Promoting a Positive Math Identity
Module 1 – The Importance of Math Identity for Math Success
Facilitator's Guide

Time: 120 minutes (90-minute option available)
Facilitators: Instructional coaches or teacher leaders who work with secondary math teachers
Audience: Secondary math teachers

Session Outcomes

By the end of the session participants will be able to:

- Reflect on their own math identities.
- Describe how math identity impacts students' engagement and learning.
- Recognize the role adults play in creating math environments that support the development of a positive math identity.
- Understand how math identity and the Standards for Math Practice support and build on each other.

Materials and Supplies

- PowerPoint slides
- Chart paper and markers
- Sticky notes
- Pens
- Internet access
- Pre-made poster labeled "Relationship to Math," with a line drawn on the poster representing a continuum from negative to positive (or create on a whiteboard or blackboard).
- Eight pre-made posters, each with one of the eight Standards for Mathematical Practice, posted around the training room.
- Handout (enough for each participant): Connection with Standards for Mathematical Practice
- Pre-loaded video: Inside Mathematics. (n.d.). *day 4: identifying strategies for perseverance* [Video] (Licensed under Creative Commons 3.0). Retrieved from: http://www.insidemathematics.org/classroom-videos/building-classroom-climates-for-mathematical-learning/secondary/taking-responsibility-for-learning/day-4-identifying-strategies-for-perseverance

Note. These materials were produced for the Idaho State Department of Education and the Idaho Regional Mathematics Centers and were presented on August 13, 2019 at the Idaho Council of Teachers of Mathematics conference.

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Session at a Glance

Timing	Segment	Key Activities
15 minutes	Welcome, Introductions, and Icebreaker	Facilitator introduces self, provides an overview of the training series, and reviews the module training objectives. Then facilitator leads participants in an icebreaker activity that helps them get to know one another. The activity will also prompt self-reflection on their experiences with and attitudes about math.
10 minutes	Overview of Math Identity and Agency	Math identity and agency are defined and described, including their relationship to the Standards for Mathematical Practice.
10 minutes	What's so Special About Math?	Presentation of math stereotypes and their implications for math performance and success.
10 minutes	What Role do Adults Play?	Description of the role of adults in shaping students' math identity.
10 minutes	Break (Omit for 90-minute session)	—
35 minutes	Key Aspects of Math Identity	Definitions and descriptions of the key aspects of math identity. Review of research highlighting the connection between math identity and math success.
30 minutes	Tying it all Together	Participants reflect on what they learned in the session and plan for how they will apply it. Includes two options that can be omitted for a 90-minute session.

Timing	Topic/Steps/Activities	Facilitator Notes	Resources/ Materials
15 minutes	**Welcome, Introductions, and Icebreaker** 1. Welcome participants to session. 2. Introduce self. 3. Review the background and progression of the modules in the training series. **Key Talking Points** • Slide 1 ➢ This module is one in a series of modules developed by REL Northwest for the Idaho State Department of Education and the Idaho Regional Mathematics Centers. ➢ REL Northwest worked with these stakeholders to develop training modules that help middle school math educators in Idaho to implement evidence-based strategies to improve students' math attitudes. • Slide 2 ➢ The current module, *Module 1*, provides an overview of the research base to build an understanding of why educators should consider students' math attitudes and beliefs. The module also shows the link between math attitudes and outcomes. ➢ *Module 2* focuses on how educators can change their practice in ways that promote a classroom climate that is more conducive to positive math attitudes and beliefs. ➢ *Module 3* provides specific activities that educators can implement to promote positive math attitudes and beliefs. 4. Review the module learning objectives (slide 3). 5. Show the math autobiography activity slide (slide 4). 6. Ask participants to complete their "math autobiography." They can write out the complete autobiography or just jot down their responses to the prompts.		Slide 1: Title slide Slide 2: Training series progression Slide 3: Module 1 learning objectives Slide 4: Activity

