these conversations provides a rich setting for prompting students to think more critically. Questions such as *What would happen if…?* and *Why do you think…?* challenge students to extend their thinking and explore more complex mathematical concepts.

Comprehension Conference Snapshot: Grades K–2

Students have been learning to identify basic plane figures. The teacher observes Cara as she is sorting shapes. Using a work mat with columns for different shapes, she has put the shapes in the correct corresponding columns. In the column for triangles, the teacher notices that each triangle has been placed base-down. The teacher wonders whether Cara understands the attributes of triangles and whether she is able to identify a triangle if it is turned so that it rests on a vertex rather than a side.



Teacher: *How is your math work going today, Cara?*

Cara: *Pretty good, I think.*

Teacher: *Will you tell me what you are doing?*

Cara: *Well, I'm just sorting these shapes. It is pretty easy to do.*

Teacher: *How do you know where each shape should go on the mat?*

Cara: *I look at it and see what kind of shape it is.*

Teacher: *What do you look at to tell which shape it is?*

Cara: *I can tell by how many sides there are.*

Teacher: *Okay.* (The teacher picks up a triangle and places it on the table in front of Cara so that one of the vertices points down.) *What can you tell me about this shape?*

Cara: *Let's see—it has three sides like a triangle.*

Teacher: *Like a triangle?*

Cara: *It has three sides, but it isn't a triangle.*

Teacher: *Why not?*

Cara: *Because triangles aren't pointy on the bottom like this is.*

During the research phase of this conference, the teacher discovers that Cara can state that triangles have three sides, but cannot recognize a triangle if it does not have a side as its base. The teacher decides to help Cara focus on the important attributes of a triangle so she will be able to identify triangles no matter how they are rotated.

Teacher: *Cara, you know an important attribute of triangles! All triangles have three sides. You are thinking like a mathematician when you look at a shape and count the number of sides. But I wonder, what happens if I rotate this shape a little?* (The teacher turns the triangle so that one of its sides points downward.)

Cara: (She looks puzzled.) *Well, it has three sides, but it's not a triangle.*

Teacher: *Why not?*

Cara: *Triangles look like this.* (Cara turns the triangle so a side faces downward.) *Now it is a triangle. Triangles don't have the point at the bottom!*

Teacher: *So if you rotate a shape, it is no longer the same shape?*

Cara: *Hmm. I don't think that's right.*

Teacher: *What did you tell me you look at to decide what kind of shape each of these shapes is?*

Cara: *The number of sides it has. Oh—and they have to be straight sides, not curvy.*

Teacher:	*Has the number of straight sides changed?*
Cara:	*No.*
Teacher:	*So why wouldn't it be a triangle anymore?*
Cara:	*It just doesn't look right that way. But I guess it has to be a triangle, because it does have three straight sides.*
Teacher:	*Cara, you have just discovered something about mathematics! Mathematicians have to look for the attributes of a shape—those things that make it what it is—and not get distracted by other characteristics. Would it still be a triangle if it were a different color?*
Cara:	*Of course!*
Teacher:	*If it were polka-dotted?*
Cara:	*Yes.*
Teacher:	*If it were turned?*
Cara:	*I see now. I know what is important about a triangle—the number of straight sides. And the number of corners, too, right?*
Teacher:	*You are right. Triangles always have three vertices, or corners. Always remember what you learned today. Whenever you are trying to identify a shape, focus on the important things that make it what it is.*

The teacher is pleased that Cara was able to express what she had learned from the teaching point of the conference. She also makes a note to be sure that students see triangles depicted in a variety of positions to help them avoid thinking that position is an essential attribute defining a plane shape.

Comprehension Conference Snapshot: Grades 3–5

The teacher observes Ruby as she compares fractions. She considers two fractions, $\frac{1}{2}$ and $\frac{1}{3}$. She writes: $\frac{1}{3} < \frac{1}{2}$. Although she properly notates the inequality, the teacher chooses to confer with her to check her understanding.

