Promoting a Positive Math Identity
Module 3 – Kernels of Practice to Promote Positive Math Attitudes
Facilitator's Guide

Time: 120 minutes
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:

- Understand how short "kernels of practice" can be incorporated into current teaching strategies.
- Implement activities to improve students' math identities in their classrooms.
- Adapt activities presented to fit the needs of their students.

Materials and supplies

- PowerPoint slides
- Chart paper and markers
- Handouts: (one copy of each per participant)
  1. Teacher Guide: Interest Interviews to Promote Math Belonging and Utility
  2. Teacher Guide: Normalizing Belonging Uncertainty
  3. Teacher Guide: Focused Breathing to Reduce Math Anxiety
  4. Emotion Reappraisal
  5. Incorporating Kernels of Practice into Instruction (Final Reflection)
- Internet access
- Preloaded videos:
  6. Digital Promise. (n.d.). Teens using mindfulness and moving in the classroom [Video] (Licensed under Creative Commons 4.0). Retrieved from https://lvp.digitalpromiseglobal.org/content-area/math-7-9/strategies/mindfulness-activities-math-7-9/summary

Note. These materials were produced for the Idaho State Department of Education and the Idaho Regional Mathematics Centers and were presented on August 14, 2019 at the Idaho Council of Teachers of Mathematics conference.

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Session at a Glance

Timing	Segment	Key Activities
10 minutes	Welcome, introductions, and icebreaker	Facilitator introduces self, leads participants in an icebreaker activity, and reviews learning objectives.
5 minutes	Overview of math identity and agency	Review the definitions of math identity and agency from module 1, including their relationship to the Standards for Mathematical Practice.
5 minutes	Introduction to kernels of practice	Participants are introduced to the concept of kernels of practice and how they promote math identity and achievement.
35 minutes	Interpersonal kernels of practice	Describe in detail several evidence-based kernels of practice that provide interpersonal supports to students and promote math identity and achievement, especially the following kernels: interest interviews; honor mistakes; and math role models
10 minutes	Break	
45 minutes	Intrapersonal kernels of practice	Describe in detail several evidence-based kernels of practice that provide intrapersonal supports to students and promote math identity and achievement, especially the following kernels: normalize uncertainty; utility reflection; focused breathing; and emotion regulation
10 minutes	Closing	Participants reflect on what they learned in the session and plan for how they will apply it.

Timing	Topic/Steps/Activities	Facilitator Notes	Resources/ Materials
10 minutes	**Welcome, introductions, and icebreaker** 1. Welcome participants to session. 2. Introduce self. 3. Display the slide with the icebreaker activity (slide 2) and review instructions with participants. 4. Have participants form a circle. 5. Say a number between 1 and 99. 6. Go around the circle of participants and have each person say the next number in the sequence as quickly as they can. However, if a number contains or is divisible by 5, the participant must say "fizz" instead of the number. If a number contains or is divisible by 7, the participant must say "buzz" instead of the number. Finally, if a number contains or is divisible by both 5 and 7, the participant must say "fizz buzz" instead of the number. If someone makes a mistake, they are out of the game. 7. Continue until only one player remains. 8. Review the background and progression of the modules in the training series using the key talking points below. **Key Talking Points** • Slide 3 ➢ 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. ➢ Module 1 provides an overview of the research base to build an understanding of why educators should consider students' math attitudes and beliefs, as well as 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	*This icebreaker is optional. Include if time permits.*	Slide 1: Title slide Slide 2: Fizz Buzz Slide 3: Training series progression

Timing	Topic/Steps/Activities	Facilitator Notes	Resources/ Materials
	more conducive to positive math attitudes and beliefs. ➢ The current module, module 3, provides specific activities that educators can implement to promote positive math attitudes and beliefs. 9. Review the module learning objectives (slide 4).		Slide 4: Module 3 learning objectives
5 minutes	 **Overview of math identity and agency** 1. Walk through the slides defining and summarizing math identity and agency from module 1. Connect these concepts to the Standards for Mathematical Practice (SMPs).  **Key Talking Points** • Slide 5 ➢ Math success depends on many factors. Of course, procedural skills and fluency, conceptual understanding of math topics, and mathematical reasoning are all important. ➢ But if we were able to peek behind the curtain of math success, we would see a more complicated process involving more than just math skills. In this training we will focus on the equally important contributors of math identity and math agency, and the surrounding math environment that supports this. • Slide 6 ➢ As educators we care deeply about academic outcomes. We ask ourselves: Are our students mathematically proficient? Are our students ready for college-level math? ➢ When we attend to the math environment and support students in promoting a positive math identity, we are doing the groundwork toward achieving our ultimate goal of making sure all students reach their potential in math. ➢ The research we have reviewed in this training shows that math identity and math agency are precursors for positive academic outcomes. Students with a positive math identity		Slides 5-8: Elements of math success; Math identity and agency critical for math success; Key aspects of math identity; Connections with the Standards for Math Practice (4 slides)