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	7. Have participants share their math autobiography with a partner at their tables. 8. Distribute sticky notes to participants. Invite them to come up and place one of the sticky notes on the math relationships continuum line to indicate if they describe their relationship to math as mostly positive, mostly negative, or somewhere in between. 9. Show the slide with the discussion prompts (slide 5) and use them to facilitate a discussion on participants' math identities. Record/summarize responses on chart paper. 10. Pause for questions before proceeding.	*Consider whether this sticky note activity is appropriate for your audience and omit if not.* *The key point to surface is that not everyone has a positive math identity and early experiences can hold strong influence over the development of math identity.*	Materials: Sticky notes; math relationship continuum (See "Materials and Supplies" above) Slide 5: Discussion Materials: Chart paper and markers
10 minutes	 **Overview of Math Identity and Agency** 1. Walk through the first three slides that provide the contributors to math success and highlight math agency and math identity, making the following key points.  **Key Talking Points** • Slide 6 ➢ If we were somehow able to peek under the hood to see all the cogs in the complex machine of math success, we would definitely expect to see math abilities, such as procedural skills and fluency, conceptual understanding of math topics, and mathematical reasoning, which are all important. ➢ These are the kinds of math skills that many of you may have identified as contributing to your math success in your autobiography. ➢ But it's likely that some of you also brought to mind other contributors. • Slide 7 ➢ Assuming that math success is only a product of having the right math skill and ability oversimplifies a more complicated process. ➢ In this training we will focus on the equally important, but	*Connect back to any relevant examples or points shared by participants in the debrief of the math autobiography.*	Slides 6-8: Elements of math success (3 slides)

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	often ignored contributors of math success, including: math identity, math agency, and the surrounding math environment. • Slide 8 ➢ The goal of this session is to help you understand the importance of math identity and agency, how they are related to success in math, and why some students are less likely than others to develop a strong math identity. ➢ In the sessions that follow we will cover evidence-based classroom practices and strategies that support students to develop a positive math identity. 2. Define math agency and math identity and describe their relevance to math success using the slides provided. **Key Talking Points** • Slide 9 ➢ Math identity is an umbrella term that encompasses how students see themselves in relation to math. This includes beliefs about one's potential as a math learner, beliefs about how others perceive you, and beliefs about the nature of math abilities. ➢ These beliefs can be positive or negative in nature. ➢ It's also important to keep in mind that students' identities are connected to and shaped by their other importantly held identities, such as their racial, cultural, gender, family, faith, and language identities. • Slide 10 ➢ Math identity focuses on internal beliefs and attitudes. ➢ In contrast, math agency is the outward expression of one's math identity. ➢ Students with a positive math identity enact that identity by being highly engaged and active participants in the classroom.		Slides 9-11: What is math identity?; What is math agency?; Why should we care about identity and agency? (3 slides) Materials: Handout, "Connection with Standards for Mathematical Practice"

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	• Slide 11 ➢ As educators we care deeply about academic outcomes. We ask ourselves important questions, like are our students mathematically proficient? Are our students ready for college-level math? ➢ When we attend to the math environment and make sure it affirms a positive identity for all students, we are doing the groundwork to achieve our ultimate goal of making sure all students reach their potential in math. ➢ The research we will review today shows that math identity and math agency are the precursors for positive academic outcomes in math. Students with a positive math identity are more agentic about their math learning. Agentic students take more ownership of their learning and they engage in the types of behaviors that facilitate better outcomes — things like studying harder, seeking out assistance, and persevering when things get challenging. ➢ So, although attending to math identity and agency may seem like its drawing focus away from the ultimate goal of promoting academic outcomes, you are actually directly supporting that goal by ensuring your classroom is identity-affirming for all students. 3. Distribute the handout that provides connections to the Standards for Mathematical Practice (SMPs), if not already distributed. 4. Connect math identity and agency to the SMPs and the Routines for Reasoning framework using the provided slides. **Key Talking Points** • Slide 12 ➢ One way to situate the importance of math identity and agency is by considering them in relation to the Common Core State Standard (CCSS) and the Standards for Math Practice (SMPs). ➢ The SMPs articulate the way mathematicians work and		Slides 12-13: Connection with Standards for Math Practice (2 slides)

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	approach problems. These are the ways effective math students think and act when problem-solving in math. ➢ Thus, one way of framing the SMPs is that this is what math agency looks like in practice. • Slide 13 ➢ You may be familiar with the Routines for Reasoning framework. These authors make the case that not all math practices are equal. They frame SMP 1 as an overarching goal. SMPs 2, 7, and 8 are different "avenues of thinking" that promote SMP 1. SMPs 3, 4, 5, and 6 are "supporting actors" that play an important role in the problem-solving process, regardless of which avenue of thinking is engaged. ➢ Because a positive math identity is at the root of math agency, math identity is related to all the SMPs. Without a strong math identity, students have little motivation to engage with math and persevere when they face challenges. ➢ As you learn more about math identity today, we encourage you to look for other connections between the SMPs and math identity. We have shared a handout with you, so you can refer back to these standards as we return to the connections between the standards and math identity throughout the session. 5. Pause for questions before proceeding.		
10 minutes	**What's so Special About Math?** 1. Display the "What's so Special About Math?" slide (slide 14) and preview the content to be covered in this segment. **Key Talking Point** • Slide 14 ➢ The opening discussion likely proved that participants' attitudes towards math and experiences with math are not		Slide 14: What's so special about math?