Teacher: *How is your math work going today, Ruby?*

Ruby: *Okay. I think I got the right answer.*

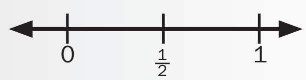
Teacher: *Tell me what you are doing.*

Ruby: *I was comparing these fractions.*

Teacher: *What did you find?*

Ruby: *Just like I wrote down here: one-third is less than one-half.*

So far, the teacher knows that Ruby correctly wrote and read the inequality showing the relationship between the two fractions. To be sure she really understands what she is doing, the teacher shows Ruby a number line.



Teacher: *On this number line, will you show me where one-third is?*

Ruby places her finger between $\frac{1}{2}$ and 1.

Teacher: *Why do you think that is where one-third is?*

Ruby: *Because three is greater than two. If one-half is right here* (she points to $\frac{1}{2}$), *then one-third would be just a little more. So it's right about here.*

The teacher realizes that Ruby has learned a procedure for writing and reading the inequality, but does not really understand the relationship between the two fractions. Moreover, she either does not completely understand fractional parts or she is not connecting what she knows when she is asked to compare fractions. For the teaching point of this conference, the teacher decides to reinforce the meaning of fractional parts. After drawing two congruent rectangular bars—one directly above the other, the teacher continues.

Teacher: *Ruby, you wrote an inequality that was true, and you read it correctly. Those are both important skills. Now, let's think a little more about fractions. Look at these two bars. Will you please divide the top bar into halves? Tell me what you are doing as you work.*

Ruby: *I'm supposed to divide it into halves, so that means two parts.* (She draws a line correctly dividing the bar into halves.)

Teacher: *Why did you decide to draw the line there and not over here?* (The teacher points to another part of the bar.)

Ruby: *It's got to be about halfway. There has to be the same amount of space on both sides.*

Teacher: *So when a whole is divided into halves, it is divided into two equal parts?*

Ruby: *That's right, they have to be the same size—equal like that.*

Teacher: *Okay. Now, please divide the other bar into thirds. Tell me what you are doing as you work.*

Ruby: *If it is thirds, that means three parts. That's harder. They have to be equal. I'll put one line here and one here. That looks about right.* (Ruby correctly divides the bar into thirds.)

Teacher: *So now the top bar is divided into halves and the bottom bar is divided into thirds. Which is greater: one-half of the bar or one-third of the bar?*

Ruby: *The half is bigger because it is only divided into two pieces. The other bar is divided into three parts—so they are smaller.*

Teacher: *You can see that one-half is greater than one-third. Think about what you just said—that half the bar is greater because it is divided into fewer pieces—only two pieces instead of three. Knowing that, which do you think would be greater: one-third or one-fourth?*

Ruby: *Well, four is greater than three—but wait, that means the bar is divided into more pieces, so each part is smaller. I guess one-third is greater than one-fourth, right? It's sort of like dividing a candy bar. If there are only two of us, we get more than if I have to divide it between three or five people.*

Teacher: *You are thinking like a mathematician! Now, look at the number line. Show me where you think one-third would be.*

Ruby: *It's just like dividing the bar! It would be just about here, I think.* (Ruby places her finger at about one-third on the number line.)

Teacher:	*How do you know?*
Ruby:	*I just divided the line into three parts—equal parts—in my head.*
Teacher:	*You are able to visualize thirds on the number line. You know that the denominator, the number on the bottom of a fraction, represents how many equal parts a whole is divided into. So you know that the larger the denominator, the smaller the part will be. That is something mathematicians figured out a long time ago and something that you should always remember when you are working with fractions. Will you please share something you thought about mathematically while we talked today?*
Ruby:	*I just thought that it makes sense. Everybody should know it because we all share. The more people we share with, the smaller the part we get. Just like with fractions—when the bottom number—I mean, the denominator—is bigger, each part is smaller and smaller. I never knew that was math.*

With this conference, the teacher discovered that Ruby failed to connect what she knew about fractional parts to the process of comparing fractions that she had learned. She was able to express the relationship between two fractions in writing and orally, yet did not grasp how that relationship was linked to locating the fractions on a number line. By exploring what Ruby already knew, the teacher helped Ruby extend her understanding and make this connection.