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	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. • Slide 7 ➢ Math identity is a complex topic. ➢ We focus on these four aspects, which are distinct concepts but also interrelated: • A sense of belonging is when students feel like an accepted, valued, and legitimate group member. • Growth mindset is the belief that intelligence and ability can be developed with effort, strategies, and support. • Perceived math utility is the belief that math is useful, worthwhile, and relevant to life outside of school, now and in the future. • Math anxiety is feeling apprehensive, tense, and fearful about situations involving math. ➢ In the activities that follow we review ways to promote students' sense of belonging, growth mindset, and perceived utility. We will also look at ways to decrease students' math anxiety. We expect that actively promoting one aspect of math identity can also benefit the others. ➢ In the last module we focused on building the math environment and reviewed general practices to create identity-affirming classrooms. ➢ In this session we will focus on shorter, more targeted strategies, or "kernels", to promote positive math identities. • Slide 8 ➢ One way to situate the importance of math identity and agency is by considering them in relation to the Common Core State Standard (CCSS) Standards for Math Practice (SMP). The CCSS SMPs are meant to articulate the way mathematicians work and approach problems. These are the ways effective math students think and act when problem-solving in math. In other words, one way of framing		

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	the SMPs is that this is what math agency looks like in practice. ➢ You may be familiar with the framework presented by Kelemanik, Lucenta, & Creighton (2016) in *Routines for Reasoning*. This framework shows relationships between the SMPs. The authors of the framework 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 the "supporting actors." ➢ Because a positive math identity is at the root of math agency, math identity is related to all the SMPs and can also be thought of as a supporting actor. Without a strong math identity, students have little motivation to engage with math and persevere when they face challenges. 2. Pause for questions before proceeding.		
5 minutes	**Introduction to kernels of practice** 1. Display the slides defining and describing kernels of practice and share the following key points. **Key Talking Points** • Slide 9 ➢ Next we will discuss what we mean by "kernels of practice" and why we expect them to promote positive math identity and student math achievement. • Slide 10 ➢ The strategies presented in this module come from research on psychological interventions. ➢ Students perceive their environments differently based on their past experiences, beliefs, and identity. How they perceive the classroom environment shapes their experiences and outcomes at school.		Slides 9-11: Kernels of practice; What is a psychological "intervention"?; How do kernels affect outcomes? (3 slides)

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	➢ Psychological interventions target how students *perceive* both their environment and how they view themselves. These interventions seek to change students' perceptions from one that harms their experiences and outcomes in school to one that promotes positive identities and success. ➢ In this module we refer to interventions as "kernels of practice." We take evidence-based interventions shown to influence students' identity positively, and we interpret these interventions as practices we can use to promote positive math identity and achievement in the math classroom. • Slide 11 ➢ Interventions, or kernels of practice, are low-cost strategies designed to reshape how students make sense of and view the environment or themselves. ➢ Kernels of practice are not meant to be large shifts in classroom practices. They are meant to be practices you can easily integrate with what you are already doing. ➢ Kernels of practice affect students' outcomes through two different methods. ➢ First, kernels can target students' interpersonal perceptions, such as how they see or relate to others or their external environment. Kernels of practice that target students' interpersonal perceptions focus on changing how students relate to others and change classroom cues and messages to affirm the math identity of all students. ➢ Second, kernels can target students' intrapersonal perceptions, or how they see themselves. Kernels of practice that target students' intrapersonal perceptions focus on changing how students see themselves as math learners by reframing students' negative thoughts and feelings about math. The reframing process allows students to transition toward a more positive and identity-affirming status. ➢ Improving students' interpersonal and intrapersonal perceptions about math promotes positive math identity, which as we've previously discussed, leads to increased math agency and math outcomes.		

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	2. Display the slide with the list of evidence-based kernels that target both students' interpersonal and intrapersonal math perceptions (slide 12) and share the following key points. **Key Talking Points** • Slide 12 ➢ In this module we will discuss kernels of practice that target both students' interpersonal and intrapersonal math perceptions. ➢ Each kernel presented is supported by evidence and specifically targets at least one of the four key aspects of math identity discussed in module 1. ➢ As you can see, many of the kernels affect several aspects of students' identity, as these aspects are interrelated and reciprocal to one another. ➢ We've provided space throughout the module for you to brainstorm ways you can adapt or adopt the activities presented to use in your own classroom. This way you will leave today with a plan for how you can use what is presented to help promote positive math identities among your students.		Slide 12: Summary of evidence-based kernels
35 minutes	**Interpersonal kernels of practice** *Interest interviews–15 minutes* 1. Display the slide with the list of evidence-based kernels of practice with Interest Interviews highlighted (slide 13). 2. Walk through the first five interest interview slides and share the following key points to describe the purpose and uses of interest interviews.		Slide 13: Summary of evidence-based kernels: Interest interviews Slides 14-18: Interest interviews (5 slides)