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	entirely positive. The next portion of the presentation delves into the prevalence of math negativity and examines why math in particular may set some people up to hold more negative attitudes. 2. Review the prevalence of math anxiety among both adults and secondary students taking the Programme for International Student Assessment exam using the slides provided. **Key Talking Points** • Slide 15 ➢ Over 90 percent of adults report at least some level of anxiety about math. • Slide 16 ➢ Amongst students ages 15-16, over half worry that math will be difficult on the Programme for International Student Assessment (PISA) exam. • Slide 17 ➢ Amongst students ages 15-16 who are taking the PISA exam, a third report that they feel very tense when completing math homework. • Slide 18 ➢ Amongst students ages 15-16 who are taking the PISA exam, nearly a third report being very nervous when doing math problems. ➢ The key take-away here is that negativity about math is highly prevalent. You should expect about 1 in 3 of your students to have intensely negative feelings about math. 3. Display the “Negativity about math” slide (slide 19) and review how math carries more “baggage” than other domains.		Slides 15-18: Prevalence of negativity about math (4 slides) Slide 19: Negativity about math

Timing	Topic/Steps/Activities	Facilitator Notes	Resources/ Materials
	Key Talking Points • Slide 19 ➢ Why is math negativity so prevalent? One reason that math negativity is so prevalent may be that this content area, more so than others, has a lot of "baggage" associated with it. ➢ You are unlikely to hear people openly disparage their reading skills, but you've probably all heard someone say "I'm just not a math person" or "I'm so bad with numbers." 4. Display the slide with the first five results from a Google Image search for "math genius" (slide 20) and ask participants to think about what it might mean and how it points to math having more "baggage" than other domains using the following prompts. **Key Discussion Questions** • What do you notice about these images? • Do you think they reflect some cultural assumptions in our society about who is good at math? 5. Walk through the slides describing stereotypes about math and the harm they can cause using the following key points. **Key Talking Points** • Slide 21 ➢ What these images reveal are some strong cultural associations we have with the nature of math abilities. ➢ The first stereotype is that math requires brilliance, and that math ability is innate. In other words, you've either got it or you don't. Many people believe that math skills are somehow very different from other types of skills, and that only certain people—math geniuses—are born with innate math abilities.	*If most participants have a computer and the meeting space has internet access, consider directing participants to do a Google Image search for the term "math genius" prior to showing this slide.* *Some ideas to surface include youth, glasses ("geekiness"), gender, race.*	Slide 20: Google image search for "Math Genius" Slides 21-26: Stereotypes about math; Which groups does our society associate with brilliance?; Girls and math; Stereotypes emerge early; What's the harm? (6 slides)

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	➢ The second stereotype is that certain types of people are more likely to possess math skills. • Slide 22 ➢ These two stereotypes in conjunction set up some students to be less likely to develop strong math identities. ➢ Not only do these stereotypes affect the identities students hold for themselves, but they can also set teachers up (consciously or not) to *prescribe* particular identities to students. • Slide 23 ➢ Who should we expect to be negatively impacted by these stereotypes about math? ➢ As a society, we tend to associate brilliance with males. ➢ Consider this analysis of parents' search terms. For every 10 Google searches about daughters being gifted, there are 25 about sons. (In contrast, parents are more likely to do web searches asking "is my daughter overweight?" compared to googling whether their sons are overweight.) • Slide 24 ➢ This quote from Shelley Correll summarizes a key takeaway from her research on gender differences in math: "Boys do not pursue mathematical activities at a higher rate than girls because they are better at math. They do so, at least in part, because they *think* they are better." ➢ Of course, negative math stereotypes are not constrained to gender. They also extend to African American and Latino students who are stereotyped as less intelligent than white students. If we think back to the images of what a math genius looks like, it becomes clear who we expect to belong and who is left out. • Slide 25 ➢ Research has found evidence that children endorse stereotypes about math as early as elementary school. What's particularly telling is that the gender stereotypes	*If time allows, ask participants what these findings suggest about the effects of math tracking.*	