Comprehension Conference Snapshot: Grades 6–8

To truly understand the structure of the number system, students must have a concept of the incredible density of real numbers. While older students regularly work with decimals and fractions, many of them fail to grasp the fact that there are an infinite number of real numbers (Van de Walle, Karp, and Bay-Williams 2010). In this conference snapshot, students were asked how many numbers they think are between five-tenths and one. While most students are busy jotting down numbers, Hakeem has written his answer: 4. The teacher decides to confer with Hakeem to help him expand his thinking.

Teacher: *Hello, Hakeem. How is your math work going today?*

Hakeem: *I'm finished already. What else do you want me to do?*

Teacher: *Will you tell me what you have done?* (The teacher chooses to take this approach rather than to tell him he needs to think about it a little more. By asking Hakeem to explain his thinking, the teacher will be able to identify a compliment and a teaching point to extend his understanding.)

Hakeem: *Okay. It's just like counting, right? So I counted six-tenths, seven-tenths, eight-tenths, nine-tenths. And next was one, so I didn't count it. What do we do next? I know that was too easy for it to be all you want us to do.*

Teacher: *Hakeem, you showed me that you understand the decimal system through the tenths. You also let me know that you understand that our work in middle school is more challenging than just counting by tenths. So now I am going to ask you to think a little more deeply about what we have been learning.*

The teacher draws a number line from 0.5 to 1 lengthwise across a sheet of paper.

Teacher: *Will you please place the numbers you just counted on this number line?*

Hakeem adds the numbers 0.6, 0.7, 0.8, and 0.9 to the number line.

Teacher: *Look at all that space between five-tenths and six-tenths. Are there any other numbers represented in that space?*

Hakeem looks puzzled.

Hakeem: *Not tenths.*

The teacher draws a number line from 0.5 to 0.6.

Teacher: *This is another way to represent that space. Is there a number you can think of that would represent this point?* (The teacher points to the line midway between 0.5 and 0.6.)

Hakeem is still confused, so the teacher points to a hundredth chart.

Teacher: *Show me where five-tenths is on the hundredth chart.*

Hakeem points to 0.50 on the chart.

Teacher:	*And now, where is six-tenths?*
	Hakeem points to 0.60.
Hakeem:	*Ohhh! Now I get it. There's like all those hundredths between five-tenths and six-tenths—like fifty-one hundredths, fifty-two hundredths. All those numbers. There are lots of them in there between five-tenths and one.*
Teacher:	*Hmm. Do you think there are any more numbers between five-tenths and fifty-one hundredths?*
Hakeem:	*Of course. You gotta go to thousandths, too. But you can't stop there! How about ten-thousandths? Was this a trick question? You could just keep getting smaller and smaller parts. How could anybody figure that out?*
Teacher:	*Now, Hakeem, you are thinking like a mathematician! You are wondering about the math right there in front of you. What do you think? Can anybody figure out exactly how many numbers there are between five-tenths and one?*
Hakeem:	*I don't think it is possible. There are just more and more—just like infinity. It can go on and on. But doesn't it have to stop somewhere?*
Teacher:	*Think about it and talk about it with your friends. After a day or two, we are going to talk about it together as a class and see what we think. This kind of thinking is what mathematicians do. Keep on wondering, Hakeem!*

With this conference, the teacher was pleased that Hakeem became so curious about the density of real numbers. Although he was focusing on decimals and had not even considered fractions, Hakeem was beginning to think mathematically. Rather than leading him to consider fractions, the teacher hopes that conversations with classmates will expose Hakeem to some additional ideas. And within a day or two, the teacher will call the class together for a Math Huddle—a focused conversation of the class mathematical community—to share ideas and possibly develop a conjecture.

Skill Conferences

Skill conferences are similar to comprehension conferences, but instead of focusing on what students know about the mathematical concepts they are learning, these conferences check on what they can do. At times, the

Conferring Activity

Based on this piece of student work…

1. What do you know about this student's mathematical understanding?

2. What would you like to know?

3. What questions will you ask the student?

Reflections: