

What Your Colleagues Are Saying . . .

“This book is the complete guide for well-developed math instruction for single students or for small groups of students. The book not only emphasizes the basic needs of the students, building relationships, but incorporates all the important elements of math instruction in the 21st century.”

Jaime M. Miller

Math Interventionist, Marlborough Public Schools
Marlborough, MA

“Clear and concise! Highly recommend for new and experienced tutors.”

Laura Hatheway

Educational Consultant, Lecturer, and Instructional Coach
California State University—Sacramento
Sacramento, CA

“This one-of-a-kind book is the ultimate guide to achieving the ‘Oh! Now I get it!’ moments every tutor strives for. The intergenerational duo Steve and Caroline provide readers with a perfect mix of research and practicality.”

Susan Looney

Creator, Same But Different Math
Founder, Looney Math Consulting
North Falmouth, MA

“This book adopts an asset-based approach to tutoring support. Firmly rooted in research and best practices in math tutoring, it also humanizes tutoring support by offering real-life examples and strategies. It provides guidance on fostering strong relationships between tutors and students, and techniques for reducing and eliminating anxiety. This book effectively links strategies, actions, and research to promote successful tutoring.”

Robert Q. Berry III

Dean & Professor, College of Education at the University of Arizona
Tucson, AZ

“Thank you, Steve and Caroline, for such a practical and robust guide for tutors of mathematics, written so that tutors of various experiences can effectively support their learners. Each section offers many excellent suggestions that focus on developing the learners’ competence and confidence—an excellent resource for school tutoring programs as well as professional tutors!”

Jennifer M. Bay-Williams

Professor, University of Louisville and Author
Louisville, KY

“Steve Leinwand brings the wisdom of experience, and Caroline Welty brings empathy with students, together creating an essential guide for math tutors. They demonstrate how math tutoring isn’t just social or cognitive work but both simultaneously, and they’ll show you how to excel at it.”

Dan Meyer

Vice President of Teacher Growth, Amplify
Oakland, CA

“Finally, a toolkit for tutors that offers practical strategies, concrete examples, and tips to create an asset-based lens that cultivates positive math dispositions. Grounded in research, this guide considers different types of learners, the role of math anxiety, and the importance of relationships in a successful tutor–tutee relationship. *The Math Tutor’s Handbook: Strategies and Tips for Success* is a must-have resource for tutors looking to create productive, positive, and engaging tutoring sessions.”

Alison Mello

Math Consultant, Alison Mello Consulting
North Attleboro, MA

THE
MATH
TUTOR'S
HANDBOOK

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HANDBOOK

STRATEGIES AND TIPS FOR SUCCESS



STEVEN LEINWAND AND CAROLINE WELTY

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Steven Leinwand is a principal research analyst at AIR, the American Institutes for Research, in Arlington, Virginia, and has more than 40 years of leadership positions in mathematics education. He currently serves as mathematics expert on a wide range of AIR projects that focus on high-quality mathematics instruction, turning around underperforming schools, evaluating programs, developing assessments, and providing technical assistance for school improvement. Leinwand coauthored “What the United States Can Learn From Singapore’s World-Class Mathematics System (and What Singapore Can Learn From the United States).” He has spoken and

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Leinwand is an author of several mathematics textbooks and has written numerous articles. His books *Sensible Mathematics: A Guide for School Leaders in the Era of Common Core State Standards* and *Accessible Mathematics: 10 Instructional Shifts That Raise Student Achievement* were published in 2012 and 2009, respectively. His most recent, *Invigorating High School Mathematics: Practical Guidance for Long-Overdue Transformation*, coauthored with Eric Milou, was published in 2021. In addition, Leinwand was the awardee of the 2015 National Council of Supervisors of Mathematics Glenn Gilbert/Ross Taylor National Leadership Award for outstanding contributions to mathematics education and has been awarded the 2021 NCTM Lifetime Achievement Award.