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	Key Talking Points • Slide 14 ➢ While creating a welcoming environment for all students is important, it is different from creating an environment addressing the specific needs and interests of *your* students. ➢ This first kernel, interest interviews, provides the ability for you to adapt your current math instruction to incorporate students' interests in a way that affirms their belonging and helps them make the connections between math and their everyday lives. • Slide 15 ➢ In a study conducted with Algebra 1 students, researchers gave half the students problems on linear functions that used the story problems already in their curriculum unit. They gave the other half story problems that were personalized based on students out-of-school interests, such as sports, movies, or music. ➢ The students who received the personalized problems performed better and learned faster than the students who received the problems from the curriculum unit. And, four units later, they were still performing better on difficult, non-personalized problems. ➢ The positive effects of receiving a personalized problem were the greatest when students were working on difficult problems. Using personalized problems proved particularly effective for students identified as those struggling in math. ➢ Why does personalizing problems lead to these outcomes? ➢ First, personalizing problems uses students' interests to elicit their beliefs about the utility and usefulness of math, which can lead to a deeper level of engagement and persistence with math concepts. ➢ Second, personalizing problems helps make abstract concepts more concrete and understandable. This can help students improve their ability to choose how they approach a problem and to judge whether their strategies and solutions are reasonable.		

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	➢ Third, when teachers take the time to learn about their students' interests and meaningfully incorporate these interests into the classroom, this signals to students that they *belong*, and are an accepted and valued member of the math classroom community. • Slide 16 ➢ To learn about and incorporate students' interests into math lessons, one strategy the researchers recommend using is to conduct short interest interviews (5-10 minutes) with your students. As the teacher, you can interview each student individually to get a sense of the types of things students are interested in outside of school and how math is involved in those things. It is best to conduct the interviews within the first three weeks of school. ➢ We recognize, however, that personally interviewing every student is time consuming. Another researcher, Jamaal Sharif Matthews, suggests an alternate format, in which students interview each other, record the answers, and submit their recorded interviews as an assignment. ➢ Using this format, first provide students with a list of interview questions and ask them to prepare their answers as homework. This allows students time to think about their answers independently. ➢ Next, pair students together during class and have them trade off interviewing one another. Ask them to record their conversations using a phone or a digital recorder. ➢ Then, have students submit their recordings to you at the end of class. • Slide 17 ➢ After the interviews are submitted, you now have rich, student-generated data to use in your instruction throughout the year. ➢ You can use this data to create powerful examples and problems for students, facilitate classroom discussions, help students understand the utility of math concepts in their lives and interests, and foster a sense of belonging in the math		

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	classroom. ➢ Be sure to make meaningful connections between the math concepts and students' interests. ➢ As discussed earlier, personalized problems were especially effective when students were working on difficult problems, and students were still performing better on difficult, non-personalized problems four units later. ➢ This shows that not every single math problem needs to be personalized towards students' interests. Instead, focus on personalizing key concepts, or those concepts you find most difficult for students. ➢ Students may not make all the connections you were hoping they would make between math and their personal lives. This is okay. Throughout the year, use this as an opportunity to help students discover these connections. Doing so can show them how math connects to their present and future lives. • Slide 18 ➢ This activity should be more than just getting to know your students. Incorporating their experiences and interests into the classroom signals that their past knowledge and experiences are important to you and to their learning. ➢ Do not do this activity if you're not sure how to use—or do not plan to use—the information you collect. If you ask for students' input and then do not use it, this can cause students to lose trust and agency. 3. Display the interest interview slide that provides sample interview questions (slide 19). 4. Distribute the interest interview handout that provides a copy of the sample interview questions on the last page (if not handed out previously). 5. Tell participants that they will now practice individualizing problems based on each other's interests. 6. Instruct attendees to think about their responses to the questions on the slide (or in their handout) and write down brief answers.		Slide19: Interest interviews Materials: Interest interview handout (See "Materials and supplies")

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	7. Instruct participants to pair up and take turns conducting interest interviews with their partners using the questions provided. 8. Once the attendees are done interviewing, display the next slide and review the instructions for the next step of the activity. 9. Ask the pairs to rewrite this problem on the slide, so it incorporates their partners' interests. 10. Invite a couple of volunteers to share with the large group an interest they learned about their partners, how math is involved in those interests, and how you rewrote the word problem to incorporate that interest. 11. Pause for questions before proceeding. *Honor mistakes–10 minutes* 12. Display the slide with the list of evidence-based kernels of practice with "honor mistakes" highlighted (slide 21). 13. Display the slide describing the reasons for honoring mistakes and make the following key points. **Key Talking Points** • Slide 22 ➢ In the last module we talked about how you can create a general classroom climate that encourages students to view mistakes as learning opportunities. ➢ A classroom culture that emphasizes learning over correct answers is consistent with practices that build growth mindsets. In this kind of environment, wrong answers are valuable! ➢ This may alleviate some of the pressure highly math-anxious students feel. Normalizing and embracing mistakes also aids to build belonging by helping students reframe mistakes: "Mistakes are not indicative that I don't belong. They're a normal part of the learning process!" ➢ Next we present specific activities you can use to build a culture that embraces and honors mistakes. These activities will further students' learning while helping them build a positive math identity.		Slide 20: Interest interviews Slide 21: Summary of evidence-based kernels: Honor mistakes Slide 22: Honor mistakes as part of the learning process

