What Your Colleagues Are Saying . . .

This book will be a game-changer for secondary mathematics teachers. I especially appreciate the inclusion of activities that integrate SEL and UDL and explain how they can be uplifted in instructional practices. Implementation of the practices described will indeed transform math instruction in 6–12 classrooms.

Latrenda Knighten
President, National Council of Teachers of Mathematics (NCTM)
Baton Rouge, LA

Kudos to Michael D. Steele and Joleigh Honey for this hands-on guide! They give us concrete tools for shifting our beliefs, implementing classroom routines that operationalize what we say we believe, and collaborating to re-envision the systems we operate in. Whether you work in one classroom or support teachers in many classrooms, you'll want to include this invaluable resource in your must-read pile.

Cathy Seeley
Past President, NCTM
McDade, TX

Our education lexicon is filled with often overused—and seriously misunderstood—terms like *rigor, differentiation,* and (sadly) *asset-based*. Fortunately, in this accessible, practical, and powerful book, Steele and Honey help us convert "asset-based" into a way of thinking and acting that can truly transform our interactions with students and classes.

Steven Leinwand
Principal Researcher, American Institutes for Research
Washington, DC

Steele and Honey's book on asset-based language, routines, and systems expertly weaves together best practices for mathematics instruction and diverse learners. The care and attention to detail for how each decision we make can be grounded in an asset- or deficit-based perspective is something that can impact the trajectory of all of our students. I can't wait to have my teachers dive into this book, and wish it was something I had early in my career to help me see how each of these components work together to create an asset-based learning environment. I know this book will be a tool used to strengthen instruction and bolster the mathematical identities and futures of students whose teachers choose to leverage its potential.

Melissa Robbins
Director of Mathematics, LEAD Public Schools
Hermitage, TN

Steele and Honey have successfully shown us how we can take the assets-based views of teachers and students advocated by organizations like NCTM, NCSM, ASSM, and AMTE and turn them into practical actions every teacher and leader can take to make our math classrooms more equitable and student-centered.

Paul Gray
Past President, NCSM: Leadership in Mathematics Education
Dallas, TX

This book is a great resource for taking educators through the change process of using asset-based language, routines, and systems in place of the current practice. The inclusion of strategies for a variety of stakeholders (teachers, math coaches, district personnel, state personnel, the community, and more) makes this book a valuable tool that can be used for professional learning community (PLC) work and book studies. Its connections to aspects of social-emotional learning (SEL) and universal design for learning (UDL) math provide added value. This book is a must-have.

Shelly M. Jones
Professor, Connecticut State University
Hamden, CT

I believe in students and will bet on them being capable of grade-level work every time. We should all teach in a way that embraces what students bring with them to our classrooms. This book supports teachers in shifting their practice so that it supports positive student identity through asset-based actions.

Travis Lemon
Teacher, Instructional Coach, Author Consultant, Alpine School District
Lehi, UT

The authors exhibit a strong yet non-judgmental understanding of the unintentional consequences of status-quo deficit-based situations, and gently guide the reader to easy-to-implement alternatives that better support the desired outcomes of all educators: more students finding the joy and beauty of mathematics as they learn content deeply. Read this book now and do what you can. Not only will student outcomes improve, but educators who are tired and burned out will find new joy and energy in this important work.

Joanie Funderburk
Strategic Alliance and State Policy Director, Texas Instruments
Past-President Colorado Council of Teachers of Mathematics Affiliates
Coordinator, NCSM
Littleton, CO

This book makes you think about the messages students get from their teachers, schools, and school system structures. Could you unintentionally be sending students negative messages? Dr. Michael D. Steele and Joleigh Honey support you to reflect and adjust actions and practices at all levels of the systems to make sure all students know they are valued and have potential for mathematical brilliance!

Katherine Arrington
NCSM President
Director of Systemic Transformation,
Charles A. Dana Center at the University of Texas at Austin
Austin, TX

Transform Your Math Class Using Asset-Based Teaching for Grades 6–12 provides practical, applicable strategies that support teachers in keeping students at the forefront of our decision-making. In our dynamic, diverse world, this book provides math teachers with tools that can meaningfully transform their practice and empower *all* students to see themselves as doers of mathematics.

David Dai
Math Instructor, Mobile County Public School System
2022–2025 NCTM Board Director
Mobile, AL

This book is a must-read for anyone who is ready to truly transform their secondary mathematics classroom and leverage the mathematical assets of learners!

Lindsey Henderson
Secondary Mathematics Specialist, Utah State Board of Education
Salt Lake City, UT

Whether you are new to asset-based teaching or you've been doing your best to move in that direction for years, *Transform Your Math Class Using Asset-Based Teaching for Grades 6–12* will help you sharpen your understanding and implementation. It's truly an all-in-one practical toolbox to support and challenge individuals or groups of teachers.

Ted Coe
VP Academic Advocacy, Mathematics, NWEA
Scottsdale, AZ

The authors have done a masterful job of describing how an asset-based perspective can transform a classroom into an environment where students' thinking is elicited and used to advance their mathematical understanding and development of identity. The examples provide vivid illustrations of how the language we use, the routines we employ, and the structures we create make a difference in students opportunities to learn and grow. An eye-opening read!

Margaret (Peg) Smith
Professor, Emerita, University of Pittsburgh
Gibsonia, PA

This book is incredibly thought-provoking and will challenge the reader to carefully examine current practices. There are so many wonderful suggestions of relatively minor—but very significant and impactful—changes that can be made in the secondary classroom to be more asset-focused. The classroom vignettes and examples are especially powerful to help in putting the theory into practice.

Kevin Dykema
President, 2022–2024, NCTM
Math Teacher, Mattawan (MI) Consolidated Schools
Mattawan, MI

This book is a game-changer that equips us with tools to transform our classrooms into an environment where students' assets are prioritized. Steele and Honey invite us to extend our thinking by reflecting on, questioning, and enhancing the common routines and procedures we regularly implement. Both new and seasoned educators will gain valuable next steps to shift current practices and improve mathematics education for all students. The authors share their own experiences and learning journeys, offering tips to support educators with actionable steps toward creating a more asset-based setting that welcomes all learners to succeed.

Kristi Martin
Mathematics Teacher, Tumwater School District
Tumwater, WA

TRANSFORM
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ASSET-BASED TEACHING
FOR GRADES 6–12

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Preface

Teaching mathematics is a complex yet rewarding profession. We develop relationships and cultivate critical thinking among our students. But sometimes it is difficult—not just hard but *difficult* work. The complexity of our profession has become exacerbated since coronavirus of 2019 (COVID-19), and yet, somehow, while the world stopped, we did not. We learned new ways to engage students and found out that not everything we did before COVID-19 was always best for students.

The beginning of the authors' asset-based journey together began at a Conference Board of Mathematical Sciences (CBMS) meeting during the early days of COVID-19 when we were collaborating with a small group of presidents from different national organizations about the assets that so many teachers brought with them to support students during the pandemic. During the course of the next few years, we worked with teachers and other mathematics educators and national organization leaders to recognize the power and impact that asset-based language, routines, and systems have made for so many students and their families.

Thank you in advance for taking this journey with us and for creating space to reflect on ways to transform our math classrooms. The process of creating this book began a few years ago after our initial discussion in 2020, but what you will read in this book spans across many years (from the National Education Association Committee of Ten established in 1892 to research findings, interviews, and observations in 2024). We hope that your experience with this book represents our own in writing it. In the beginning, we saw the power in, but also the need for, stronger asset-based perspectives. Over time, we began to uncover areas of our own practice that were less asset based, even deficit based in some instances, than we may have liked. However, this awareness made it possible to gain new insights and consider ways to shift our work toward a more asset-based perspective. An outcome: Our personal lives have also become more asset based! We are more aware when we hear deficit language (which is different than constructive criticism), and we are more intentional in thinking about how we are expanding the sphere of belonging using asset-based perspectives.

Acknowledgments

None of the work you are about to read would be possible without the collaborations that both authors have had with secondary mathematics teachers during the past four decades. From our work as classroom teachers, curriculum developers, teacher educators, professional developers, and leaders, we have learned so much about the work of effective mathematics teaching and learning from the teachers with whom we've had the privilege of working alongside. The work of transforming classroom practice by leveraging students' mathematical assets is challenging, and the opportunities that we have had to bear witness to teachers doing this work in classrooms with students have transformed our own thinking about effective teaching practice. We're also thankful for our professional communities and associations that have trusted both of us with significant leadership roles, allowing us to build our networks, collaborate with colleagues, and better understand how to leverage student assets in the classroom. And of course, our thanks to Corwin and our editor, Debbie Hardin, for her tremendous support and attention to detail (including deadlines!).

Mike would like to acknowledge his wife, Amanda Cooper Steele, and their three children, Linnea, Robbie, and Gracelynn: My family has graciously stood by while I spent late nights and early mornings in the office behind the computer, not to mention the sometimes too-loud animated video chats with Joleigh! My wife and kids are a constant source of inspiration and joy, especially after long days and nights of writing, work in schools, or days on campus. I'd also like to thank three of my professional organizations, the Association of Mathematics Teacher Educators, the Conference Board of Mathematical Sciences, and the National Council of Teachers of Mathematics. The membership of each of these organizations put significant trust and faith in me as a leader, and it is that very leadership that connected me with Joleigh and led directly to the volume you are about to read. I thank my longtime mentor and friend, Peg Smith, who has been kind and generous over the years with her wisdom and collaboration. Peg's talent for listening to teachers, giving reflective guidance that advances thinking, and writing about research-informed ideas in meaningful and accessible ways has guided my own professional work and writing. I'm thankful for extraordinary school district colleagues like Jen Walton in Noblesville (IN) Schools and Kris Devereaux in

Zionsville (IN) Community Schools who have trusted me to foster long-term collaborations with their districts and teachers. It is in their schools and classrooms that my own thinking about asset-based learning environments has been shaped. And finally, to Kate Johnson and Cai Steele, who serve both as educator colleagues and dear friends (the former) and family (the latter), who have been powerfully influential in pushing my thinking about the assets that students (and teachers) bring to the classroom and how we attend to each and every student's needs.

Joleigh would like to acknowledge her husband, Andrew Marchant, and their three children, Alyssa, Dayne, and Fletcher: They have been supportive and encouraging throughout this process and have taught me many things about asset-based perspectives that have transformed my personal life. My husband has mastered being supportive while reminding me that part of this work is giving myself grace to step away. I would like to thank my colleagues (and second family) from the Association of State Supervisors of Mathematics. I have appreciated the many conversations I have had with this group of extraordinary peers on this topic. I would especially like to thank Mary Pittman, Andrew Byerly, and Becky Unker for their passion and feedback. I would like to thank members and the Executive Board of the Conference Board of Mathematical Sciences for always pushing my thinking. Whether we are discussing the Year of Math (2026!); diversity, equity, and inclusion; or opportunities for students to take courses that better align with their future interests, the conversations always put students first and epitomize asset-based perspectives. This includes bringing awareness to deficit-based perspectives that we may have been blind to before our conversation. I'd also like to thank the National Council of Teachers of Mathematics for their never-ending, ongoing pursuits to further the goals of this organization to support and advocate for mathematics teachers. I'd also like to thank Utah math teachers and my Math Vision Project family. For 30 years, I have felt supported and part of a very strong network of people who deeply care for students and strive for them to have a better future. Thank you for all you have taught me and continue to teach me. I'd also like to thank my friends who also love math education. We spend our time off talking about . . . math education, even when we are engaged in other activities. Thank you for your support and for pushing me to be a better human.