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Introduction

Dear Readers,

Welcome to the amazingly gratifying world of tutoring mathematics. Whether you are just starting out or have years of experience, our goal is to reaffirm for you the joy of this role and provide a wealth of practical strategies you can grab-and-go for your very next session.

What sets this book apart is the authorship: We represent two generations coming together to write a resource that has both the wisdom of decades (Steve) and the “with-it” insight into today’s learners (Caroline). Steve was born in 1949; Caroline, his granddaughter, came into the world in 2007. You do the math! That is quite a generation gap. One is a Beatlemaniac, the other is a Swiftie. One is a renowned math leader, the other a sought-after tutor getting ready for college. Yet what closed this potential divide was a shared belief in the power of tutoring.

For both of us, tutoring affords the one-on-one teaching and learning context that can bring about a sense of mathematical empowerment in *every* student. As we began dreaming up this book, we spent many hours in a family living room in North Carolina during the pandemic lockdown, whittling our pedagogical beliefs to a smoothly carved set:

- Building strong relationships is essential.
- Diagnosing strengths and needs is critical for maximizing the impact of tutoring.
- Effective tutoring is built on holding high expectations, stoking children’s self-confidence, and reducing math anxiety at every turn.
- While correct answers are obviously one goal of learning math and of effective tutoring, the ability to explain and justify answers and demonstrate an understanding of why a process and an answer are correct is equally important.
- The secret to a satisfying life is the secret of successful tutoring: Be curious, ask lots of questions, and deep learning will ensue.
- Mathematics is like a Mozart piano sonata. The mathematician, like the musician (and we both play the piano), doesn’t merely follow the printed score. They envision, wonder, solve, operate, intuit, improvise, collaborate. Only then if they are asked, “Can you play again that way?” they can. Because they know how they got there; they can explain and justify every move.
- Mistakes are expected, valued, and inspected as critical parts of learning and never considered “bad” things.

- Mathematics is known to be an ordered universe, and yet the cosmic joke is that it's best understood through myriad alternative approaches and myriad alternative representations that fit the brains and learning patterns of each student you tutor.

When we were brainstorming this book, we kept returning to a phrase we've each heard hundreds of times: "Ohhhh . . . now I get it." That's the moment in tutoring when you know the student's mental lightbulb goes off, a mistake is fixed, a concept is clarified, or a misconception is resolved. It's the moment when all the hard work becomes worth every moment invested.

It's our deepest wish that this book brings about those aha moments often for the students with whom you work.

Sincerely,



Steve Leinwand



Caroline Welty

PART 1

PERSONALIZING TUTORING

Tutoring offers you a unique opportunity to personalize instruction for a unique learner. The one-on-one context is a boon to students because every minute is devoted to furthering their skills and confidence. We chose the words *skills* and *confidence* deliberately because these two facets are like two sides of a coin. Tutors develop these assets in students through the teaching-learning relationship. Many of the students you will tutor are diffident, unconfident. They are there because someone has noticed their struggle. The relationship is the key that unlocks their potential!

Your role is twofold:

1. You shore up the math skills that give them confidence.
2. You shore up the confidence that gives them the emotional mindset for acquiring a skill.

You can't do that unless you truly know the students—their interests and personalities, their favorite sports, authors, singers. All the things that put a spring in their step and convince them that you understand them, they can trust you, and you care about their well-being.

Accordingly, in this first part of the book, we focus on the following interpersonal aspects:

- Building relationships with those we tutor
- Diagnosing their strengths and needs
- Reducing, if not eliminating, math anxiety so each learner can succeed

As this book goes to press, there is a great deal of hope and hoopla about artificial intelligence and machine tutoring. Yet we remain convinced that no one is better than you, the dedicated tutor who picked up this book. No machine and no software can outperform you—a caring, knowledgeable, human tutor, interacting face-to-face with an equally human student.



