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CHAPTER #2

Diagnosing Strengths and Needs

Parents don't know what goes on at school, teachers don't know what goes on at home, and students are consistently unreliable narrators. Fortunately, math itself tells a story only math can tell. Thus, the best way to know the truth is by working through problems with them.

Why?

Everyone has strengths and weaknesses. From Archimedes to Aristotle, Euclid to Einstein, even famous mathematicians got it wrong sometimes. In the finite time of a tutoring session, you want to make the best of your instructional minutes by knowing a learner's assets and areas of need quickly. And the best way to do that is to work through a set of grade-level problems with students to start diagnosing.

In tutoring, as is true in all types of teaching, you need to strike a balance between celebrating what students know and can do, while also addressing weaknesses. We've found that tutors just starting out want to swiftly fix every small error students make. We've also noticed that tutors who aren't yet experienced tend to rush to address every concern voiced by parents or teachers. Our best advice to you is to provide a balance of task-specific praise and task-specific naming of what's tripping them up, followed by on-the-spot feedback that scaffolds them up and over the speed bump.



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You are hired to be there for the students and to get them from one designated point to another. With that in mind, remember that you tutor the learner but are accountable to the client, which is often a parent or caregiver, or sometimes a school or district. So, part of diagnosing strengths and weaknesses is sharing what you’ve gleaned with both the learner and the person or people to whom you are accountable. It’s about being efficient, clear, and communicative about performance, progress, and concerns with everyone involved. Honesty prevails, and whenever you point out something a student needs to work on, also provide your next-step plan for attacking it.

Strategies to Try

A theme running throughout this book is this: Be curious, stay curious, and constructively communicate what you notice with the student and their family. The four strategies that follow help you become an astute coach.

Embrace Diagnosis as an Ongoing Process

You want to determine strengths and needs during the very first session, but keep in mind that diagnosis is an ongoing process. It will likely take many hours of working together to discover exactly what a student needs help with and exactly what a student doesn’t. And it will change! Students will be learning new content that may challenge them and may start to master content that once challenged them. Never stop assessing, and avoid the temptation to have a fixed mindset about what the student knows and doesn’t know. Also, embrace that sometimes students struggle with the same concepts for months and even years, even though you have spent a lot of time on them. Mathematical skills aren’t a checklist that you can cross off and never return to again; it’s important to always be assessing and reassessing.

Pay Attention to Students’ Thinking Processes

Assessment isn’t merely reviewing students’ answers; it’s looking at their processes that yields the richest data. That is why we like to work through problems with students or at least have students work through problems out loud. Independent work is important as well, but whenever a student does independent work, you should try to balance it with working together to see *how* they solve problems, not just if they can arrive at the correct answer.

Ask Yourself Four Questions

“What do they know?”, “What do they struggle with?”, “What gaps do they have?”, and “How do they best process the math and visualize the math they are learning?” (See chapters 10 and 13 for more on visualizing strategies.) For example, using both broad observation and a series of microdiagnosis, you are well positioned

to determine whether struggles with subtracting with regrouping emerge from misunderstanding or inappropriately using place value or a weakness with subtraction facts or both. If a weakness doesn't immediately appear but they are still struggling in the classroom, keep looking.

Prep and Launch

Follow this process in the days leading up to the first session:

- ▶ *Reach out to the parents.* Have a FaceTime or Zoom meeting to talk to the parents about what they have observed about their child and math. Talk to them about what strategies they've tried in the past and which strategies they have found effective.
- ▶ *Reach out to the teacher.* A face-to-face online meeting is preferable, but email can be used if necessary. Have specific questions prepared so that the meeting is time-efficient. You might ask, "Are there specific units (the student) has struggled with?" "What skills are most important to build for your upcoming units?" "Any other insights about this learner you would like to share?"
- ▶ *Prepare a set of practice problems.* When we make a set of practice problems, we like to cover all our bases. This means we'll look through units the student has had recently (either previously that year, if tutoring is starting in the middle of a school year, or in previous grades, if tutoring is starting at the beginning of a school year) as well as preparing questions that will reveal common issues. These can be word problems, fraction inequalities, understanding the difference in multiplication and division, applying a proportion, or completing a geometric proof, among many others. You will work through the set in your first meeting.
- ▶ *Give your sessions a predictable structure.*
 1. Discuss.
 2. Work through a problem(s) together.
 3. Independent practice.