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Michael D. Steele is a professor and chairperson of the Department of Educational Studies in Teachers College at Ball State University. He is a past president of the Association of Mathematics Teacher Educators, current director-at-large of the National Council of Teachers of Mathematics, and editor of the journal *Mathematics Teacher Educator*. A former middle and high school mathematics and science teacher, Dr. Steele has worked with preservice secondary mathematics teachers, practicing teachers, administrators, and doctoral students across the country. He has published several books and research articles focused on supporting mathematics teachers in enacting research-based effective mathematics teaching practices.

Dr. Steele's work focuses on supporting secondary math teachers in developing mathematical knowledge for teaching, integrating content and pedagogy, through teacher preparation and professional development. He is the co-author of NCTM's *Taking Action: Implementing Effective Mathematics Teaching Practice in Grades 6–8*. He is a co-author of several research-based professional development volumes, including The *5 Practices in Practice: Successfully Orchestrating Mathematics Discussions in Your High School Classroom*, *Mathematics Discourse in Secondary Classrooms*, and *We Reason and Prove for All Mathematics*. He directed the National Science Foundation (NSF)-funded Milwaukee Mathematics Teacher Partnership, an initiative focused on microcredential-based teacher professional development and leadership. His research focuses on teacher learning through case-based professional development, and he has been an investigator on several NSF-funded projects focused on teacher learning and development. He also studies the influence of curriculum and policy in high school mathematics, with a focus on Algebra I policy and practice, and is the co-author of *A Quiet Revolution: One District's Story of Radical Curricular Change in Mathematics*, a resource focused on reforming high school mathematics teaching and learning. He works regularly with districts across the country to design and deploy teacher professional development to strengthen effective secondary teaching practice.

Dr. Steele was awarded the inaugural Best Reviewer award for Mathematics Teacher Educator and was author of the 2016 Best Article in *Journal of Research in Leadership Education*. He is an active member of and regular presenter for the National Council of Teachers of Mathematics, the National Council of Supervisors of Mathematics, and the Association of Mathematics Teacher Educators. He reviews regularly for major mathematics education and teacher education journals.

Joleigh Honey is an author and consultant and is in her 30th year as a mathematics educator. She is the immediate past-president of the Association of State Supervisors of Mathematics (ASSM), serves on the Executive Committee of the Conference Board for Mathematical Sciences, and is a current director-at-large of the National Council of Teachers of Mathematics. Joleigh has been a secondary mathematics classroom teacher, academic coach and specialist, PK–12 district- and state-level mathematics supervisor, and the PK–12 STEM coordinator and equity specialist for the state of Utah.

Joleigh is an author of *Open Up Resources High School Math*, a consultant for the Launch Years Initiative through the Charles A. Dana Center, and serves on the STEM Identity working group as a member of ASSM. Over the years, she has worked with teachers, specialists, and state supervisors across the country. She has designed and led professional learning focusing on equity, student engagement, and ensuring all students, including students with disabilities, have access to and success with meaningful course level content.

Joleigh was awarded the 2024 Lifetime Achievement Award by the Utah Council of Teachers of Mathematics and is an active member of and regular presenter for the Association of State Supervisors of Mathematics, National Council of Teachers of Mathematics, and National Council of Supervisors of Mathematics Leadership in Mathematics Education.

CHAPTER 1

Introduction to an Asset-Based Perspective

Welcome! The goals of this introduction are to welcome you to the community, introduce you to the "why" of this work, and explain how this book is organized. Much like we would advocate with our students, we'd like to start out by supporting you in thinking about what ideas and assets you bring to this work. This chapter will ask you to think about what asset-based perspectives mean to you, provide you with some of our thoughts, and give you a variety of frameworks and tools that may be useful to you as you build and grow your sense of asset-based perspectives and how they can support student learning in secondary mathematics.

There are many ways that you can use this book. You can read this book for pleasure or reflection, and we anticipate that you'll have many opportunities to add to and reflect on your own teaching knowledge and practice. We also encourage you to use the online study guide to have a more enriching experience individually or with colleagues, perhaps in a professional learning community (PLC).[1] However you are able to or choose to engage in the work, we welcome you to join the asset-based perspectives community.

online resources The online study guide for this book is available for download at https://qrs.ly/xyfid21

> *"Do the best you can until you know better. Then when you know better, do better." (Maya Angelou)*

Each chapter in this book will begin with some questions to consider. These questions are designed to guide and scaffold your thinking as you engage with the ideas in each section of text. We'll return to the questions (or similar versions of them) at the close of each chapter when we prompt you to Reflect, Apply, and Transform your thinking and practice.

[1] PLCs are defined and operationalized in a wide variety of ways. In some places, they're large umbrellas for smaller, coordinated groups of colleagues that teach a course or grade level. In other places, they encompass a department's worth of math teachers. We use PLC in this book in the most inclusive and expansive sense, accommodating those two examples and the many variations between. Engaging in this text with your PLC colleagues brings value, no matter what the size and shape of your PLC.

Questions to Consider

1. What do asset-based perspectives mean to you?
2. How does the language we use, the instructional routines we implement, and the classroom, school, district, state, and national (federal) systems we work in impact student outcomes?
3. Why are asset-based perspectives critical in mathematics education?

What are some things you do differently because you now "know better"? I (Joleigh) have many experiences of this in both my professional and personal life. Professionally, this is my 30th year in education, and it is almost hard to recognize the person I was when I started on this journey as a mathematics educator. One example (of thousands) of where I do better now is classroom management.

When I started teaching, I remember writing names on the board when students were disruptive and placing check marks by their names if the disruption continued. I had a whole structure to this system. Writing someone's name on the board was a "warning" and then a check meant some form of a consequence, with additional checks adding to the consequence. I never felt comfortable doing this, so I rarely did even though this strategy was my primary form of classroom management during my first couple of years as a teacher. It was also a common practice in my school (when I was a student in high school in South Carolina and during my first couple of years as an educator in Utah). I knew teachers who never wrote names on the board and others who had a list daily. I don't know anyone who does this now and would say that this is an example of when our system learned better classroom management strategies, we did better (Terada, 2020). My classroom management is ongoing. Today, I use assets and strengths to focus on building inclusive relationships, engaging students with meaningful, relevant math contexts, and valuing student contributions that position all students as capable of being doers of mathematics. I continue to learn what to do (be present and pay attention so that I recognize the needs of individuals and the group) and what not to do (react to minor distractions).

I continue to learn better when I reflect on my *decisions*, *self-awareness*, and *self-management*, and I reach out to others to support my growth. These Social Emotional Learning (SEL) strategies (CASEL, 2024) have helped me become more intentional in my work. For example, I am more self-aware of my actions and recognize my strengths and areas I want to improve. My strengths include listening to student ideas, hearing what they do know, and cultivating a classroom environment that embodies a community of learning. I am also aware that I can become anxious with everything that takes place in a classroom and do not always recognize when individual students are having a hard day. I am also not as good as I'd like to be at pausing and celebrating student successes within and outside the classroom. I continually think about responsible decision-making when it comes to pacing a lesson and about attending to ensure all students are positioned as contributors in small group and whole group discussions, as well as about the million other choices we make that impact student outcomes. Over time, I have increasingly come to value the importance of relationships. Students and colleagues have provided many lessons that have transformed this work from a job to a rewarding career.

Many people have contributed to my growth in asset-based perspectives throughout the years. Over time, and through my collaboration with my co-author Mike Steele, I have come to synthesize asset-based perspectives that fall under these three main categories: Language, Routines, and the Systems in which we teach.

ALIGNMENT EXERCISE: WHY ASSET-BASED PERSPECTIVES?

Each chapter of this book includes an Alignment exercise. The purpose is to engage in a reflection or an activity aligned to the chapter. A supplemental study guide aligns with all of the activities included in this book that you can download and use as a resource. The study guide provides you with additional reflective activities that you can engage in by yourself or if you are working with a group of colleagues.

online resources — The online study guide for this book is available for download at https://qrs.ly/xyfid21

In Chapter 1, the Alignment exercise is an introduction to the book. We will consider our current understanding of asset-based perspectives, including what they are and why they are essential. Pause and reflect on the following questions before reading the rest of the chapter.

■■■ Try This

Reflect on the following questions:

1. What does it mean to have an asset-based perspective?
2. How are asset-based perspectives similar to and different from a strengths-based or growth mindset view? What other education initiatives seem similar (or contrary) to asset-based perspectives?
3. Why is an asset-based perspective essential in education today? ■

We hope this exercise elicited your understanding of asset-based perspectives and how they are similar yet distinctively different from other constructs. Let's unpack each of these questions a bit. In doing this, we are sharing with you our experiences and the input of other experts in the field. The answers to these three questions are our answer to the *why* of writing this book.

WHAT DOES IT MEAN TO HAVE AN ASSET-BASED PERSPECTIVE?

Asset-based perspectives mean starting with what's already there or what is known instead of focusing on what's missing. To start with what's there, we must first learn to listen for the reasoning and sense-making of the person or people we are communicating with. We ask questions or engage in a task that surfaces ideas that engage students in activating background knowledge. This work recognizes that all students bring prior experiences, strengths, talents, and resources to the learning process and can contribute meaningfully in an authentic learning environment (Association of State Supervisors of Mathematics & Association of Mathematics Teacher Educators, 2024). Student thinking is central and is valued. Mathematics learning environments that are asset based feature students and teachers using language that draws on mathematical strengths and teachers using routines designed for students to surface those strengths and build meaningfully on them toward new learning goals. In asset-based learning environments, the teacher facilitates discussions that amplify what students know and aligns and builds those ideas toward the lesson's content goals and learning progressions.

This book will provide multiple aspects of using asset-based perspectives that increase student outcomes through the lens of language, routines, and our systems. In future chapters, we will highlight that specific language, routines, and systems are not strictly asset or deficit based but their use falls somewhere along a deficit-to-asset continuum. Changing our classrooms is not necessarily about discarding old practices and adopting new ones; it can also be about reshaping and revising existing practices to better reflect asset-based perspectives. We'll use illustrations of this deficit-to-asset continuum throughout the book to remind us all that adopting asset-based perspectives is about a continuum, or a movement over time, not about flipping a switch.

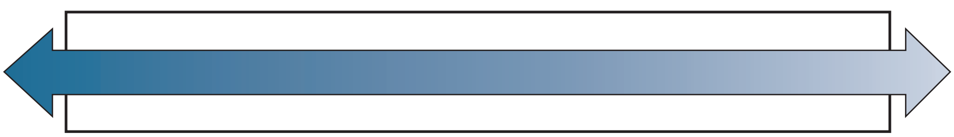


Table 1.1 compares key features of asset- and deficit-based perspectives. The distinction is not about who we are as educators but about how we attend to situations. Do we start with what is accurate or good with a situation, or do we start with what is inaccurate or missing? Do we listen and use student thinking, or do

we tell steps and say things like "This is easy" or "You just have to follow these steps"? The overview is a first step to reflect on our practices, as well as to do better when we know better. My own efforts are to be more aware when I (Joleigh) am using deficit perspectives and to do my best to shift to be more intentional with implementing asset-based perspectives. As you read Table 1.1, what does the asset-based perspective look like in a classroom? What does the corresponding deficit-based perspective look like? How would an intentional focus on using asset-based perspectives enhance your practice? What would it mean for your classroom and your math department or school?