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	14. Using the key points provided, discuss the three kernels of practice that honor mistakes (inverted test activity; Mistakes Game; and My Favorite 'No.') **Key Talking Points** • Slide 23 ➢ For the inverted test activity, give students a test or assignment that's been completed by a fictitious student. This test will have several incorrect answers. ➢ Have students correct the test by identifying and explaining each mistake. Ask students to describe how they would approach or solve the problems differently. • Slide 24 ➢ In the Mistakes Game, students first work alone to complete a set of problems. ➢ Then students are put into groups and share their solutions. Each group must present one problem to the class, but the group must incorporate at least one intentional mistake into its solution. This could be a mistake one group member made, or the group can think of another mistake someone might make. ➢ As each group shares its problem with the class, the class listens and attempts to find the mistake. Direct the class to use questioning to get the group to admit its mistake. This can involve questions such as "Why did you choose to …?" and "Can you explain how you did …?" • Slide 25 ➢ Another activity you can implement in your classroom is My Favorite 'No.' ➢ At the beginning of class, put a warm-up problem on the board and hand out index cards to each student. Give students time to write their answers to the problem on their		Slides 23-25: Inverted test activity; Mistakes Game; My Favorite 'No' (3 slides)

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	index cards. ➢ Collect the index cards and sort them into yes's (correct answers) and no's (wrong answers). As you're sorting, look for your favorite wrong answer that will highlight the concept you are teaching. ➢ Display your favorite incorrect response, so everyone can see the student's work. ➢ Begin by talking about what was right about the response, so the student whose work it is sees that there was something good in their work. One way to do this is by asking the class, "What do I like about this problem?" ➢ Then, use the mistake as an opportunity to clarify the student's misconceptions. Ask the class to identify where the student made the mistake and to explain how to fix it. 15. Display the Decide and Defend slide (slide 26) and review the key points provided. **Key Talking Points** • Slide 26 ➢ Some of you may already be familiar with the book, *Routines for Reasoning*, which advocates for the use of instructional strategies that are also likely to help honor mistakes as part of the learning process. ➢ One instructional strategy, called Decide and Defend, emphasizes that mistakes are opportunities to learn. ➢ The purpose of Decide and Defend is for students to interpret another's mathematical reasoning, decide if they agree or disagree with that reasoning, draft and present an argument defending their decision, and then reflect on the learning that took place. ➢ To begin the activity, present a problem for students to complete independently. Then place students in pairs and ask them to interpret their partners' work. Provide your students with questions to help guide their interpretations, such as: • What is the question they are answering?		Slide 26: Decide and Defend

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	• What did they do? • What did they find? • Does the answer make sense? • Does the process make sense? • Are the calculations correct? ➢ After students interpret their partners' work, they next decide if they agree or disagree with their partner. ➢ Once students have decided whether they agree or disagree, students will draft their defense. In this step, students prepare what they'll show and say to defend their decision. ➢ Next the students defend their decisions to the larger class. To do this, students share out and record the steps they used to make their decisions. Provide sentence stems to aid students in defending their position, such as "I decided the work is correct/incorrect, because …" ➢ During this defense, the other students and teacher plays the role of skeptics by clarifying, probing, pushing back, or furthering the argument by agreeing or disagreeing. The teacher should clarify vocabulary and/or concepts as necessary. Once again, it is a good idea to provide students with sentence stems for being a productive skeptic, such as "I agree/disagree with your defense, because …" or "A question I have is …" ➢ Lastly, students reflect on the learning that took place during the activity. Ask students to reflect using prompts such as: "Next time I interpret someone else's work, I will (ask myself, pay attention to …);" "In order to convince a skeptic, it's important to …;" A new math idea I learned is …" 16. Display the slide connecting Decide and Defend to the SMPs and make the following key points. **Key Talking Points** • Slide 27 ➢ Decide and Defend provides a way to emphasize that		Slide 27: How does decide and defend support and build on the SMPs?