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	emerge before we even begin to see differences in math achievement. • Slide 26 ➢ Why should we worry about the potential harm of math stereotypes? Constraining students' participation in math is problematic, because we know math serves as both gateway and gatekeeper. ➢ Students with strong math experience and skills have access to more advanced courses, entrance to more selective colleges, and can choose from a wider selection of math-dependent careers that also tend to be more lucrative. ➢ And this pattern begins early. Research shows that math skills at entry to kindergarten are the strongest predictor of later academic outcomes (followed by reading and attention skills). 6. Pause for questions before proceeding.		
10 minutes	 **What Role Do Adults Play?** 1. Display the "What Role Do Adults Play?" slide (slide 27) and preview the content to be covered in this segment. 2. Review the ways in which adults' attitudes towards math impact children using the slides provided.  **Key Talking Points** • Slide 28 ➢ In addition to being affected by cultural stereotypes about math, we know children are also affected by the adults in their environment. Negativity about math is easily transmitted from adults to children. ➢ For instance, research shows that children with math-anxious parents are more likely to have math anxiety and show lower math achievement. This is particularly true for		Slide 27: What role do adults play? Slides 28-31: Adults' attitudes matter (4 slides)

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	children whose math-anxious parents provide a lot of help with homework (and thus have more opportunity to express their own math negativity). • Slide 29 ➢ We also know that teacher attitudes matter. ➢ Research also shows that children with math-anxious teachers are more likely to have math anxiety, are more likely to endorse math stereotypes, and learn less in math. ➢ Math-anxious teachers often avoid teaching math and teach it differently. Math-anxious teachers spend about 50 percent less time teaching math. They also rely more on teaching skills and facts compared to deeper processing and mathematical reasoning. • Slide 30 ➢ Teachers attitudes and beliefs matter in other ways as well. ➢ Recall the stereotypes we talked about earlier and how they can influence the identities students hold for themselves. ➢ Well, not only do these stereotypes affect the identities students hold for themselves, but they can also set adults up (consciously or not) to *prescribe* particular identities to students. • Slide 31 ➢ A robust body of research on teacher expectancy effects shows that teacher expectations regarding student achievement can hold sway for future outcomes. ➢ Few of us explicitly and outwardly endorse stereotypes. However, our implicit attitudes can run counter to our consciously endorsed beliefs. And even these implicit attitudes can be harmful. ➢ For instance, research shows teachers' implicit attitudes about intellectual abilities are related to classroom achievement gaps. 3. Display the reflection slide (slide 32). 4. Ask participants to form small groups of three or four and discuss		Slide 32: Reflection

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	the reflection questions. 5. Allow 5 minutes for small-group discussions, then reconvene for a large-group share-out and debrief.  **Key Talking Points** • Slide 32 ➢ Our perceptions of others are colored by our background, life experiences, personal biases, and cultural stereotypes. This is true of all of us! ➢ As teachers our perceptions can and do affect how we treat students, so we have a responsibility to reflect on our perceptions and challenge them. 6. Pause for questions before proceeding.		
10 minutes	**BREAK**	Be sure to set a timer. This break can be cut if conducting a 90-minute session.	Slide 33: Take a break
35 minutes	 **Key Aspects of Math Identity and Agency** *Overview – 3 minutes* 1. Display the "Key Aspects of Math Identity and Agency" slide (slide 34) and preview the content to be covered in this segment.  **Key Talking Points** • Slide 34 ➢ As we mentioned before, math identity is an umbrella term that refers to many aspects of students' beliefs about math and themselves in relation to math. We will now focus on some key aspects of math identity. These aspects were selected based on our review of the research base on math identity and outcomes. We highlight the components of math		Slide 34: Key aspects of math identity and agency