TABLE 1.1 Characteristics of Asset-Based Perspectives and Deficit-Based Perspectives

ASSET-BASED PERSPECTIVES	DEFICIT-BASED PERSPECTIVES
Center students' current understandings and work	Focus on errors, mistakes, or incomplete thinking as something that needs to be immediately repaired
Consider students' current state of understanding as a foundation on which to build	Center what students *should have done* rather than what students did
Instructional routines are implemented with the mindset that students have lived experiences and funds of knowledge to draw from	Instructional routines are implemented with the assumption that students do not have funds of knowledge to draw from
Provide students with clear feedback about their current performance and how to build on it	Teacher lesson notes perceive deficits or lack of knowledge in student work without a clear path to improve
Teacher voice and actions strengthen students' identities as competent doers of mathematics	Teacher voice and actions foster fixed-ability mindsets and negative mathematics identities
Recognize that students can be successful in any math pathway and that they select courses based on their interests	Label students and place them into tracks based on perceived ability

HOW ARE ASSET-BASED PERSPECTIVES SIMILAR TO AND DIFFERENT FROM A STRENGTHS-BASED OR A GROWTH MINDSET VIEW?

All three of these constructs have much in common. They all impart the value of believing in students and promote the importance of thinking and reasoning as central to deeply learning mathematics. All three, implemented in concert, result in students experiencing joy, beauty, and wonder in mathematics. To truly transform our classrooms, we must recognize the differences between each of these. Let's look more closely to see how each is unique.

Mindset is about how individuals see the world. According to Carol Dweck (2016), individuals who believe their talents can be developed (through hard work, good strategies, and input from others) have a growth mindset. Those who develop and cultivate a growth mindset achieve more because they try more and are less worried about "looking smart" (O'Keefe et al., 2018). They recognize mistakes as opportunities for learning. Conversely, a fixed mindset is when individuals think that talents or interests are inherent in a person. A conception about this work, or education initiative, is that people either have a fixed or a growth mindset. This conception needs a tweak: Everyone is a mixture of fixed and growth mindsets, continually evolving with experience (Dweck, 2016).

A distinction between *asset-based perspectives* and *growth mindset* is that in an asset-based perspective, we always start with what students know. In a growth mindset space, we believe students are capable, but our lens is from the space of considering what is not known. . . yet (Boaler, 2022). This small distinction is quite important. Although both recognize that students can be successful in mathematics at high levels, how we enter the work is different.

Strengths-based perspectives are similar to asset-based perspectives in that they both start with what students know as opposed to what is missing. A strengths-based focus uses an appreciative inquiry model in which we first identify and then focus on using one's strengths to support learning (Kobett & Karp, 2020). Examples of different types of strengths that leverage students funds of knowledge include focusing on quantitative reasoning, structural thinking, and repeated reasoning (Kelemanik et al., 2016) or on disposition, processes and practices, and content (Kobett & Karp, 2020). Asset-based perspectives, such as those described in this book, pay greater attention to how we emphasize student choice, which may or may not align with specific strengths, when engaging in mathematics (more about this later!).

We feel there is great value in both strengths-based and growth mindsets. This book, however, takes a deep look into how asset-based perspectives can transform the thousands of decisions we make each day. We can look at the decisions we make in each teaching moment as having a particular location on the continuum of deficit-to-asset perspectives. These decisions and how we operationalize them impact students and our work in the classroom, as well as across our educational system. These decisions can either resonate with one another or clash, which can result in neutralizing or negating important asset-based efforts. Throughout each chapter, we stop, step back, and pay attention to our beliefs and notice where they do and do not align with our behaviors. We will analyze structures and identify shifts that can transform outcomes for students and teachers. This work recognizes that one's identity and strengths in mathematics are not fixed but change with experiences. We will address methods for building strengths and cultivating a positive mathematics identity, meaning that we position students so that they see themselves, and others see them, as capable (Aguirre et al., 2024).

WHY IS AN ASSET-BASED PERSPECTIVE ESSENTIAL IN EDUCATION TODAY?

We need asset-based perspectives because we live in a world that is different than it has ever been. Our previous systems of schooling, particularly in mathematics, were built with the express purpose of identifying who was equipped for further mathematical study and who was not. This system inherently embodied deficit-based perspectives. These systems have resulted in countless students seeing themselves as incapable of making sense of mathematics and of valuing its role in the world. If we didn't need asset-based perspectives in teaching mathematics, we would have far more students saying that they enjoy math and that they see why learning math is helpful to them in their lives than the minority of students who report so now. We would have far fewer people saying they are not good at math.

I (Joleigh) have interviewed close to 1,000 students in several states over the years about their experiences in math in my role as a state mathematics supervisor, an author, and a consultant. Most students have expressed that they take math either because it is required or because it will help them in their next math class (or to get into college). Students generally do not describe math as something that is currently meaningful to them in their lives. How do we stop the perpetual message that math is only for a few or that math is about getting an answer? We stop the myth that math is only for some and that it is only about computation through asset-based perspectives. We need asset-based perspectives for students, and we need them for ourselves. Asset-based language, routines, and systems have the power to transform our classrooms and how our communities view mathematics.

Asset-based perspectives resonate strongly with the strategies described in the CASEL Social Emotional Learning (SEL) Framework (2024) mentioned earlier in the chapter. Starting with ourselves, we need time to self-manage, make responsible decisions from a larger perspective, reflect on our self-awareness, *increase* our social awareness, and build relationships. Using this framework also allows us to develop these skills in our students while increasing engagement and content knowledge for all of our students. Yes, every student. Therefore, we need to create learning environments to empower each student and learn how to enhance their experiences so that they have access to and success with content.

Asset-based perspectives can shift our work from being overwhelming to being full of joy. Instead of focusing on fixing perceived mistakes or deficiencies one individual at a time, we build a community of learning in which students process concepts, make conjectures, and construct viable arguments. The community is structured using ideas and strategies that enhance learning. The teacher provides a classroom environment that cultivates a community of learning in which all students are positioned as meaningful contributors. Likewise, students are responsible for communicating their reasoning and building their understanding from the community via speaking, reading, writing, and listening. They also extend and refine their thinking, just as mathematicians do. Using asset-based perspectives doesn't mean that we all already have the answers but that we can all reason about mathematical ideas and modify our conceptions as we learn new information.

Our journey will focus on asset-based language, routines, and systems that promote positive mathematics identities and support the learning of meaningful mathematics content. In *Catalyzing Change* (National Council of Teachers of Mathematics [NCTM], 2018), the authors discussed the importance of a positive mathematical identity and defined mathematical identity as:

> *the way in which people think of themselves in relation to mathematics: Having a positive mathematical identity means that people feel empowered by mathematics and as doers of mathematics, see the multiple purposes for learning mathematics, appreciate why mathematics is important in their lives, and come to believe that they can succeed in mathematics. (p. 25)*

ORGANIZATION OF THIS BOOK

Throughout our research and discussions with fellow mathematics educators, it has become clear that language, routines, and systems implementing asset-based perspectives can elevate student outcomes and increase morale among all involved in mathematics learning and teaching.

PART 1: ASSET-BASED LANGUAGE

In Part 1 of this book, we address asset-based language. The language in our classroom, school, and the larger system all contribute to our perceptions about mathematics and one's abilities. The first section of this book takes a closer look at the norms in our classrooms that communicate our beliefs, how we attend to the development of academic language, and the conversations we have about mathematics and our beliefs about the abilities of our students.

- Chapter 2: Mathematics content and asset-based language intersect. We provide examples of how language can be both mathematically meaningful and precise and build on and honor the language assets students bring to the classroom.
- Chapter 3: Specific teaching moves can be used to build on students' language assets in the moment-to-moment work of teaching. We focus on these in this chapter.
- Chapter 4: Analysis of our language choices and how they evolve and change over time. We consider the language that we use to discuss specific groups of students and ways to describe student groups and students performance that focus on student assets.

PART 2: ASSET-BASED ROUTINES

In Part 2 of this book, we address asset-based routines. Our classrooms' routines include those that are structural, those that are instructional, and the combinations of certain routines that become practices.

- Chapter 5: Structural routines guide our daily decisions in our classrooms. They are the what, how, and why of what we do. Examples of structural routines include warm-ups, exit tickets, instructional routines, and homework (or checks for understanding). This chapter will unpack aspects of our structural routines that cultivate asset-based learning environments and aspects of structural routines that need disrupting or that fall on the deficit side of the deficit-to-asset continuum.
- Chapter 6: Instructional routines are the decisions we make about implementing instruction. This chapter focuses on instructional routines that continually support students in developing a positive mathematics identity. Instructional routines are not simply asset or deficit based. Learning to implement routines as intended takes an asset-based routine and moves it further along the continuum.
- Chapter 7: After considering various instructional routines, this chapter will deepen our awareness of how to put asset-based instructional routines together in a coherent structure to establish asset-based practices. We highlight the Five Practices for Orchestrating Productive Discussions as an example.

PART 3: ASSET-BASED SYSTEMS

In Part 3 of this book, we address asset-based systems. Many moving cogs go into the system of educating children, from the structures in our classroom to the laws and policies at the state and federal levels. We will examine the many structures that impact our work.

- Chapter 8: Classroom teachers and instructional leaders make thousands of decisions every hour. Some decisions are in the moment, whereas others are more overarching and create the structures of our school and classrooms. This chapter will increase our awareness of how these structures contribute to asset-based learning environments. In addition, we will provide suggestions and ideas to disrupt aspects of our structure that do not benefit students or teachers.
- Chapter 9: Academic coaches, district specialists, district personnel, state-wide personnel, and federal employees also impact the structure of the work we do. This chapter will support current and future employees who work at these levels to stop, reflect, analyze, question, and take action to enhance asset-based structures and disrupt those less asset based.
- Chapter 10: This chapter draws across chapters 8 and 9 and provides suggestions for how to start conversations to foster more asset-based systems in your school and district.

FORMAT OF EACH CHAPTER

Each chapter starts with a short activity aligned with the chapter's theme and is designed to elicit the assets you bring to the chapter's ideas. The Alignment exercises may be a reflection on a current practice, reading a vignette and analyzing information, unpacking routines, and so on. These activities are written to take approximately 15 minutes. We recommend spending time on this before reading the rest of the chapter. The accompanying study guide provides space to capture questions to consider, complete the Alignment exercises, reflect and discuss ways to transform our practice, and activities that provide learning communities with opportunities to deepen thinking about the topic and its connection to your local practices and contexts. If you are reading this book as part of a PLC, we also encourage you to discuss the Alignment exercise with colleagues. The intention is to encourage discourse and contribute to each other's understanding of your diverse perspectives.

Each chapter continues with an exploration of an aspect of mathematics classroom language, routines, or systems from an asset-based perspective. This journey makes use of classroom and school vignettes and provides tips that can be used immediately in the secondary mathematics classroom. We also make connections to three frameworks throughout the book that can support the development of more asset-based learning environments: Social Emotional Learning (SEL), Universal Design for Learning (UDL), Special Populations, and NCTM's Effective Teaching Practices.

The Digging Deeper feature in each chapter is a spotlight on a particular population that showcases how the asset-based strategies support the population being spotlighted. Although the content shared in the chapter is important for all students, the spotlight explicitly calls out how and why it makes a difference to specific populations.

The Reflect, Apply, Transform section returns to the questions at the start of the chapter to support reflection and action items that move your work toward more asset-based perspectives and have a strong impact for students and teachers.

THEMES THROUGHOUT THE BOOK

As we worked on writing this book, we noticed patterns or themes that kept coming up in each chapter in the form of frameworks for the teaching and learning of mathematics that may be familiar to you. We have chosen to embrace these and have identified them using icons. By making these connections explicit, we invite you as readers to make connections to learning that you have already undertaken related to these themes to accelerate your classroom practice toward more asset-based perspectives.