During **discussion**, let students do most of the talking. Some kids will only say a few words, others will share for several minutes. You may want to take notes, but be sure to say something like "I'm going to take notes so that I can keep track of all the great thinking going on here and also so I can remember later how to best support you." For the **collaborative work** on a problem, if a student is eager to do it independently, let them work until they get stuck. Then, to scaffold them toward understanding, ask a question along the lines of, "Why do you think that's the next step?" Make sure they explain their reasoning. Next, find something in their reasoning that seems correct, and build on that strength and say, "Oh, I like the part where you _____." Maybe let's try from there." Make note of where they got stuck, as that's a weakness you'll want to look out for. As they **work independently**, don't step in and correct. Let them discover their own mistakes when you're going over the problem together.

In Action

After ice-breaking questions (see Chapter 1), I ask my tutee a question about their general feelings about math. It helps students lay their cards on the table, and it helps me discern their degree of struggle. I then ask more direct questions about specific units or concepts. Following is an excerpt from a conversation with a Grade 4 student, Santosh.

Me: I want us to work together on math that you think you don't understand. Can you tell me what kind of math you think that is?

Santosh: Yeah. I mean, I got a bad grade on our last math test. It was on . . . multiplication, I think?

Me: Okay, that's good to know. Did you feel good about the math going into the test?

Santosh: I guess. I didn't know everything, but I've never done this bad on a test before, so I didn't think I'd do bad this time.

Me: That makes sense. Were there specific types of questions on that test that were especially hard for you?

Santosh: I think the ones with bigger numbers were harder. And the ones that had multiple parts and told a story.

As the student talks, I take notes. For example, Santosh was talking about multiplication using the traditional algorithm for multiplication, so I noted to check his command of the following: *how to line up; what number to start with; how to redistribute numbers; extra zero; addition.*

Then, I'll ask the student what they want to teach me about traditional algorithm multiplication, and I'll cross things off my bulleted list as the student works and describes their process. If they miss concepts or steps, we'll go over them together, and I'll mark them down as things to look out for in the student's work in the future.

—Caroline

What About You?

Pause for a minute, and think about a recent or current tutoring experience. Considering the Strategies to Try that we have suggested and the In Action that we have described, what approaches might have helped or might you try next time?

Research Spotlight



Students who have difficulty learning mathematics often lack important conceptual knowledge. To spot patterns of mistakes, researchers Howell et al. (1993) make several helpful suggestions for conducting diagnostic error analysis.

- Collect three or four samples of student work on a particular type of problem.
- Ask the student, with no cuing, to verbally walk you through their thinking process.
- Considering both written and oral responses, look for patterns of common errors or misconceptions.
- Consider any exceptions to the pattern that might indicate partial understanding of the procedure or of a basic concept.
- Make some notes about the patterns you identified, and try to pinpoint any common procedural errors or conceptual misunderstandings.
- Finally, find convincing ways, often using prior understandings, concrete materials, or pictures, to help the student understand any errors or misconceptions.

Responsive Tutoring: Diagnosing Strengths and Needs

Common Challenges and Solutions

If . . .	Try This . . .
Your tutee is embarrassed by what they don't know and starts to shut down.	You can say "You know what? This task is pretty complex. Let's start with a simpler piece of it and work our way up." You can add that this is really helping you find the line between what is understood and what needs to be developed.
You contact the student's teacher more than once and don't get a response.	Try asking the parent to send a note to the teacher, cc'ing you, and explaining why 5 minutes to help their child would be much appreciated. If a teacher continues to be unresponsive, try asking the parent for recent test scores.
The parent seems content to let you take the lead as the tutor and expects you to do all the work.	Thank the parent for their commitment to their child and explain that you fully expect to do the lion's share of the work; however, suggest that the experience can be much more successful if the parent checks and helps with homework, asks for and reviews test papers, and tries to keep informed on how the math in school is going so that you and they become a team.
Your tutee often responds with something like "Oh, I know that already" and you think they are trying to avoid dealing with the math.	Respond with "That's probably true, so here's a problem to check that we can agree that this one goes on the 'got it' side. Okay?"
You find yourself unable to identify the underlying difficulties your tutee is facing after trying the four strategies.	Consider asking the questions in a different way or using different terms. Sometimes it's the vocabulary causing the trouble; at other times, it's that the skills are there but knowing how to apply them to a problem is the sticking point.

THREE KEY TAKEAWAYS

1. It will likely take many hours of working together to discover exactly what a student needs help with and exactly what a student's strengths are. Trust the process.
2. You are only one portion of a student's mathematical journey. If parents or caregivers are hiring you, or if a school or district has assigned you to tutor struggling students, it's likely because they've exhausted other options. Parents have experienced late-night breakdowns. Teachers do what they can every day, but you are here because you can maintain a detailed analysis of a student's challenges and assets. You are the child's content expert. You are their rock.
3. Never dial down your role as a diagnostician. As students learn more skills, they will develop additional or new weaknesses. It's our job to stay vigilant and to identify these challenges early on. This is why consistent communication with caretakers and teachers is important and why open communication with students is vital.

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