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	mistakes are opportunities to learn. This serves to both increase students' growth mindset and decrease math anxiety, as mistakes are seen as a productive part of the learning process rather than a signal that the student is not capable. This approach can reduce the pressure and anxiety students experience in a math classroom that traditionally emphasizes correctness. ➢ In addition to being a useful strategy for helping students build a positive math identity, this activity supports and builds on several SMPs. ➢ The authors of *Routines for Reasoning* connect this activity to SMP 3 (construct viable arguments and critique the reasoning of others), as students are interpreting each other's' thinking, deciding whether they agree or disagree, and then defending their answers. ➢ But there are other connections with the SMPs as well. For example, we see a connection with SMP 6, as students must attend to precision when drafting and defending their answers. What are other ways you see this activity supporting and building on the SMPs? ➢ Allow participants to provide responses. At a minimum, we expect audience members to make a connection between SMPs 2 and 7. If this does not arise through participants' responses, the facilitator should highlight these connections. 17. Invite participants to identify other ways they see the Decide and Defend activity supporting and building on the SMPs. 18. Display the group brainstorm slide (slide 28) and share the following key points about sentence frames.  **Key Talking Points** • Slide 28 ➢ Another essential instructional strategy from *Routines for Reasoning* is using sentence frames and sentence starters as prompts to help teachers and students focus their attention. ➢ Sentence frames can help build a sense of belonging, as they level the playing field by providing a common language		Slide 28: Group brainstorm

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	and structure to group discussions. Sentence frames are also a great way to incorporate SMP 6 (attend to precision), as they provide students with language and scaffolding towards using precise math language. ➢ Let's think about whether it's possible to use sentence frames to help students recognize the ways that they and their peers make mistakes. These recognitions can further normalize the process of struggling. 19. Direct participants to work in small groups to brainstorm possible sentence frames or sentence starters that would get students to reflect on what went wrong and/or focus on common mistakes. The following are two examples: a. One thing I tried that didn't work was_____. Now I see that this didn't work, because _____. b. I almost forgot to _____, but then I remembered it is important to _____. 20. Ask for a few volunteers to share the sentence frames that their groups created. 21. Pause for questions before proceeding. *Math role models–10 minutes* 22. Display the slide with the list of evidence-based kernels of practice with "math role models" highlighted (slide 29). 23. Display the self-relevant role models slide and give participants a few moments to read the student profile on the slide. 24. Share the following key points. **Key Talking Points** • Slide 29 ➢ The last interpersonal kernel we'll discuss today focuses on guiding students in identifying positive math role models. The strategies that follow target both students' sense of belonging and their perceived utility value of math. Concerning their sense of belonging, this is where students	*This activity is optional. Skip steps 19-21 if omitting.*	Slide 29: Summary of evidence-based kernels: Math role models

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	begin to view themselves and others like them as mathematicians. The strategies we are about to discuss will present role models who are similar and relatable to students. Students will see how these role models use math during everyday activities, which will help students begin to understand the utility value of math in real-world situations. • Slide 30 ➢ In a study targeting belonging among American Indian middle schoolers, students were provided a biography and photograph about one of three role models: a self-relevant role model (i.e., an American Indian); a self-irrelevant role model (i.e., a European American); and an ambiguous role model (i.e., no photo or last name provided). All were gender consistent. ➢ American Indian students exposed to a self-relevant role model reported significantly higher school belonging than students exposed to either a self-irrelevant role model, an ethnically ambiguous role model, or no role model. ➢ The same researchers conducted another study in which they asked American Indian and European American middle school students to think about two people they knew who went to college and to list how they know each of these role models. A control group of American Indian and European American students was established, and this group was not asked to identify role models. ➢ American Indian students asked to name role models showed a greater sense of belonging than American Indian students in the control group. ➢ American Indian students in the role models group also showed a greater sense of belonging than European American students in the control group, demonstrating that when American Indian students participate in this activity, the gap between their belonging and European American students' belonging is diminished. ➢ European American students, who are widely represented in the academic domain, reported no differences in school belonging by the conditions in this study.		Slide 30: Self-relevant role models

Timing	Topic/Steps/Activities	Facilitator Notes	Resources/ Materials
	25. Display the slide with the discussion prompts (slide 31). 26. Ask participants to respond to the prompts in their table groups. 27. After a few minutes of discussion, invite several volunteers to share their ideas for how they could use self-relevant role models with their math students. 28. Share the following key points providing ideas for how to use self-relevant role models in math classrooms. **Key Talking Points** • Slide 31 ➢ The self-relevant role models activity targets academic belonging in general and promotes college attendance. As we've talked about before, belonging is domain-specific. How can you adapt this activity to focus on belonging and math? And how can you adapt this activity to use with your specific student populations? This activity targeted American Indian students' belonging, but we know that many groups of students feel they do not belong in math, including women and people of color. ➢ One example for adapting the self-relevant role models activity is that you could invite previous students to come into your classroom as guest speaker. Focus on asking previous students who now work in jobs that use math. You can include a wide range of jobs, including some that do and do not require a college degree, and some in which the connection to math is not immediately obvious. ➢ Another idea: Ask students to identify a recent experience when they recognized a practical use for math by a person they know well who is out of school. 29. Pause for questions before proceeding.		Slide 31: Discussion
10 minutes	**BREAK**	*Be sure to set a timer.*	Slide 32: Break