The themes you will encounter are as follows:

- Social Emotional Learning (SEL)
- Universal Design for Learning (UDL)
- Student Populations
- NCTM's Effective Teaching Practices

Look for the icons throughout the book to indicate discussions especially related to these themes.

Social Emotional Learning

Universal Design for Learning

Student Populations

NCTM's Effective Teaching Practices

SOCIAL EMOTIONAL LEARNING (SEL)

The CASEL Framework (2024) addresses five areas to advance student learning and development. The five areas are self-management, self-awareness, social awareness, relationship skills, and responsible decision-making. An overview of each is shown in Table 1.2.

TABLE 1.2 The CASEL Framework

SELF-MANAGEMENT	SELF-AWARENESS	SOCIAL AWARENESS	RELATIONSHIP SKILLS	RESPONSIBLE DECISION-MAKING
Manage one's emotions, thoughts, and behaviors effectively in different situations and to achieve goals and aspirations	Understand one's own emotions, thoughts, and values and how they influence behavior across contexts	Understand the perspectives of and empathize with others, including those from diverse backgrounds, cultures, and contexts	Establish and maintain healthy and supportive relationships and effectively navigate settings with diverse individuals and groups	Make caring and constructive choices about personal behavior and social interactions across diverse situations

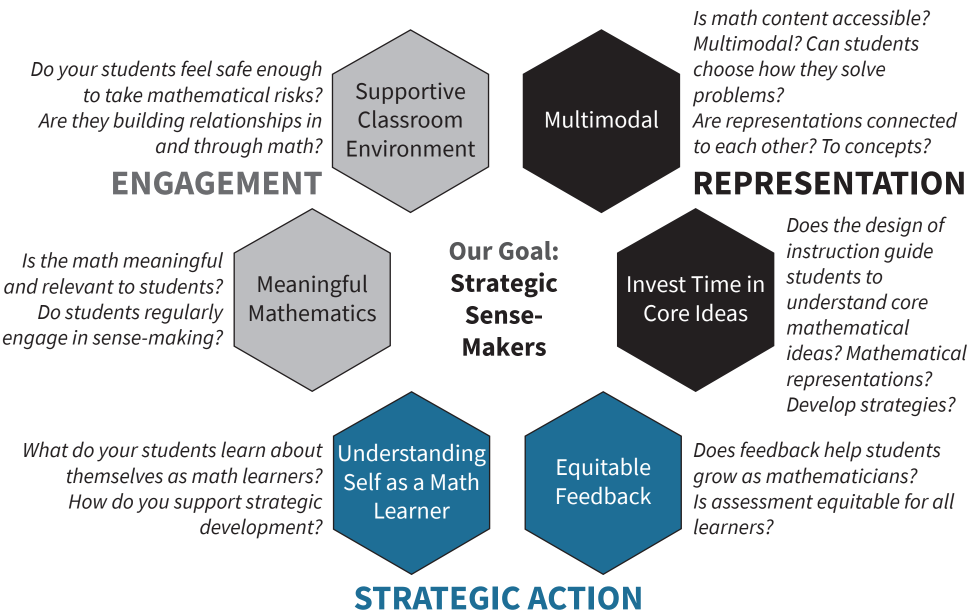
SOURCE: Adapted from CASEL.org (2024).

When you see the SEL icon, we encourage you to return to this table to identify the facets of the CASEL Framework that are at play in the discussion. You might reflect on how the language, routine, or system being discussed interacts with the five categories in the CASEL Framework and how the categories can support stronger asset-based perspectives in the mathematics classroom.

UNIVERSAL DESIGN FOR LEARNING (UDL)

The Universal Design for Learning (UDL) framework is based on scientific insights into how humans learn (CAST, 2018). The framework (see Figure 1.1) includes guidelines with descriptions on how to provide multiple means of engagement, representation, and action and expression. Lambert (2021, 2024) adapted this framework with specific attention to the learning of mathematics through the design elements of engagement (meaningful mathematics and supportive classroom environment), representation (focus on core ideas and multimodal), and strategic action (understanding self as a math learner and equitable feedback).

FIGURE 1.1 UDL Math Design Elements



SOURCE: Reprinted with permission from Lambert (2024).

When you see the UDL Math icon, you might return to this framework and consider which of the design elements relate to the language, routines, or systems being discussed. How might your practice better incorporate aspects of these design elements to promote a more asset-based mathematics classroom learning environment?

STUDENT POPULATIONS

As noted, sometimes we want to highlight student populations that deserve additional consideration. Aspects of our system were created years ago that created structures we still use today in our classrooms. Some of these structures must be disrupted if we adapt asset-based perspectives. Some of the populations highlighted include:

- Students who are multilanguage learners
- Students who have mathematics anxiety
- Students with disabilities, including neurodiverse students, or students identified via the Individuals with Disabilities Education Act (IDEA) of 1990 (reauthorized 2004)
- Students who are identified as having a propensity for mathematics
- Students who are Black, Indigenous, and people of color (BIPOC), including those who identify as Hispanic, Pacific Islander, or other racial/ethnic groups you serve. Throughout this book, we will identify specific populations of students where appropriate and use BIPOC when referring to students of color.
- Teachers
- Other community members

When you see the Student Populations icon, you might consider how students similar to the students being discussed are afforded opportunities to demonstrate their assets in your mathematics classroom or the classrooms of teachers you support. How might we provide more explicit and clear opportunities for different student populations to identify and leverage their assets? And how might we be attentive to the deficit-based messages these groups may have been exposed to in the past and shift that thinking?

NCTM'S EFFECTIVE TEACHING PRACTICES

The NCTM introduced the Effective Teaching Practices in the 2014 publication of *Principles to Actions: Ensuring Mathematical Success for All*. These eight practices represent a synthesis of over three decades of research into effective mathematics teaching, and it's likely you're using some, if not all, of these practices already in your classroom. When you see the NCTM Effective Teaching Practices icon, at least one of the following practices will be integral to the discussion:

- Establish mathematics goals to focus learning.
- Implement tasks that promote reasoning and problem solving.
- Use and connect mathematical representations.

- Facilitate meaningful mathematical discourse.
- Pose purposeful questions.
- Build procedural fluency from conceptual understanding.
- Support productive struggle in learning mathematics.
- Elicit and use evidence of student thinking.

(NCTM, 2014)

When you see the Effective Teaching Practices icon, you might reflect on how the practice or practices being discussed are used in your classroom. You might further consider how one might shift the implementation of the practice(s) toward more asset-based perspectives.

■ ■ ■ Digging Deeper

The Digging Deeper component in each chapter highlights specific student populations as it relates to the chapter. Although many aspects of asset-based perspectives positively impact all populations, we will spend time highlighting how this work specifically has significant impact for different populations of students. Don't worry if your reflection does not include information for each population or only includes a little bit. You will have new insights to add as you read and reflect from chapter to chapter. Feel free to add student populations to this list that may be more specific or relevant to you. For example, if your work includes a group of students with disabilities not included below, add this group. For our introductory chapter, we encourage you to use Table 1.3 to reflect on how asset-based perspectives benefit specific student populations.

TABLE 1.3 Reflections on How Asset-Based Perspectives Benefit Specific Populations

STUDENT POPULATION	HOW WOULD THIS POPULATION SPECIFICALLY BENEFIT FROM ASSET-BASED PERSPECTIVES (LANGUAGE, ROUTINES, AND SYSTEM)?
Students who are multilanguage learners	
Students who have mathematics anxiety	

TABLE 1.3 (*Continued*)

STUDENT POPULATION	HOW WOULD THIS POPULATION SPECIFICALLY BENEFIT FROM ASSET-BASED PERSPECTIVES (LANGUAGE, ROUTINES, AND SYSTEM)?
Students with disabilities	
Students who are BIPOC	
Students who are identified as having a propensity for mathematics	

Reflect, Apply, Transform

Asset-based language, routines, and systems can transform our classrooms and our mathematics education community. We will continue discussing the three questions introduced at the beginning of this chapter (Questions to Consider) throughout the book. Now that you have read the Introduction, we ask you to reflect on the questions to consider for the chapter:

1. What do asset-based perspectives mean to you?
2. How does the language we use, the instructional routines we implement, and the classroom, school, district, state, and national (federal) systems we work in impact student outcomes?
3. Why are asset-based perspectives critical in mathematics education?

PART 1

Asset-Based Language

Take in the examples that follow of a teacher-student exchange about a math problem, a teacher launching a task with their class and invoking classroom norms, and two teachers talking about instructional approaches to the unit circle. Based on each of these excerpts, what beliefs might you infer that the teacher holds about the following:

- Students and their competence?
- What the work of knowing and doing mathematics is?
- What it takes to be successful in school mathematics?

EXCHANGE A	EXCHANGE B	EXCHANGE C
S: I'm stuck. I know I need to divide $1\frac{1}{2} \div \frac{1}{3}$ but I don't remember how. T: Remember Keep, Change, Flip? S: Which one do I flip again? T: The second fraction. S: Do I need to change the mixed number? T: Yes. Make it an improper fraction.	T: Let's start the way we usually do: Take 2 minutes to read the problem. Write down what you notice and what you wonder about, and we'll share some noticings and wonderings after everyone has had a chance to think and jot ideas down.	Teacher A: We had a great discussion today with my Honors class about the unit circle and how it relates to trigonometric functions. Teacher B: My class always struggles with that. I give them a handout with the important ratios on the unit circle and we have a quiz the next day to see if they remember. The regular class just can't handle that kind of discussion.

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The beliefs that we hold influence our work as teachers, including how we structure our class time, the mathematical ideas that we center in our classrooms, and the language we use with students and our teacher colleagues about mathematics. Thinking about our beliefs and how they influence our classroom practice is important, but it's also important to acknowledge that beliefs are complicated, messy, and sometimes contradictory.

In this part of the book, we consider the language we use in teaching mathematics. As we examine language from multiple perspectives, consider how language can both reflect and influence our beliefs as teachers, the beliefs of our colleagues, and the beliefs of (and in) our students.

CHAPTER 2

Honoring Student Language While Building Meaningful and Mathematically Accurate Content

One of the most important functions of the language we use in the classroom is to convey mathematical meaning. The goal of this chapter is to consider the interactions between mathematics content and language. We will explore how, as teachers, we can take an asset-based approach to language that is mathematically accurate and appropriate. By the end of this chapter, you will have some strategies you can use to elicit and use asset-based language from students, as well as to disrupt deficit-based language in your classroom. Specifically, we consider how our language use can serve to advance mathematical understandings while leveraging student assets.

> *"Students whose whole selves are welcomed in class have more bandwidth to focus on learning."* (Ruef, 2020)

Questions to Consider

1. When you think about students' academic language in mathematics, what ideas come to mind?
2. How do you respond when students use informal mathematics language?
3. What contexts do you use when teaching using real-world mathematics tasks?
4. How does students' language use relate to how we give feedback to students and provide assessment opportunities?

ALIGNMENT EXERCISE: BIG ROCKS

SOURCE: istock.com/joshuaraineyphotography

Teaching is often like our commute to work. Sometimes our commutes are exactly as we pictured them when we got in the car. Other times, we experience events like construction, traffic, weather, or other unexpected acts that change the ways we go from point A to point B. We're used to being flexible in teaching, especially with the hundreds of small changes and adjustments we make in a class period. We want to focus here on the *big rocks* that might happen during teaching—significant challenges that have the potential to stop or derail a discussion within a lesson.