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	identity that have been related to later outcomes and for which there are evidence-based practices and strategies shown to promote more positive outcomes. 2. Preview the key aspects of math identity and agency using the slide provided. **Key Talking Points** • Slide 35 ➢ Our research review pointed to four key aspects of math identity that have been shown to either promote a more positive math identity or to detract from a positive math identity ➢ The aspects that promote a positive math identity are a sense of belonging, growth mindset, and perceived utility of math. ➢ In contrast, math anxiety works to thwart math identity. ➢ In the section that follows we will briefly define each of these aspects and highlight some key research findings linking them to important outcomes. *Sense of Belonging – 9 minutes* 3. Walk through the slides describing belonging using the following key points. **Key Talking Points** • Slide 36 ➢ There are many ways to describe belonging, but all share the common theme of connection between people. Today we will use this definition: Feeling like an accepted, respected, valued, and legitimate group member. ➢ It's important to stress the "feeling like" part of that definition and to keep in mind that when we discuss belonging, we are referring to people's subjective perceptions about their		Slide 35: Key aspects of math identity Slides 36-44: What is belonging?; Belonging is a fundamental need; Exclusion is painful; Belonging in school: So what?; Belonging as a "Psychological Hub"; Lack of belonging saps concentration and focus; Do I fit in socially?; Belonging is multidimensional; Do I fit in intellectually? (9 slides)

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	acceptance in groups. A student who appears to be very connected (i.e., is a member of a club or organization and seems to have friends) may still feel a painful lack of belonging. • Slide 37 ➢ Belonging matters, because we are inherently social creatures and have a strong, fundamental need to form and maintain positive connections with other people. It is important to distinguish between need and want: Failure to satisfy a want may lead to disappointment, but failure to satisfy a need leads to severe distress and negative long-term consequences. ➢ Psychologists theorize that we have evolved with the need for belonging, because connection to groups was so critical to survival. In other words, we are hard-wired for connecting with other people. Although humans may differ in the quantity of connections they desire, we all need to be connected. This is really striking when you review the literature on belonging. These results are replicated again and again, across age groups, across cultures, and across time. ➢ Research has shown that we are very attuned—consciously or not—to our belonging status at all times. We pick up on and react to cues that our belonging might be at risk. Maybe you've received the "silent treatment" from a friend before and know how hurtful that can be. That is a pretty extreme signal about belonging, but we also pick up on more subtle cues, such as when another person won't look us in the eye. • Slide 38 ➢ When we experience exclusion or feel a lack of belonging, it's intensely painful and can have serious psychological and health consequences. (Paraphrase slide). ➢ Concerns about belonging and inclusion are likely very salient among middle and high school students who have expanding peer groups and who must also negotiate establishing new social ties and identities.		

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	• Slide 39 ➢ Just as general belonging is linked to more positive outcomes, we also know that belonging in schools is linked to better outcomes for students, both in terms of health and academics. Here are just a few of the outcomes associated with belonging. • Slide 40 ➢ Because belonging is related to and promotes so many important things, we view belonging as a kind of psychological hub. It is very difficult if not impossible to be fully engaged, motivated, interested and persist within a context when you don't feel as though you belong. ➢ In other words, students who feel a strong sense of belonging are also more agentic. • Slide 41 ➢ When we are concerned about whether we belong, precious mental energy gets sapped, and we have fewer resources left over to concentrate on other things. Uncertainty about belonging makes people more vigilant to cues about their belonging. ➢ What's more, this uncertainty colors people's interpretation of social events. As a result, these events are often interpreted with more negative meaning. For instance, normal things, such as a teacher canceling a meeting or a classmate that doesn't say "hi," can get interpreted in the worst possible light. The student may feel that the classmate and teacher are avoiding them, because the student believes that everyone hates them and that they don't belong. ➢ This creates even more uncertainty, which feeds back into the cycle. ➢ If we consider the flip side, when someone feels more positive about their belonging, then they are less attentive to cues regarding belonging and more likely to give any incoming cues the benefit of the doubt. This further bolsters		

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	their sense of belonging, which promotes resiliency and strengthens social connections. • Slide 42 ➢ Coming from a place of not belonging versus a place of belonging can create very different perceptions of the same environment or event, and those different perceptions can lead to different reactions. Think back to the example of the friend who didn't say "hi" in the hallway. ➢ For a student lacking belonging, this event may be perceived as an indication that no one at school likes them and that they don't fit in. This perception will probably lead to more withdrawal. In contrast, for a student who feels a sense of belonging, the friend not saying "hi" is explained away: "She just didn't see me." This perception may lead to friendlier behavior next time. ➢ This difference in perspective can be a challenge for teachers and administrators who may be aware of the importance of belonging, but who are coming from a different perspective than students. For example, canceling a meeting with a student carries no hidden meaning for a teacher who assumes the student will understand that they were simply busy at that time. But to the student who worries about belonging, it may feel as though the teacher doesn't like the student and doesn't want them in the class. • Slide 43 ➢ When we talk about belonging in academic contexts, it's important to consider that it is multidimensional. Students not only have to negotiate their sense of belonging with their peers ("Do I fit in here socially?"), but also with the content area itself ("Do I fit in here intellectually?"). ➢ These two aspects of belonging can interact, and both are important. For instance, a student may feel like an outsider in math, but have a strong sense of connection with their peers in math class. On the other hand, a student can feel like he or she is a "math person," but can still have trouble connecting with his or her classmates in a math class.		