Timing	Topic/Steps/Activities	Facilitator Notes	Resources/ Materials
45 minutes	**Intrapersonal kernels of practice** *Normalize uncertainty–15 minutes* 1. Display the slide with the list of evidence-based kernels of practice, with "normalize uncertainty" highlighted (slide 33). 2. Walk through the first three slides and share the following key points to connect uncertainty to belonging. Describe the steps of the normalizing uncertainty kernel of practice. **Key Talking Points** • Slide 34 ➢ Concerns about belonging can affect behavior in ways that reinforce negative patterns. ➢ Students who feel less certain about their math belonging may interpret normal setbacks and challenges much more negatively. They may misperceive their struggle as an indication that they are not good at the subject and will never succeed in it. ➢ For instance, receiving negative feedback from a peer during partner discussion work may be attributed to their lack of ability and belonging in math. This in turn leads to more negative responses, such as withdrawing effort and disengaging. On the other hand, students who feel more positive about their math belonging are likely to respond to challenges with more adaptive strategies, which has positive implications for their behavior. • Slide 35 ➢ Researchers have developed an activity called normalizing uncertainty to promote students' belonging and normalize the experience of struggling. This activity can be applied to the situations students experience when feeling challenged while learning math. ➢ The crux of the activity is to emphasize that concerns about		Slide 33: Summary of evidence-based kernels: Normalize uncertainty Slides 34-36: Do I fit in intellectually? Normalizing uncertainty activity (3 slides)

Timing	Topic/Steps/Activities	Facilitator Notes	Resources/ Materials
	belonging are *normal for everyone* and are likely to fade with time. Basically, this activity imparts the message, "I've been there, too, and it gets better." ➢ Normalizing belonging concerns can help young people frame setbacks, challenges, and worries about belonging as common and transitory events instead of proof that they do not belong. • Slide 36 ➢ The goal of the normalizing uncertainty activity is to communicate a two-part message: Worrying about belonging and struggling in school is a normal experience for *everyone*, and these worries fade with time. ➢ This activity is an active reading and writing experience. ➢ In the first part of the activity, students hear authentic first-person stories from older students that convey this message. The messages can come in the form of letters, videos, or in-person visits. What's important is that these messages are genuine reflections of students' lived experiences. ➢ The first-person messages should also come from students of varying background characteristics, and most especially from counter-stereotypical exemplars, to show that everyone—regardless of gender or race—worries about their belonging or has struggled in school (specifically with math) from time to time. ➢ In order to customize this to focus on your students' belonging in math, consider adapting this activity to your students' current challenges (e.g., the transition to more challenging math in middle school). 3. Share the slide with the example message and give participants a few moments to read it (slide 37). 4. Share the slide that describes the second part of the normalizing uncertainty activity and share the key points provided.		Slide 37: Example message Slide 38: Normalizing uncertainty activity

Timing	Topic/Steps/Activities	Facilitator Notes	Resources/ Materials
	Key Talking Points • Slide 38 ➢ In the second part of the activity, students engage in a writing exercise in which they reflect on how the messages they've heard have been true in their experiences. For example, they may discuss when they've struggled with solving a problem, but found that with time and new strategies they improved. ➢ The purpose of this second part of the activity is to help students to internalize the message. Students should be directed to personalize the intervention message, put the key process into their own words, and view their experience as consistent with the message. ➢ This writing exercise can be framed as having students write letters to younger students that will soon be in this class. This invites students to advocate for the key intervention message, and it also helps students to view themselves as giving help to others instead of being the beneficiaries of the help. 5. Share the slide that connects normalizing uncertainty to the SMPs (slide 39) and share the following key points. **Key Talking Points** • Slide 39 ➢ The normalizing uncertainty activity serves the purpose of affirming struggling students' math belonging by providing the message that many people struggle with math, but that struggling is a normal part of the learning process, and many people worry about struggling and belonging. This is important in helping students build and/or maintain a positive math identity. Doing so will assist them in persevering towards solving problems even if they struggle. ➢ In addition to reassuring students that struggling and worrying are both normal and not an indication that they are "bad at math" or "do not belong," the SMPs provide students		Slide 39: Normalizing uncertainty

Timing	Topic/Steps/Activities	Facilitator Notes	Resources/ Materials
	with tools and resources to equip students to overcome their struggles. ➢ For example, SMP 5 emphasizes the strategic use of skills in solving problems. When students are equipped with the proper tools and the knowledge of how and when to use them, this can reduce their struggle and encourage students to persevere. 30. Invite participants to identify other ways they see Normalizing Uncertainty supporting and building on the SMPs. 31. Display the discussion slide (slide 40). 32. Distribute the *Normalizing Uncertainty* handout. 33. Give participants two minutes to review the handout on their own. 34. Ask attendees to respond to the prompts on the discussion slide with their table group members. 35. Pause for questions before proceeding. *Utility reflection–15 minutes* 36. Display the slide with the list of evidence-based kernels of practice with utility reflection highlighted (slide 41). 37. Walk through the three slides describing perceived utility and connecting it to the SMPs using the following key points. **Key Talking Points** • Slide 42 ➢ Perceived utility of math is the extent to which students believe that math is worthwhile to pursue, whether they see it as useful and relevant to their lives outside of school, now and as it applies to their future careers and choices. ➢ 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. ➢ In a study with grade 9 students, researchers presented students with examples of utility in mathematics for future education, career opportunities, and leisure time activities.		Slide 40: Discussion Materials: *Normalizing Uncertainty* handout (See "Materials and supplies") Slide 41: Summary of evidence-based kernels: Utility reflection Slides 42-44: Perceived utility; Perceived utility activities; Math utility (3 slides)