Two brief excerpts follow that describe important mathematics content ideas at the middle and high school levels. Read one or both of the excerpts; you might consider one that's closest to the grade level with which you are most familiar and one that reflects mathematics that you may not have visited in a while. As you read, think about what the big rock might be in each situation and what the teacher might do to navigate around it in a productive way.

The class had been working in small groups on the Cookie Conundrum task for about 10 minutes. Ms. Dohm calls the class together to discuss solutions.

Ms. Dohm: So the situation is that we're putting together boxes of cookies for a party. The party colors are green and silver, so the organizers want to make bags with 5 green cookies and 3 silver cookies each.

We have 200 green cookies. How many silver cookies do we need? Who would like to start us off? *Several hands go up to volunteer.* Okay, Brette?

Brette: Well, first we thought it was just 2 less, so 198. But that didn't make sense. We started thinking about making the bags and how we'd have a whole lot of silver ones left over.

Ms. Dohm: Okay, so what did you do next?

Brette: We started drawing pictures of the bags of cookies and counting.

Andre: Brette, we did the same thing but then we made a table.

Ms. Dohm: Can you show us that table, Andre?

G	5	10	15	20	25	30	35	40	45	50
S	3	6	9	12	15	18	21	24	27	30

Andre: From there, we knew that we could double 50 to get 100, and double 100 to get 200, so we came out with 120 silver.

Ms. Dohm: Okay, let's back up. How did you make each row of your table?

Justice: We just added the same thing each time.

Ms. Dohm: Why was that a strategy that made sense to you?

The group all look at one another; nobody verbally responds initially.

Brette: Well if you just look at my picture . . .

Ms. Dohm: We'll take a look at the picture in a moment. But first I want to hear from the group about their strategy.

A few more seconds pass with no response from the group.

Lawrence (who is not in the group): Just say *proportional*. The columns in the table have to be proportional. (Lawrence gestures at the note on the board that says, *Lesson 7.2: Proportional relationships.*) There, done. Can we go to the next question?

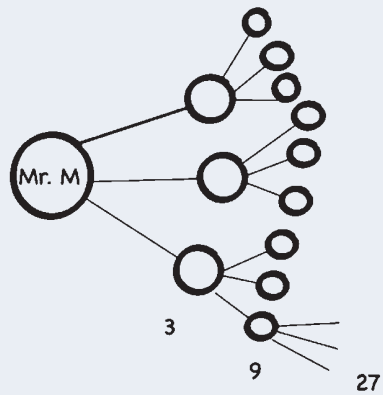
Mr. Mutford's Algebra I class is starting a unit on exponential functions. To get them started, he gave them a task centered on the familiar Pay It Forward idea. He framed the task as follows:

Mr. Mutford is going to try to change the world this summer while we are on break. On the last day of school, he is going to do three good deeds for people. In return, he will ask *them to do 3 good deeds for others on the first day of break, and pay those deeds forward the next day. If everyone does as they are asked, how many good deeds will be done on the fifth day of break?*

Students are sharing their responses to the task after small group work. Some drew pictures, others made tables, and a few others wrote equations. Mr. Mutford had made note of the strategies students used and made specific choices about whom to call on in the dialogue that follows.

Mr. Mutford (after some discussion): So we seem to be gravitating toward 243 as our answer. Maya, would you please share how you thought about it with your diagram?

(Maya shows a tree diagram in which each person does three good deeds on the next day.)



Maya: Here's how we started. So here's you on the last day of school. You did three good deeds. One of them was for me, just sayin' Mr. M. Then the second day, me and the other two people do three more. Then those people do three more. We got 3 times 3 times 3 times 3 times 3 and that's 243.

Mr. Mutford: Great! Who has questions for Maya? Janelle?

Janelle: Can I be one of the other people?

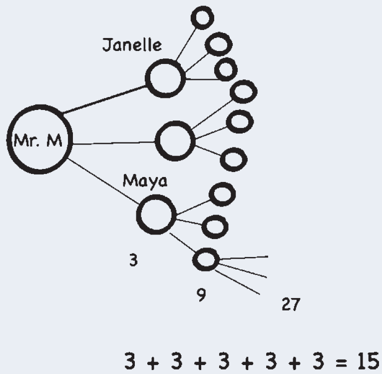
Maya: I got you. (Maya labels one of the stage 1 figures with Janelle's name.) Better make a list, Mr. M.

Mr. Mutford: So I don't hear questions about her math. Did everyone do it the same way then?

Panch: We used exponents, but we got the same thing, 243. Three to the fifth, which is 3 five times.

Mr. Mutford:	I heard Panch and Maya both say "times" when they were talking about getting to their answer. But Maya also described each day as being three *more* deeds. Maya, did I get that right? (Maya nods yes.) We usually use *more* to talk about addition. So why are we multiplying here? (*There's no initial response but some murmuring in the room.*) Talk about that for two minutes in your small groups.

(While groups discuss, Mr. Mutford writes 3 + 3 + 3 + 3 + 3 = 15 on the board next to Maya's diagram.)



Mr. Mutford:	Okay, so I think what I just wrote is the right answer. Change my mind.
Jay:	Nah man, that's not it. You have to multiply. Because it's like each person does three more the next day.
Mr. Mutford:	Yes—three *more*. That's addition. Still not convinced. Ramie?
Ramie:	Every person does three more, but like the multiplication comes from the days. You have three times as many people doing the deeds from one day to the next. (Ramie begins pointing at Maya's tree diagram.) See like Mr. M is the only one in that first one, then it's like Maya and Janelle and I'mma put me as that third one on the first day of break. Then each of us get three more—shoot, I'm trying not to say more because I know you're gonna roast me, we get three people each to do another one and then it goes from there. It's that each that gets us to the times.
Mr. Mutford:	There's a lot of heads nodding here so maybe we're on to something. But riddle me this, I thought Panch used exponents. So are we supposed to add, multiply, or use exponents here to find out how many deeds on Day 5?
Janelle:	Oh come on Mr. M, we all got it ***right*** already.

■■■ Try This

Discuss these questions with your professional learning community (PLC) or other colleagues. Once you've done so, continue reading and we'll share some thoughts of our own related to these questions.

In the vignette that you read . . .

- What is the math content being discussed?
- What pieces of language (from students or the teacher) seem to be supporting students in understanding the content?
- What pieces of language seem to be getting in the way or causing confusion?
- What would you do next (or if you disagreed with a teacher's choice, what would you do differently)? ■

MS. DOHM'S MIDDLE SCHOOL CLASSROOM

The lesson in Ms. Dohm's classroom is focused on proportional reasoning using a straightforward contextual situation. One can infer that the goal of this lesson is to establish a conceptual basis for the notion of a multiplicative relationship that maintains a common ratio. A common thought pattern for students at this stage is to attend to the additive difference between two quantities, which does not attend to the common ratio. Ms. Dohm's questioning has the goal of teasing out why this relationship is multiplicative rather than additive. While using waiting strategies to afford the group an opportunity to think and respond, a student short-circuits the discussion by making use of the term *proportional* (gleaned from the lesson title) and suggesting that just using this term will suffice as the understanding Ms. Dohm was looking for. This move has the potential to put a halt to students sharing their thinking and grappling with the important mathematical ideas and sends a message that a single answer (in this case, the word *proportional*) is the important part of the mathematical exercise. What might Ms. Dohm do in response to recalibrate after Lawrence's comment?

MR. MUTFORD'S HIGH SCHOOL CLASSROOM

Similarly, Mr. Mutford and his class are grappling with the language for describing exponential relationships in which the rate of change from one stage to the next results in multiplying by a set factor rather than adding. This particular piece of content can be very challenging for students as many of the words in English to describe increases are associated with additive changes. You hear Mr. Mutford pressing on the use of terms like *more* and *times* that tend to have specific associations with arithmetic operations (adding and multiplying). It's also notable that the mathematically precise language of exponents comes out early in the conversation. Mr. Mutford doesn't grab on to that language in that moment; instead, he continues to press for clarification and only brings the term *exponent* back at the very close of the vignette. Janelle's comment at the end expresses what we might hope is good-natured frustration with being pressed to explain, but there's also another implicit message here that the right answer is what's important. What would you do in Mr. Mutford's shoes at this point? Would you let that comment go and move on? Would you say something about it?

* * *

We called this alignment activity *Big Rocks* because in different ways, the mathematical language and ideas expressed at a key moment in each vignette can represent a big rock in language. These pieces of language can serve to close off continued conversation and potentially interrupt or stop entirely the sense-making work that students are doing. In the middle grades vignette, the use of the term *proportional* serves as the big rock (and the student using it does so explicitly to bring an end to conversation). The term *exponent* plays the role of the big rock in the high school excerpt.

Classroom discourse can move quickly, and as a teacher, we're often managing competing demands in the classroom. Some students want feedback or are asking for help, we're checking in on some students to make sure they're making progress and are not silently stuck, and we're always thinking about the next thing we'd like to unfold in the lesson. It's not always clear in the moment when a big rock has been dropped into the road that our lesson is traveling down. And sometimes what may be a big rock to one person may not be to another, especially for us as teachers since we've been thinking deeply about the math ideas in the lesson. Think again about the end of the story about Ms. Dohm. Can you imagine a teacher who heard Lawrence's comment and thought to themselves, *Thank goodness, I was hoping for that word to come out; now let's move on to some notes*? Or maybe you've even had that thought yourself? (We know that we have!) The goal of this Alignment exercise is to help us look out for big rocks in academic language and think about how we can work with those big rocks in asset-based ways.

Now that we've set the stage, in this chapter, we're going to explore together the role of math content in asset-based language. When you think about asset-based language, you may think more about how we elicit and build on the math ideas that students create to focus on their strengths. How might the math content ideas like decimal points, proportional relationships, or exponential functions be asset or deficit based? These ideas may *seem* neutral, but the way that we and our students use the language of mathematics in classroom talk can position these pieces of language in different places on the deficit-to-asset continuum. Knowing the content goal and thinking deeply about the mathematics behind your goal can help us leverage our own language and to think about what to pursue in classroom discourse and what we let go by.

WHAT'S THE ROLE MATH CONTENT PLAYS IN FOSTERING ASSET-BASED LANGUAGE?

As we saw in the opening of this section, the language that we use as teachers and the language students use in talking with us and their peers can foster more asset- or deficit-based perspectives in our classrooms. The words we use, how we use them, and when we use them can position students as capable of knowing and doing mathematics. The what, how, and when of language can potentially make students feel like they should have known a particular idea, that they've described a mathematical idea in an incorrect or improper way, or that they should have remembered something in the moment that they did not. All of these examples can result in students developing a deficit-based perspective.

And our responsibilities as teachers goes beyond the language that we personally might use. Students might use mathematical language in ways that can foster deficit perspectives. This might be intentional at times, such as when a student might correct another with a more mathematical term to appear smart or exert interpersonal leverage. But more commonly these experiences are likely to be unintentional. In using mathematical language that is natural to them but may not be shared by others, a student can unintentionally create a *big rock* situation that shuts down further engagement. As teachers, we need to be thoughtful about how to navigate, and sometimes even disrupt, mathematical language that surfaces in conversation to ensure that each and every learner sees a path forward for themselves to develop new understandings.

Let's look at asset-based mathematical language in the following three ways:

1. Let's think about how we as teachers can position math vocabulary and terminology in our classrooms. This includes the situations directly under our control (*how* we use math terms and *when*) and those that are not (how we respond when students do—and do not—use mathematical language).
2. Let's think about how we handle language when math ideas get more complicated and the terms become increasingly dense and complex. This generally happens as we move into middle and high school, but there are lessons about this idea for every grade level.
3. We'll bring these first two ideas together to help us think about specific teaching actions that allow students to leverage assets. The end goal will be to think about what we want students to walk away with in terms of mathematical language and how we can best facilitate that goal with understanding behind that language.