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	➢ It is especially important to consider the multidimensional nature of belonging when we're talking about math, given that the stereotypes we discussed earlier set up expectations about who belongs and who doesn't. These stereotypes and beliefs about math can make math belonging particularly difficult for some students. • Slide 44 ➢ Just as concerns about social belonging can affect social behavior in ways that reinforce negative patterns, concerns about intellectual belonging can negatively affect academic behavior in ways that further threaten belonging. ➢ Students who feel less certain about their math belonging may interpret setbacks and challenges much more negatively. 4. Display the slide with the student vignette (slide 45) and give participants time to read it. 5. Ask participants to turn to partners and discuss the following questions. **Key Discussion Questions** • How might this situation affect Olivia's math identity? How might it influence her sense of math belonging? • Do you think the adults in this situation are prescribing a math identity onto Olivia that affects their decisions? What could the teacher do differently in this situation? 6. Reconvene the group and ask for a few volunteers to share what they discussed with their partners. 7. Display the slides connecting belonging to the SMPs and make the following key points. **Key Talking Points** • Slide 46 ➢ Let's connect the concept of belonging back to the SMPs.	*This activity (reviewing and responding to the student vignette) is optional; consider skipping if time is limited.*	Slide 45: Olivia's Story Slides 46-47: How does this aspect of math identity support and build on the SMPs? (2 slides)

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	• Slide 47 ➢ The research base shows a clear connection between belonging and perseverance in academic contexts. ➢ We also see a connection between belonging and SMP 3: To the extent that students have a strong sense of belonging in the math classroom, they are more likely to be able to share their arguments with others and critique others' reasoning. ➢ Do you see other connections? 8. Ask participants if they see additional connections between belonging and the SMPs. 9. Pause for questions before proceeding. *Growth Mindset – 9 minutes* 10. Walk through the slides describing growth mindsets using the following key points. **Key Talking Points** • Slide 48 ➢ Growth mindset regards the beliefs we have about the nature of intelligence and ability. ➢ When we believe that intelligence can be developed with effort, as well as the right strategies and support, we have a growth mindset. • Slide 49 ➢ The research on growth mindsets has been pioneered by Dr. Carol Dweck, a psychologist who wanted to understand how people respond to failure. ➢ In her research, Dweck examined traits that allow some people to cope with failure rather than crumble. During her studies, she realized it wasn't that some people coped with failure better than others, but rather that they embraced		Slides 48-54: What is a growth mindset?; What are mindsets?; Mindsets are domain specific; Growth mindset and math; *How* does growth mindset impact math achievement (7 slides)

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	failure as a necessary step to learning and to eventual success. ➢ From her research, Dweck identified two belief systems that people tend to fall into. ➢ With a fixed mindset, intelligence and ability are viewed as fixed qualities that one has from birth and that cannot be significantly changed over time. ➢ With a growth mindset, intelligence and ability are viewed as dynamic elements that can be developed over time with effort, strategies, and support. • Slide 50 ➢ People can hold different mindsets regarding specific domains or abilities. That means students have different mindsets depending on the subject: math, art, language, etc. • Slide 51 ➢ Many other researchers have studied mindsets and their impact on student success. They have found that mindset matters a great deal in academics and math, especially once math becomes very challenging (as in middle school or junior high). ➢ Student mindset predicts math success. Students with growth mindsets have better math grades and test scores than students with fixed mindsets. ➢ These effects have been replicated with many different types of students. For example, a large study in Chile found that mindset predicted student performance on the national exam. Interestingly, having a growth mindset seemed to help low-income students (who tend to do worse on standardized tests, on average) perform as well as students from much wealthier families. • Slide 52 ➢ When students have a growth mindset, they engage in positive behaviors and have other beliefs that serve them well in school: ➢ They believe effort pays off.	*If time allows, consider asking participants to give examples of domains for which they might hold a fixed versus a growth mindset.*	