Source: istock.com/SDI Productions



Building Relationships

Go into the first sessions assuming the tutee is nervous and insecure about their math skills. Know that the student craves a safe connection. All students want to be accepted and liked.

Why?

Building a good relationship is the most important component of tutoring. We are literally wired to use human connection to aid cognition. Studies using functional neuroimaging techniques have yielded an array of intriguing ideas on how educators can optimize learning (Carew & Magasmen, 2010; Um et al., 2012). The studies measure such things as facial and vocal expressions, gestures, and heart rate, in response to different stimuli in a learning setting. Suffice it to say, the brain itself has a complex emotional operating system!

Yet researchers caution us from rushing from this research to simple conclusions about teaching. For example, although it's true that positive emotions facilitate learning, there is more to it: Recent studies show that a negative learning state (confusion) can also improve learning because of an increased focus of attention on learning material (D'Mello et al., 2014). When a student is confused, this is a form of cognitive disequilibrium. When such confusion occurs, a learner has to work through the fog to a new understanding through a process called productive struggle. We call it productive struggle because it requires just the right amount of thinking and problem solving to clear up misconceptions without getting so frustrated that the brain shuts down. It is a motivating form of cognitive work.

In other words, it's all a matter of degree; too much confusion and stress impairs learning, but just the right amount can aid it.

What does all this mean for you? You only need to know this little bit about this brain research to see that your relationship with the learner helps you strike just the right balance of positive reinforcement and healthy challenge.



Too much confusion and stress impairs learning, but just the right amount can aid it.

Let's look now at four strategies that help you build a good relationship.

Strategies to Try

The following four strategies are all based on the premise that you want to be naturally yourself so students can be themselves. You can use some of them, all of them, or mix and match as time goes on. You don't have to be stand-up comic funny or be their instant bestie. You are working to build their confidence and their trust in you.

Listen, Look, Lean in

Think of yourself as the most wide-awake detective. You develop the relationship by noticing everything the student does. Every question missed, every comment, furrowed brow, pause, sidebar story, misgiving, or redirection from the student is information that can allow you to personalize the learning experience. Therefore, the first step in building a personal relationship is absorption. Become a sponge. Soak up as much as you possibly can about the learner. Of course, the usual questions and responses to answers but also the not-so-usual stuff, such as test scores, emotions attached to test scores, classroom experiences, hobbies, friends, and how they feel about learning in general, math, and school.

Ice-Break With Questions

It can be hard to know which topics to begin with, but here are some we've had success with. In the first few sessions, it's good to jump right in, even if it seems awkward to pose a series of questions. We promise this curiosity will pay off in the long run.

- ▶ Do you play any sports? Do you play them at school or outside of school?
- ▶ Do you play an instrument? Do you play it at school or outside of school?
- ▶ Do you have any pets? What are their names?
- ▶ Where is the coolest place you've been? Where is a place you really want to go?
- ▶ What's your favorite movie/book/TV show, and why do you like it?

- ▶ If you could choose one book to live inside for the rest of your life, which book would you choose, and why?
- ▶ If animals could talk, which one do you think would have the best jokes, and why?
- ▶ If you could create a new holiday, what would it be called, and how would people celebrate it?
- ▶ If you had to eat one type of cuisine for a year, which would you choose?

Each time you meet, begin by asking a question to discover how the learner is doing. Ask some variation of “How was your week?” or “What did you do this past week?” and expect to use follow-up questions to gather additional details. Doing so enables the tutee to keep opening up about their daily lives, and you get a bead on the learner’s current activities and mindset.

Open With a Question of the Day

Another option is having a Question of the Day. With this strategy, you and the tutee spend the first 5 minutes discussing lighthearted things like your least favorite days of the week, best pizza, worst movie, and what name you would change yours to if you could. The strategy works especially well with elementary school students. (See Chapter 5 for more on this strategy.)