Throughout this chapter, we're going to pay special attention to multilanguage learners as this population has a particular intersection with the idea of developing academic language. The approaches and tips we share here will benefit all learners, but we also highlight ways in which strategies will be particularly helpful for multilanguage learners. We also provide some additional discussion in the Digging Deeper section. Math terms and math talk have special implications for these groups, and we'll think together about particular actions that work well to support their learning.

But first, a word about our use of language going forward. Already in this chapter, we've talked about math content words and phrases as:

- vocabulary,
- terminology, and
- academic (or mathematical) language.

Sometimes we use these flexibly and interchangeably in our everyday talk, and that's fine! For the purposes of this chapter and book, we'd like to share the key distinctions between these ideas so that *we* have a shared understanding and the terms can help us focus on aspects of language in our classroom and how they can support us in leveraging assets (see Table 2.1).

TABLE 2.1 Understanding the Words We Use to Talk About Math

MATH CONTENT WORDS	DEFINITION	EXAMPLE OF USAGE
Vocabulary	the **words** used in a particular context	We frequently use vocabulary to connote unfamiliar or new words.
Terminology	terms with a **specific technical meaning** in a field of study	This is an important distinction in math—we have some words specific to the domain, like *hypotenuse*, and others that have both mathematical and nonmathematical meanings, like *function*.
Academic language	the **language** needed by students **to be successful in schools**, including oral, written, gestural, and visual representations and the customs and norms of a discipline (Halliday & Webster, 2003)	Vocabulary and terminology are a part of academic language, but it's so much more! In mathematics, it includes the grammar and syntax we use to communicate about math and the culture of how mathematics is discussed and represented. It's important to note that gesture and visuals are important parts of academic language, too.

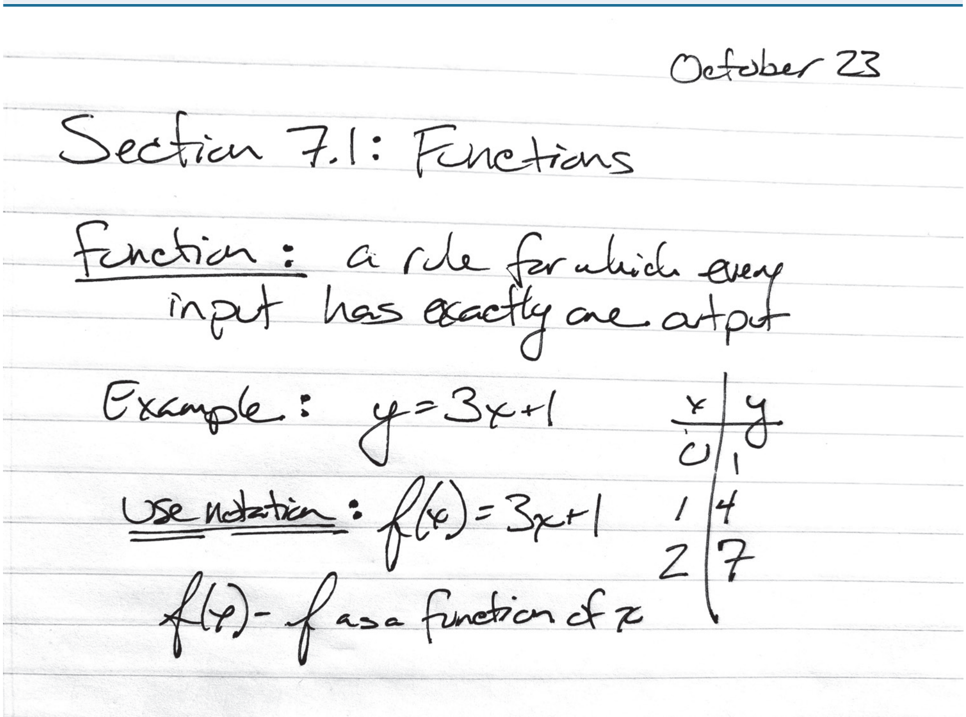
When we discuss language in this chapter and throughout the book, we'll most commonly be referring to *academic language*. This term is inclusive of both the particular words we use and how and when we use them. The broader context and the explicit inclusion of gestures and representations will help us think as broadly as possible about asset-based approaches to language. Academic language, as you notice, is also inclusive of vocabulary and terminology. When we use those words, we'll be using them in the specific ways they're defined above. We know these two ideas are important too—students need to learn how to use math-specific terminology and vocabulary, particularly for words that have meanings in both colloquial language and math that may be different.

POSITIONING VOCABULARY AND TERMINOLOGY WITHIN OUR CLASSROOM'S ACADEMIC LANGUAGE

Take a moment and think about what your own school mathematics learning experience was like and about how and when vocabulary was introduced and used. How did you learn a new piece of vocabulary or math terminology? How was that new word or phrase integrated into the class's academic language? What were the expectations around how you would use those terms going forward?

If your experience was anything like mine (Mike), the introduction to vocabulary might have looked like what we see in Figure 2.1.

FIGURE 2.1 A Student's Notes From Math Class



For many students, the start of a unit of study on a new math idea began with a definition of vocabulary written at the top of a textbook page, followed by an example or two. In the discourse that followed, you were expected to make use of that vocabulary when describing the idea.

Consider the notes artifact in Figure 2.1 and the description. As a student, where were there opportunities for me to share my ideas that might relate to functions? Where are my assets and my voice represented? Defining vocabulary and asking students to write down the definition and use the word going forward are not, in and of themselves, deficit-based practices. In fact, they are done with the very best of intentions: To advance their mathematical understandings, students need to know and understand the language of mathematics and use that language in accurate and appropriate ways. Defining a vocabulary word and using that word in examples is certainly one way to do that. But consider whether there are other ways in which as teachers, we can better integrate our treatment of *vocabulary* into the broader sphere of *academic language* that students will use going forward. And consider how we might think about making use of students' assets as we go about introducing new math concepts and the language associated with them.

GETTING READY FOR A POOL PARTY

Let's look at a task from the Algebra 1 or Math 1 (Grade 9) Open Up Resources (2021) curriculum to help us think about vocabulary, terminology, and academic language.

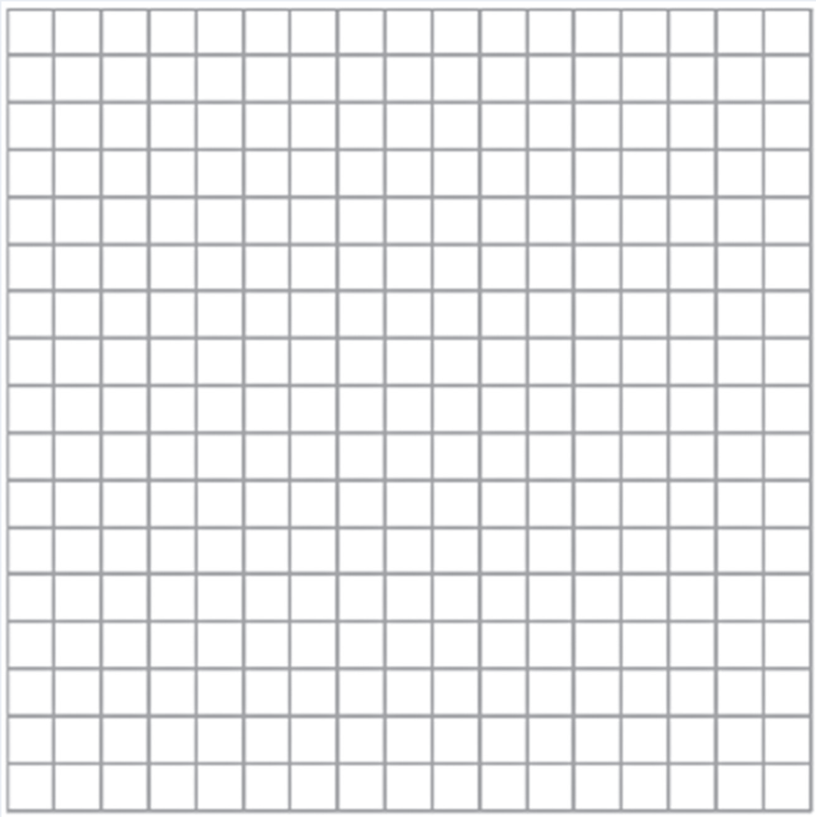
Try This

Work on the Example Task, Getting Ready for a Pool Party, a little bit on your own. Then discuss the task with your colleagues. As you do, think about the math content ideas this task addresses and the academic language you imagine students would use in their responses to and discussions about the task. ■

Sylvia has a small pool full of water that needs to be emptied and cleaned, then refilled for a pool party. During the process of getting the pool ready, Sylvia did all of the following activities, each during a different time interval.

Removed water with a single bucket	Filled the pool with a hose (same rate as emptying pool)	Drained water with a hose (same rate as filling pool)
Cleaned the empty pool	Sylvia and her two friends removed water with her three buckets	Took a break

1. Create a story of Sylvia's process for emptying, cleaning, and filling the pool. Number the activities given 1–6 to indicate the order in which they occurred in your story.
2. Sketch a possible graph showing the height of the water level in the pool over time. Be sure to include all of the activities Sylvia did to prepare the pool for the party. Remember that only one activity happened at a time. Think carefully about how each section of your graph will look, labeling where each activity occurs.



3. Does your graph represent a function? Why or why not? Would all graphs created for this situation represent a function?

SOURCE: https://access.openupresources.org/curricula/our-hs-math/integrated/math-1/unit-3/lesson-1/index.html Used with permission from Open Up Resources.

What math ideas did you encounter when you were working on the task? What academic language did you use to describe those ideas?

According to the curriculum guide, the goals for this task include graphing a function to model a situation and interpreting the key features of the graph. Open Up Resources also notes the notation, vocabulary, and conventions relevant to this lesson (see Figure 2.2).

FIGURE 2.2 Notation, Vocabulary, and Conventions for Getting Ready for a Pool Party

Adding Notation, Vocabulary, and Conventions

Key features of functions:

- *x-intercept – when* $f(x) = 0$
- *y-intercept –* $f(0)$
- *Maximum – greatest y-value*
- *Minimum – lowest y-value*
- *Interval of increase – as x values increase, y-values increase*
- *Interval of decrease – as x values increase, y-values decrease*
- *Rate of change –* $\frac{\text{change in } y}{\text{change in } x}$
- *Constant rate of change is the slope for linear functions*
- *Rate of change is zero when there is no change in y-values, the graph is horizontal*
- *Domain – the set of possible input values for a relationship*
- *Range – the set of possible output values for a relationship*
- *Continuous, discrete, discontinuous*

SOURCE: Reprinted with permission from Open Up Resources (2021).