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	➢ They focus on learning things (rather than simply trying to appear like they know things). ➢ They use effective strategies to learn or recover from mistakes, such as working harder when they get a bad grade on a test. • Slide 53 ➢ Students with growth mindsets are much less likely to exhibit helplessness when they suffer a setback. They don't blame the test for being unfair when they fail. Instead they double down on their efforts to improve. • Slide 54 ➢ These findings together paint a picture of a student that continues to put in effort, even after encountering failure. The findings show a student who focuses on what they can learn instead of on "looking smart". ➢ Overtime, these attitudes lead to the behaviors that result in better math performance. 11. Display the slides connecting growth mindsets to the SMPs and make the following key points.  **Key Talking Points** • Slide 55 ➢ Let's connect the concept of growth mindset back to the SMPs. • Slide 56 ➢ Perseverance is deeply connected to growth mindset. ➢ We also see a connection to SMP 3: The vulnerability required to engage in critique requires growth mindset. ➢ What other connections do you see? 12. Ask participants if they see additional connections between growth mindsets and the SMPs.		Slides 55-56: How does this aspect of math identity support and build on the SMPs? (2 slides)

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	13. Pause for questions before proceeding. *Perceived Utility–5 minutes* 14. Display and review the definition of perceived utility using the slide provided (slide 57). **Key Talking Points** • Slide 57 ➢ Perceived utility of math is the extent to which students believe that math is worthwhile to pursue. It's about whether they see math as useful and relevant to their lives outside of school now and as it applies to their future careers and choices. 15. Display slide 58 with the student comment from MathForum.org and have participants read it. Note that the comment expresses a sentiment that math educators often hear. 16. Walk through the slides describing perceived utility using the following key points. **Key Talking Points** • Slide 59 ➢ Utility matters, because it is a key source of motivation. When students see the connections between what they're learning and how it relates to their own lives, they will be more motivated and engaged learners. • Slide 60 ➢ Research shows that helping students see the utility in what they're studying leads to many desired outcomes, including: increased interest in the topic; increased confidence in their abilities; and better academic performance. ➢ Research also points to the benefit of involving parents and helping them promote the utility of what students are		Slide 57: What is perceived utility? Slide 58: Math—Why bother? Slides 59-60: Why does perceived utility matter? (2 slides)

Timing	Topic/Steps/Activities	Facilitator Notes	Resources/ Materials
	learning for their futures. 17. Display the slides connecting perceived utility to the SMPs and make the following key points. **Key Talking Points** • Slide 61 ➢ Let's connect the concept of perceived utility back to the SMPs. • Slide 62 ➢ Perseverance is more likely to occur when students see utility in the math they are learning. ➢ Perceived utility is also connected to SMP 4, which focuses on modeling with mathematics and using math to make sense of and solve real-world problems. ➢ What other connections do you see? 18. Ask participants if they see additional connections between perceived utility and the SMPs. 19. Pause for questions before proceeding. *Math Anxiety – 9 min* 20. Walk through the slides describing math anxiety using the following key points. **Key Talking Points** • Slide 63 ➢ We define math anxiety as feeling apprehensive, tense, and fearful about situations involving math. • Slide 64 ➢ This definition is less technically described in this quote from a 10-year-old math student. ➢ This quote illustrates that math anxiety can be triggered just		Slides 61-62: How does this aspect of math identity support and build on the SMPs? (2 slides) Slides 63-68: What is math anxiety; Implications of math anxiety; Reciprocal cycle; Math anxiety robs performance (6 slides)

Timing	Topic/Steps/Activities	Facilitator Notes	Resources/ Materials
	by anticipating doing math. • Slide 65 ➢ Math anxiety is different from just not liking math. ➢ Math anxiety is distinct from other forms of anxiety, such as test anxiety or general anxiety, and it is not the same as having poor math skills. ➢ Research suggests that math anxiety is a global phenomenon and is very prevalent, even among young children. ➢ For example, one study found that a third of a sample of first-graders reported anxiety about math. Research suggests that math anxiety, particularly in relation to testing, begins in elementary school and increases as students get older and accumulate experiences. • Slide 66 ➢ Research evidence supports the link between math anxiety and poorer performance in math. Correlational evidence shows that math anxiety is negatively related to math performance. This has been replicated at all academic levels, from elementary school to college. ➢ Further, studies have shown that the predictive power of math anxiety is specific to math. For instance, there is little association between math anxiety and performance on a reading comprehension test. • Slide 67 ➢ Unfortunately, math anxiety can feed into a negative reciprocal cycle. Students who are anxious about math often end up avoiding math, which only exacerbates the problem, because it limits opportunities for improving math skills. ➢ This is concerning, because math avoidance closes students off from lucrative career paths. Science, technology, engineering, and math (STEM) fields and occupations drive technological innovation and bring economic and public health benefits, yet many countries face shortages of skilled STEM workers.	*Conduct a thumbs up/thumbs down poll of participants for whether they've ever experienced math anxiety.*	