Timing	Topic/Steps/Activities	Facilitator Notes	Resources/ Materials
	➢ Students either read interview quotations with young adults describing situations in which math was useful to them, OR students made a list of how math is relevant to their current and future lives. ➢ At both six weeks and at five months after participating in this activity, students showed greater math utility. ➢ Student participants showed greater math self-concept, effort, and math achievement, and they believed they could complete their math homework more efficiently as compared to students who did not complete the activity. • Slide 43 ➢ Based on the research in the previous slide, discussing the utility of math with your students can help increase their sense of the usefulness of math. ➢ However, it is important to guide students to come to their own understanding of how math is relevant to their daily lives. ➢ There are many ways you can do this. Here are some examples. ➢ Have conversations with your students about the utility of math. Ask questions, such as: • Why are the math concepts important for their future education? • In which career opportunities might they use this math? • How are the math concepts relevant to their hobbies? ➢ Showcase older students who use math in their jobs or hobbies. ➢ Incorporate hands-on activities that focus on relevant and engaging problems. • Slide 44 ➢ As mentioned earlier, research shows that when students understand the utility of the math concepts they're learning for their current and future lives, this leads to increased math self-concept, effort, and student achievement.		

Timing	Topic/Steps/Activities	Facilitator Notes	Resources/ Materials
	➢ You may hear a student say, "When am I ever going to use this?" That may indicate deeper issues than simply the student wondering how the math relates to their life. ➢ What else could a student be implying when they ask you, "When am I ever going to use this?" ➢ (Facilitator's note: Wait for answers from attendees) ➢ When students ask you this, it can also be an indication to you as the teacher that the student is struggling to grasp the math concept(s). ➢ When students are struggling, it is beneficial to guide students through a reflection of math utility and to make sure you address any underlying problems the student may be experiencing by utilizing the SMPs. ➢ SMP 4 is particularly relevant, because it both provides students with a specific tool to help address the challenges they are facing—modeling—and may serve to increase students' perceptions of utility as they feel a sense of ownership and pride for their models. 38. Display the discussion slide (slide 45) and have participants discuss the prompt with a neighbor at their tables. 39. Walk through the slides describing how parents can be brought in to the math utility and identity conversation by using the following key points.  **Key Talking Points** • Slide 46 ➢ As educators, parents can be important allies in your work with students. ➢ But, how can you engage parents in helping to promote students' math identity if parents have poor math identities and agency themselves? ➢ This is important, because as we discussed in module 1, parents' attitudes about math matter, just like teachers' attitudes do. ➢ For example, there is evidence that students whose parents are anxious about math have higher math anxiety		Slide 45: Discussion Slides 46-48: Bring parents into the conversation! (3 slides)

Timing	Topic/Steps/Activities	Facilitator Notes	Resources/ Materials
	themselves and show lower math achievement. This is particularly true when math-anxious parents provide frequent math homework help. ➢ We see many connections between the math identity and agency of a parent with the developing math identity and agency of their child. These connections are related to factors concerning classroom environment and teaching practices. Likewise, just as students can be influenced by the messages and stereotypes that teachers believe, as discussed in earlier modules, so too can students be influenced by the messages and stereotypes their parents believe about math and how it relates to their child's math identity. ➢ Therefore, just as teachers can inadvertently undermine students' sense of math identity and agency, so can parents. • Slide 47 ➢ However, there is evidence that engaging parents in promoting positive math identities can be a powerful tool, especially around perceived math utility. ➢ Researchers at the University of Wisconsin conducted a longitudinal study with high school students and their parents, aimed at increasing students' beliefs about the utility of math for their future. ➢ As part of the study, parents were mailed two brochures. One brochure was sent when students were in grade 10, and it provided information about the importance of math and science in daily life and for various careers. It also gave parents guidance concerning how to talk to adolescents about potential connections between mathematics and science and their children's lives. The other brochure was sent when students were in grade 11, and it focused on the relevance of math and science to everyday activities (e.g., video games, driving, and cell phone use). This brochure also offered information about math and science preparation for college and careers. Parents also received access to a website that provided additional resources. ➢ Compared to a control group whose parents did not receive brochures or website access, students reported having more		