■■■ Try This

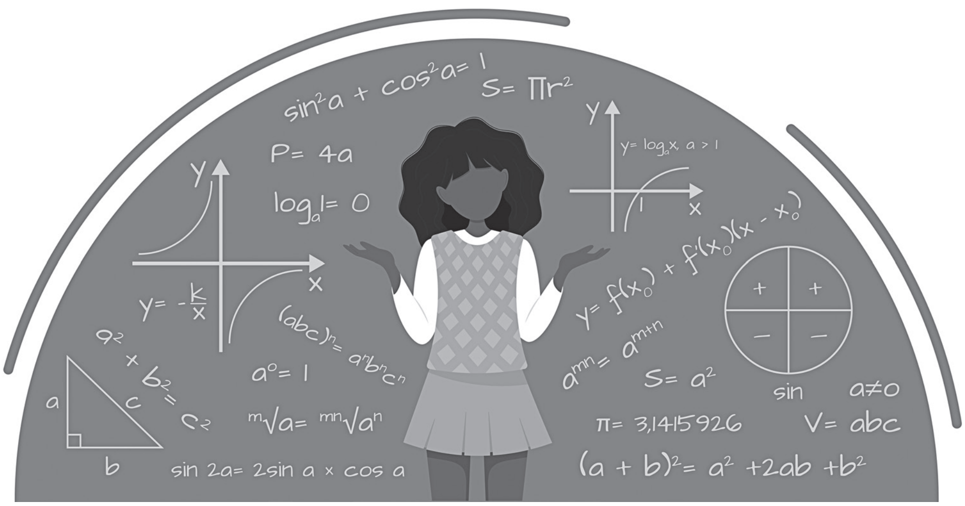
What language might we expect students to use as they work on this task? Jot down some ideas to add to the list of your own academic language that you used. If you have an opportunity to try the task with students, you might want to transcribe or audio record the language they use. ■

Here's some language we might expect to hear when students are describing their graph while sharing the story they created about the situation:

- "Nothing goes up or down when the pool is being cleaned."
- "Time goes this way (gestures left to right)."
- "A bucket would be a different kind of drop than draining with a hose. It's a dip (gestures straight down) not a drip (gestures diagonally)."

- "Do Sylvia's friends take the buckets out the same time she does, or do they go 1 2 3?"
- "Would we draw the line the same for the fill and the drain? Well, not the *same*, like the same but opposite."
- "The pool needs to be empty before we clean it."
- "Nothing changes during the break—do we just stop drawing and pick up over here?"
- "It can't just go up and up forever though, like at some point the pool is full and you've got water just spilling into the yard."
- "Look like over here at the start (gestures to *y*-intercept) you've got the pool more full than it is at the end. Shouldn't we stop where we started?"

The highly contextual nature of the task makes it likely that much of the academic language students use will draw on aspects of the context, such as buckets, filling, and draining. And when students are huddled in a small group around a graph or guiding a classmate as they're describing the story they created, the academic language they use is likely to include gestures—a hand motion, a part of the graph they're pointing at, or a sweep of the pen. Using context, gestures, and the graph is an example of using and connecting representations, one of the eight National Council of Teachers of Mathematics (NCTM) Effective Mathematics Teaching Practices.



SOURCE: istock.com/Alina Vovk

Compare this language with the vocabulary terms in Figure 2.2. We don't see many of those specific terms in students' language. But they are making use of the ideas using contextual language. We've added annotations using bold type in the bulleted list that follows to those quotes to match the vocabulary ideas to students' academic language.

- "Nothing goes up or down when the pool is being cleaned." **rate of change, interval of increase/decrease**
- "We're draining here and we're filling here." **Rate of change, interval of increase/decrease**
- "Time goes this way (gestures left to right)" **domain**
- "A bucket would be a different kind of drop than draining with a hose. It's a dip (gestures straight down) not a drip (gestures diagonally)." **Rate of change, interval of increase/decrease, continuous vs. discontinuous**
- "Do Sylvia's friends take the buckets out the same time she does, or do they go 1 2 3?" **continuous vs. discontinuous, discrete function, rate of change**
- "Would we draw the line the same for the fill and the drain? Well, not the *same*, like the same but opposite." **Rate of change, interval of increase/decrease**
- "The pool needs to be empty before we clean it." **Maximum/minimum**
- "Nothing changes during the break—do we just stop drawing and pick up over here?" **continuous vs. discontinuous, domain**
- "It can't just go up and up forever though, like at some point the pool is full and you've got water just spilling into the yard." **Maximum/minimum, range**
- "Look like over here at the start (gestures to *y*-intercept) you've got the pool more full than it is at the end. Shouldn't we stop where we started?" ***y*-intercept, maximum/minimum**

Going back to Figure 2.2, it's often very tempting to define all the terms students might need before they start an exploration. And there are times when knowing a definition in advance can be really important—for example, if we are starting a lesson focused on properties of trapezoids, the definition of what counts (or doesn't count) as a trapezoid is vital to that lesson's success! But when we define those terms and ask students to start using them, we take away opportunities for students to make use of the assets they might bring in the form of contextual, informal academic language to describe math ideas.

An alternative to defining terms first is to define terms at the close of an exploration. One way to close a lesson using Getting Ready for a Pool Party would be to take the vocabulary terms in Figure 2.2 and to have students annotate their story and graph with as many of the terms as they can. In this way, students bring their assets to the main task in making sense of the context and can connect that understanding with the specific vocabulary and mathematics terminology that will be useful beyond this specific context. For example, a future task might feature a speed versus time graph of a bike ride and we might expect students to start to use terms like *rate of change* and *interval of increase or decrease* in the context of the new task.

STRENGTHENING MATHEMATICS DISCOURSE AMID COMPLEXITY

Consider the ideas in Table 2.2 related to geometry and measurement and the grade band in which they're likely to be introduced.

TABLE 2.2 Geometry and Measurement Terminology Across the Grades

GEOMETRY AND MEASUREMENT IDEA	GRADE INTRODUCED
Triangle	Early elementary
Polygon	Early elementary
Angle	Late elementary
Angle measure	Late elementary
Interior angle	Middle grades
Exterior angle	Middle grades
Sum of the measures of the angles in a triangle	Middle grades
Alternate interior angle	Middle grades
Angle and direction of a rotated preimage of a polygon	Middle grades
Sum the squares of the legs of a right triangle	Middle grades
Arc length of a sector of a circle	High school
Corresponding sides of congruent triangles	High school
Center of dilation	High school

What did you notice about the terms? As we describe more complex geometry and measurement ideas, our names for those ideas become longer and increasingly grammatically complex. For example, "sum of the measures of the angles in a triangle" is a single idea with four different levels of nesting inherent in the phrase (there is a triangle, it has three angles, those angles have measurements, and we're interested in the total of those). As students move into middle and high school, the terminology we use to describe math ideas changes and increasingly features dense noun phrases (Herbel-Eisenmann et al., 2017) and combinations of multiple vocabulary words and terms to generate new meaning.

Tip

Introduce new academic language using multiple modalities—written, verbal, visual, symbolic—to increase access for students.

Navigating these dense phrases can be challenging for all students, especially multilanguage learners. What can we do as teachers to support student understanding and build on student assets? One important idea is using multiple modalities regularly in classroom practice. If students only hear the phrase, "angle and direction of a rotated preimage of a polygon," students may not fully parse the verbal utterance or understand that those ten words refer to a single mathematical idea. Actions such as writing the phrase down, pairing it with a visual representation of the idea, and connecting the phrase to contextual situations when possible all can support students in understanding new ideas and broadens our work from presenting vocabulary to introducing academic language.

Returning to the ideas in the previous section, it's also helpful to understand that different activity structures in the classroom promote different types of academic language. Herbel-Eisenmann and colleagues (2017) introduced the idea of the *Language Spectrum* (Table 2.3) in their work on supporting meaningful mathematics discourse in secondary classrooms.

TABLE 2.3 Language Spectrum

CONTEXT 1: SPOKEN BY A SMALL GROUP OF STUDENTS WITH ACCOMPANYING ACTION OR GESTURE	CONTEXT 2: SPOKEN BY A STUDENT ABOUT THE ACTION, AFTER THE EVENT	CONTEXT 3: RESPONSE WRITTEN BY A STUDENT	CONTEXT 4: WRITTEN DESCRIPTION FROM A MATHEMATICS TEXTBOOK
Student 1: OK, so I think you just take this away from this, and then you just have, like, something on the top. Like, here and here [*points at examples*], there isn't anything left. They all just cancel out. I think that's why the rule works. You can cross out the numbers under here [*points to the denominator*]. Student 2: Couldn't you have, like, more on the bottom?	Student 3: Remember when we had that assignment where we had to write out what all the exponents meant, like three to the fifth power was three times itself five times? And when we did that with the division problems you could cancel out the same amount on the top and bottom? Like, if there are five on top and three on the bottom, you can cancel three of them and just have two left. But we just did that problem with b to the m on top and b to the n on bottom. So, just like we said five minus three is two, you do m minus n and that's what you have left. That's what we got.	When you divide exponents with the same base, like $\frac{b^m}{b^n}$, there are m copies of b in the numerator and n copies of b in the denominator. You can simplify this expression because copies of b in the numerator will cancel with copies of b in the denominator. Since $\frac{1}{b^m} = b^{-m}$, $\frac{b^m}{b^n} = b^m \times b^{-n}$. When you multiply exponents with the same base, we add the exponents, so $\frac{b^m}{b^n} = b^{m-n}$.	In the case of division where the bases of the exponential expressions that are divided are the same, such as $\frac{b^m}{b^n}$ where b, m, and n are rational numbers, the result is b^{m-n}. This is a consequence of the multiplication rule for exponents with like bases. $\frac{b^m}{b^n} = b^m \times b^{-n} = b^{m-n}$.

SOURCE: Adapted from Herbel-Eisenmann et al. (2017).[1]

[1] For more information about these materials, please email the lead author of Mathematics Discourse in Secondary Classrooms (MDISC) at bhe@msu.edu. We acknowledge that the information related to this table is based on the idea of a "mode continuum" from systemic functional linguistics (Gibbons, 2009) and the naming as the Language Spectrum is attributed to the teacher researchers involved in Herbel-Eisenmann's National Science Foundation (NSF) CAREER grant (#0347906). Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the NSF.

(Facilitating meaningful mathematics discourse is one of NCTM's Effective Mathematics Teaching Practices.) There are two important things to note from the Language Spectrum that relate to an asset-based approach to language. First, the pronouns students use, the extent to which nonverbal and nonwritten facets of discourse are present, and the precision of the academic language used change across the communication contexts listed at the top. When students are working in groups, the language is likely to be more contextual and based in shared referents. When students are presenting their ideas to the class or writing an idea up for homework, the tense shifts to third person and more terminology creeps in.

Sometimes we introduce a new piece of vocabulary or terminology and expect to hear students using it right away in their discussions and in their written work. The Language Spectrum helps us understand that the communication context we ask students to engage in can shift the use of those vocabulary terms. Moreover, even if students have used a term one day, perhaps in their written work like context 3, subsequent work that leverages contexts 1 or 2 might shift language back toward more contextual ideas. The goal is not to move to the right on the Language Spectrum; rather, the framework helps us understand and anticipate shifts in language depending on how we ask students to engage.

USING LANGUAGE IN WAYS THAT LEVERAGE ASSETS

Now that we have explored the impact of introducing vocabulary and terminology, as well as the challenges around complexity of language, how might we take these factors into account in our classroom? This section shares some strategies for supporting students in leveraging their language assets in three categories. These suggestions work most effectively when implementing tasks that promote reasoning and problem solving as compared with lessons that center on more procedural practice.

CREATE SPACE IN LESSONS FOR STUDENTS TO BRING THEIR MATHEMATICAL ASSETS

When planning a lesson, provide clear and explicit opportunities for students to bring their mathematical assets. Rather than assuming a "blank slate" and starting a lesson with sharing ideas that you hope students will use, instead acknowledge the fact that students come in with ideas about mathematics that are helpful for everyone in the class to hear. At the start of a lesson, it's

Tip

When launching a task at the start of a lesson, provide opportunities for students to share their initial mathematical ideas before they get started.

helpful to create space for students to share those ideas. This can provide a different means for activating prior knowledge than a procedural set of warm-up problems.