Timing	Topic/Steps/Activities	Facilitator Notes	Resources/ Materials
	• Slide 68 ➢ Inherent in the concept of math anxiety is the implication that someone would be better at math if they had less anxiety about it. This is supported by a growing body of research evidence. ➢ Math anxiety appears to impact the amount of "working memory" people have. Working memory is what allows people to keep several things in mind simultaneously (such as rubbing your tummy while patting your head), and it takes energy. ➢ When the brain spends energy on being anxious, it has fewer resources to devote to the task at hand. The student now has to do two things at once: Solve the math problem (rub the tummy) AND be anxious about it (pat the head). 21. Display the slides connecting math anxiety to the SMPs and make the following key points. **Key Talking Points** • Slide 69 ➢ Let's connect the concept of math anxiety back to the SMPs. • Slide 70 ➢ Math anxiety is linked to SMP 1: Students who are math anxious are also math avoidant and less likely to persevere in solving problems. ➢ Math anxiety is also likely related to SMP 3 for many students: Interacting with others successfully is complicated when students are math anxious and may be more sensitive to performing in front of others. ➢ What other connections do you see? 22. Ask participants if they see additional connections between math anxiety and the SMPs.		Slides 69-70: How does this aspect of math identity support and build on the SMPs? (2 slides)

Timing	Topic/Steps/Activities	Facilitator Notes	Resources/ Materials
	23. Pause for questions before proceeding.		
30 minutes	**Tying It All Together** 1. Display the "Tying it All Together" slides and summarize the session using the following key points. **Key Talking Points** • Slide 72 ➢ Math identity is a complex topic. We focus on these four aspects that are distinct concepts, but which are also interrelated ➢ For instance, students with a fixed mindset are probably more likely to doubt their belonging in math, since they don't believe they can increase their math skills. If you doubt your belonging and don't feel like a "math person," you're probably less likely to see the utility of math for your life and your future. ➢ In the trainings that follow we review ways to promote these aspects of math identity and expect that actively promoting any one of the four aspects can also benefit the others. 2. Lead participants through one or both of the following reflection and action-planning activities based on available time (or skip both for a 90-minute session). *Video Viewing – 10 minutes* a. Display the slide on promoting math identity in the classroom. b. Show the pre-loaded video of a teacher facilitating a student discussion about classroom norms. c. Debrief video with participants using the prompts on the second slide.	*Omit for a 90-minute session and skip to Step 3.*	Slides 71-72: Tying it all together (2 slides) Slides 73-74: Promoting math identity in the classroom (2 slides) Materials: Pre-Loaded Video (see "Materials and Supplies")

Timing	Topic/Steps/Activities	Facilitator Notes	Resources/ Materials
	SMPs Gallery Walk – 10 minutes a. Show the slide with the SMP and Routines for Reasoning graphic (slide 75). b. Point out the eight posters posted around the room. c. Give each participant a pad of sticky notes and a pen. d. Direct participants to write ideas/respond to the following two prompts. They should jot their responses on sticky notes and place them on the appropriate poster(s). 3. Display the slide with final reflection questions (slide 76). 4. Ask participants to discuss the reflection questions in small groups for five minutes, then reconvene for an entire group share out and debrief. **Key Discussion Questions** • Do you see any connections between this math practice and particular key factor(s) of math identity? • Share an example of how math identity can impact a student's ability to engage with this practice (positively or negatively). 5. Remind participants of what's coming next in the training series using the slide provided. 6. Display the slides providing information about REL Northwest and the references used to prepare this module. 7. Take any final questions from participants. 8. Thank participants for their time and contributions.	*Omit for a 90-minute session and skip to Step 3.* *If possible, save and type these ideas up after the session to share with participants, as well as to tie back to and use for examples in Modules 2 and 3.*	Slide 75: Connection with Standards for Math Practice Materials: Eight posters with SMPs written on them; sticky notes; and pens Slide 76: Reflection Slide 77: What's next? Slides 78-82: About REL Northwest; Contact us; References (5 slides)