End With a Friendly Question

At the end of tutoring sessions, try to leave 2 or 3 minutes to see what plans your tutees have for the upcoming week. For example: Are they doing something fun over the weekend? Do they have their season-opener basketball game? Does their little brother have a band concert? Whatever activities they have planned, having them share about something you can ask them about in the next session is always helpful for building your relationship.

In Action

My first experience as a tutor was with two girls in Grade 4, Maria and Alison. All I knew about them was that they were falling behind in math class. Their parents conveyed they especially needed help with solving word problems. I also knew that if we were going to have any chance of growing together, I needed to know a lot more about them than that. So, for the first 15 minutes of our tutoring session, I asked them personal, non-math-related questions and shared about myself when appropriate.

I learned that Maria was a good tennis player, she was playing in a tournament that weekend, she had a video with over a million views on TikTok, and she’d recently become an aunt. I discovered that Alison was a dancer and a pianist, she took a rapid Covid test every morning, her grandparents lived in Oklahoma, and her dance school

(Continued)

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was going to Disney World next year. This one discussion transformed both girls from tutees to real people and, just as importantly, transformed me from a tutor that their mom found to a caring person who wouldn't make them feel bad about math.

Over the next two years tutoring them, I learned more about them, their interests, and their families. Every conversation we had after the first one was built off what I had initially learned about them. In this manner, I gradually became a big sister and mentor, in addition to trusted tutor.

—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



Researcher John Hattie (2018) proved that the student–teacher relationship is absolutely key to improving learning outcomes. In his groundbreaking meta-analysis (which is a study of studies), he demonstrated that any teaching practice above a score of 0.40 is “high impact.” That means it has the power to help a student gain more than a year’s worth of growth. The student–teacher relationship scored 0.52! It makes sense that the one-on-one nature of tutor–tutee is potentially even more highly influential.

Responsive Tutoring: Building Relationships

Common Challenges and Solutions

| If . . . | Try This . . . |
|---|---|
| Building a personal relationship with your tutee feels stilted. | Name the awkwardness! It can break the ice when you come right out and say how silly it is. You might say something like, “I know I’m asking a lot of questions” or “It’s kind of funny that I’m asking all these questions that have nothing to do with math.” |

| If . . . | Try This . . . |
|--|--|
| Your tutee seems very nervous. | Get them talking about what they like to do (sports, TV, movies, any hobbies) and keep building the exchange on that. |
| Your tutee seems reluctant to share information. | Share something about yourself. Tutoring is all about giving and taking so that when your tutee understands that tutoring is a safe and comfortable space to build a personal relationship, they are likely to be more willing to open up. |
| Your tutee seems to be bored with what you or they are doing. | Confront the boredom directly by noting with a smile, “You seem pretty bored by this work. Can you tell me why you think you’re tuning out?” Hopefully, this provides you with insights as to whether the student needs greater challenge or is masking not understanding something. Let the tutee know it’s okay to be bored sometimes. It is also an opportunity for you to switch gears. Liven things up, try a different approach, or switch topics for the session. |
| You catch yourself talking too much and dominating the discourse. You realize that you aren’t really learning much about your tutee. | Pause and move from telling or explaining to probing and questioning. (See Chapter 8 for more on asking questions.) We learn a lot more from answers to our questions than we do from watching them listen to us! In math, our questions help us learn how they process math. And when we ask questions about their lives, we are also learning about how they tend to navigate challenges and triumphs in other settings. |

THREE KEY TAKEAWAYS

1. Personal relationships are the most important part of tutoring. As a tutor, your actions communicate that you care, that you are interested in what they have to say, and that you respect them as people.
2. Students are less scared to make mistakes when they trust you. Once that trust is in place, they more readily share their answers and confusions.
3. Spending 45 or 60 minutes outside of school getting coached takes stamina. When the tutee looks forward to their collaboration with you, it helps them lean into the challenge of understanding the material.