We suggest delaying the introduction of specific vocabulary and terminology until later in lessons when students have had opportunities to make meaning and reason in rich problem-solving situations. This approach allows students to use informal language and conceptions—assets that they bring to our classroom—as a part of their mathematical reasoning and avoids the role that terminology can sometimes play as a barrier to understanding. It also gives students opportunities to revise and refine their thinking and explanations as they go, communicating the idea that mathematics is a subject where we develop and change ideas similar to draft writing in an English course (Jansen, 2020).

> **Tip**
>
> Introduce vocabulary and terminology *after* students have had a chance to make their own mathematical meaning of the content.

PLAN FOR SHIFTS IN LANGUAGE WITHIN AND ACROSS LESSONS

As we saw in the Language Spectrum, the nature of the language students use shifts as the context in which we ask them to use that language shifts. Not every situation should sound like the formal textbook-like language in context 4 of the Language Spectrum. When we're planning lessons, we should align our interactions with students and questions for them with the contexts that they're working in. For example, when students are working in small groups, it's natural for the language we use to ask questions and understand their thinking to be more informal and contextually based: "What's going on right here in the graph? Why did you add these numbers together (pointing to student writing on a page)?" When writing lesson plans, sometimes it's tempting to use more formal mathematical language; questions while students are working in small groups might be better served by less formal language that meets students where they are.

> **Tip**
>
> As students move from small-group discussions to a whole-class discussion, introduce more formal language *alongside*, not in place of, informal language.

Planning for shifts in language across a lesson is also important. The language we use to ask questions of students in small groups is likely to be different from the language we use in a whole-class discussion. When we're bringing mathematical ideas together and connecting them, this

> **Tip**
>
> When you plan your lesson flow, write down the specific moments (like small-group work) when you want to use and promote informal language and specific moments (like a whole-class discussion) to introduce formal language.

may be a time to move toward more formal language and to introduce specific vocabulary and terminology. We should plan explicitly for changes in how we ask questions and interact with students depending on whether they are working individually, in small groups, discussing as a whole class, and what our goals are for each of those segments of a lesson.

BROADEN WHAT COUNTS AS ACADEMIC LANGUAGE

What did you think of when we first used the phrase *academic language* in this chapter? What are you thinking about when you see that phrase now? Hopefully as a result of the ideas in this chapter, you've broadened your idea of what counts as academic language. Academic language isn't just the formal vocabulary and terminology of math. It includes informal language that students bring from their own experiences to describe math ideas. It includes contextual language that we all use when we're working on real-world problems.

An important piece of leveraging student language assets is to make space for an expanded and inclusive concept of academic language. We should make space in our lessons for gestures, inscriptions, and visuals. This includes making physical space, including centering students when they explain so gestures and visuals are accessible to all, and creating board and/or projector space both for students to use in sharing their ideas and for us as teachers to record important ideas (Liljedahl, 2021).

Relatedly, as teachers, we need to consider the power and privilege that comes with our status in the classroom. The ideas we choose to highlight are consequential to students because of our role. We need to think about how we explicitly mark and value informal math language and an expansive concept of academic language in the moment-to-moment work of teaching. Planning in advance helps us do this well, but we also need to think about how this unfolds in the moment.

Tip

Use gestures, inscriptions, and visuals as a part of academic language for you and your students.

Tip

As inspired by Peter Liljedahl's *Building Thinking Classrooms* (2021), use nonpermanent vertical surfaces on walls to make it easier for students to share their work when they are explaining, writing, and gesturing.

Tip

"De-front" your classroom by positioning student desks facing one another in pairs or small groups (Liljedahl, 2021).

Tip

Encourage students to talk to one another (rather than talking to or through you) during whole-class discussions by standing to the side or in the back of the classroom.

PUTTING IT ALL TOGETHER: REVISITING THE POOL PARTY

Let's pull together the ideas we've discussed in the chapter and think about how we'd plan for the Getting Ready for a Pool Party task with academic language in mind. As you work on the next activity, put the population of multilanguage learners that your school or classroom serves at the center of your discussion. In addition to the asset-focused academic language practices you're integrating into your planning, how are you specifically supporting this learner group?

■■■ Try This

Plan an imagined lesson using the Getting Ready for a Pool Party task. As you plan, discuss the specific actions you will take in different phases of the lesson (launch, small-group work, whole-class discussion) to leverage student assets related to language.

Consider specific ways to support the multilanguage learners that your school or district serves.

After you've discussed your plan, read on to learn how we thought about the task. ■

LAUNCHING THE TASK

In planning for the lesson, I (Mike) launched the task by asking students to think about draining, cleaning, and refilling a pool. I asked students to think about those situations and where they might make use of mathematical ideas to get that work done. I was mindful of the vocabulary list that's provided and made sure to revoice important ideas students shared that relate to those terms. I wrote down some key phrases or ideas on the whiteboard so that we could return to them later, and they were available for students to reference in small groups. Then I provided 3–5 minutes for students to individually get started on the task and then transitioned to small-group work. The individual work time wasn't enough to complete the task but afforded students opportunities to use some of their assets before bringing those ideas to a small group in which they would change and evolve.

SMALL-GROUP WORK

I provided about 20 minutes for small groups to grapple with the task. As I walked around the class to listen to the discussion, I made a list of the informal and contextual language that relates to those key vocabulary ideas. I listened to groups and asked clarifying questions, making use of their instructions and being attentive to gestures. I also made sure that all students in the group had a chance to use their language and tuned in specifically to my students with special language needs like emerging multilingual students or those who may be more comfortable writing than talking. I made notes about which groups are talking about the key aspects of academic language that I wanted to bring to the whole class and used those notes to organize my whole-class discussion to bring those ideas forward.

WHOLE-CLASS DISCUSSION

After I monitored the groups and had a good sense of which groups could help share their thinking about specific math ideas embedded in the task, I started the whole-class discussion. Given the importance of the context and the graph in this task, I made space for students to both speak about their solution and display aspects of it either with a document camera or with other digital technology.

During the discussion, I listened for the sorts of words and phrases that we noted in our earlier discussion. When a student used a phrase that represented a key math idea, like "goes up," I asked if anyone talked about or showed that same idea in a different way. I made space for gestures and visuals along the way and jotted down key phrases to add to our list from the start of the lesson.

To close the lesson, I provided the list of terms shown in Figure 2.2 and asked students to do two things based on their work on the task. First, they needed to annotate their work with places that reflected each term. Then for one term that their work didn't reflect, write one to two sentences about how they could use that idea in the context of the task.

LESSON SUMMARY

To summarize, students bring a wide range of mathematical assets to the classroom. So far in this chapter, we've talked about different ways to identify those assets and specific strategies we can use in the planning and teaching of a lesson to use those assets. Although many of our decisions in the moment of teaching can help leverage student assets, thoughtful planning helps us to intentionally create space and time within a lesson for leveraging students' language assets. In the last section of the chapter, let's talk about how we can extend that planning to attend to students with specific language needs.

Digging Deeper

More on Multilingual Learners and Universal Design for Learning

Emerging multilanguage learners have special language needs in the math classroom. The ideas we've discussed already in this chapter, such as delaying the introduction of vocabulary and terminology and a broad conception of academic language, are important for all learners, but particularly important for multilanguage learners. It's important to make sure we recognize the assets that multilanguage learners bring and provide them with opportunities to use those assets, even if as a teacher we are not fluent in their native language.

Rachel Lambert's Universal Design for Learning (UDL) Math (Lambert, 2021, 2024) framework introduced in Chapter 1 is particularly useful as a way to think about leveraging language assets for multilanguage learners in the secondary math classroom. Let's talk about one facet of the framework in each of the three categories—Engagement, Representation, and Strategic Action. ■

ENGAGEMENT: MEANINGFUL MATHEMATICS

Earlier in the chapter, we discussed planning lessons in ways that started with opportunities for students to bring their language assets and informal math understandings to the table. In the Pool Party task, this entailed providing students opportunities to discuss where they saw mathematical ideas in preparing a pool for a party. For our multilanguage learners, recruiting interest in ways such as this means being thoughtful about access. How might we plan to support multilanguage learners in understanding and being able to translate the key aspects of a context? What contexts are likely to be familiar to our students based on their cultural backgrounds, and which may require additional work to support their understanding? In the example of the Pool Party task, learners coming from cultures where home-based pools are not common are likely to be disadvantaged in talking about the math involved in draining, cleaning, and filling a pool. In these situations, video clips of the activity or careful prework in translating the key activities (like cleaning, draining, and filling) can support access. And as with many aspects of UDL, providing support for particular students allows for good access strategies for all students!

REPRESENTATION: INVEST TIME IN CORE IDEAS AND MULTIMODALITY

The UDL Math framework notes the importance of investing time in core ideas. Our strategy of delaying the introduction of vocabulary until after mathematical meaning-making keeps the focus on the core ideas before the introduction of vocabulary and terminology. Another aspect of the Representation category is multimodality, a strategy we highlighted in the section but that has particular importance for multilingual learners. The inclusive conception of academic language that includes gestures, inscriptions, and visuals supports making language and symbols accessible to multilanguage learners.

STRATEGIC ACTION: UNDERSTANDING SELF AS A MATH LEARNER

This facet of the UDL Math framework notes that we should support opportunities for students to reflect on their own development as mathematics learners (Lambert, 2024). With respect to students' language assets, this is when the idea of the Language Spectrum is particularly helpful. The different contexts for discussing mathematics, from informal conversations among students about a task to reporting to the whole class to a formal written explanation, can provide opportunities for students to learn about themselves as math learners and for us as teachers to support their strategic development. As we noted in discussing the Language Spectrum, the goal is not to move from left to right but to understand how language shifts and changes as we move in both directions on the Language Spectrum. Multilanguage learners are faced with the challenge of developing their language skills simultaneously with their content knowledge. Providing students with multiple opportunities to move on the language spectrum and to reflect on their language use while making sense of a new mathematical idea can be particularly helpful and supportive for multilanguage learners.

Reflect, Apply, Transform

To conclude our work in this chapter, let's think about our beliefs and how they relate to opportunities to position student language on the asset-based side of the deficit-to-asset continuum. When I first started teaching mathematics, I replicated the way I had been taught, which included starting off with key definitions like the notes shown in Figure 2.1. It took a very long time for me to stop and deeply consider *why* I had adopted those language practices and how that was both affording and restricting access to certain students in my class. When it came down to it, my beliefs about what was necessary for students to begin their mathematical learning were surfaced, and many of those beliefs were unproductive and not reflective of how students learn. In that spirit, the Reflect, Apply, Transform activity below provides you with some writing and discussion prompts to jump-start that reflective process. If you're working by yourself, you might use these as writing prompts. If you're working with a team, we encourage you to write some initial thoughts and then have a discussion with your colleagues about what you wrote.

1. What do you consider to be the most important things for students to be able to do with respect to academic language? Why are these important to you?
2. When a student uses informal mathematical language, what's your initial reaction? What reasons might students use informal language rather than formal language, even if they've already learned the mathematical term?
3. Think about the contexts you've used in recent problem-solving lessons. To whom are those contexts likely to be familiar? To whom might those contexts be less familiar?
4. Reflect on a recent lesson that you taught. When were there opportunities for students to leverage the assets that they brought to the classroom that day? When were there opportunities to listen to and build on the assets of others?
5. How might the use of students' language assets be explicitly valued in the work we do assessing student performance?