Timing	Topic/Steps/Activities	Facilitator Notes	Resources/ Materials
	conversations with their parents about STEM course choices, their educational plans, and the importance of math and science. ➢ Students also completed more math and science courses during high school, including more math elective courses and advanced courses, such as Algebra 2, trigonometry, precalculus, calculus, and statistics. ➢ When the researchers followed up with the students five years later, they found that students whose parents received the brochures had higher math and science ACT scores. ➢ Additionally, taking more high school STEM courses and getting higher ACT scores were associated with increased STEM career pursuits. Further correlations included increased STEM interest, a higher number of college STEM courses taken, and students' improved attitudes toward STEM subjects. • Slide 48 ➢ There were three important components that contributed to the success of the researchers' outreach efforts. First, encouraging parents to communicate the utility value of STEM topics to their children. Second, giving parents advice on how best to communicate these ideas with their children. And third, providing parents with specific resources, many of which are still available for educators on the study's website. 40. Display the slide with instructions for designing an "elevator pitch" aimed at parents (slide 49). 41. Divide attendees into small groups. 42. Invite attendees to craft an elevator pitch on the importance of math and positive math identity. Prompt them to think about the information and resources they would include, as well as all the factors discussed in this (and previous, if applicable) sessions (e.g., mindsets, belonging, utility, anxiety). 43. After giving participants sufficient time to design their elevator pitches, ask each to present to their group members. 44. Pause for questions before proceeding.	*This activity is optional. Skip steps 40-44 if omitting.* *There are several ways in which this activity can be modified.* *1) Have participants team up to create a brochure, webpage, or newsletter about positive math identity for parents.*	Slide 49: Bring parents into the conversation!

Timing	Topic/Steps/Activities	Facilitator Notes	Resources/ Materials
	Focused breathing–10 minutes 45. Display the slide with the list of evidence-based kernels of practice with focused breathing highlighted (slide 50), and share the key point provided. **Key Talking Points** • Slide 50 ➢ Next we will discuss several kernels of practice shown to be effective in reducing math anxiety. We will begin by discussing mindfulness in the classroom. Then we will demonstrate a focused breathing exercise that you may choose to use in your classroom. 46. Display the practice and teach mindfulness slide (slide 51) and share the key points provided. **Key Talking Points** • Slide 51 ➢ One way to combat students' anxiety is to implement mindfulness exercises in the classroom. Mindfulness is focusing awareness on the present moment, without judgment, to acknowledge and calmly accept one's feelings, thoughts, and bodily sensations. ➢ Research has shown that practicing mindfulness in the classroom benefits both students and teachers. For students, mindfulness practices can improve self-regulation and emotional competence, as well as academic skills, self-esteem, mood, and stress levels. ➢ Mindfulness seems to help students, because it reduces the emotional response to anxiety-producing testing situations, freeing up working memory resources and improving performance. ➢ Mindfulness can help teachers improve their classroom management and relationships with students. It can also	2) *If there are many teachers from the same school in the audience, ask teachers to form small groups with other teachers from their school to develop a plan for engaging parents in topics of math identity at an upcoming parents' night.*	Slide 50: Summary of evidence-based kernels: Focused breathing Slide 51: Practice and teach mindfulness

Timing	Topic/Steps/Activities	Facilitator Notes	Resources/ Materials
	increase teachers' feelings of well-being and efficacy. ➢ Teachers can implement a quiet time for students to engage in a group meditation practice. ➢ A proven way to help reduce math anxiety that is easily accessible to young children is a brief focused breathing exercise in which deep breaths are drawn into the abdomen. 47. Display the Focused Breathing exercise slide (slide 52). 48. Tell participants that they will now experience a short focused breathing exercise, similar to what they could try in their classrooms. 49. Distribute the handout with the focused breathing exercise instructions. 50. Use the suggested script in the handout to lead participants through the breathing exercise. 51. Display the mindfulness in practice slide with the still from the preloaded video showing mindfulness exercises in a classroom. 52. Play the preloaded video. 53. Share the provided key points. **Key Talking Points** • Slide 53 ➢ There are many ways to bring mindfulness into your classroom. This video shows how mindfulness exercises can be incorporated into your teaching practices. ➢ There are many free mindfulness resources available, including breathing/meditation apps. Explore the resources available to you and see which best fit your classroom needs. 54. Pause for questions before proceeding. *Emotion regulation–5 minutes* 55. Display the slide with the list of evidence-based kernels of practice with emotion regulation highlighted (slide 54). 56. Show the emotion regulation exercises slide (slide 55) and share the key points provided.		Slide 52: Focused breathing practice Materials: *Focused Breathing* handout (See "Materials and supplies") Slide 53: Mindfulness in practice Materials: Pre-loaded video 2 (See "Materials and supplies") Slide 54: Summary of evidence-based kernels: Emotion regulation Slide 55: Emotion regulation exercises

Timing	Topic/Steps/Activities	Facilitator Notes	Resources/ Materials
	Key Talking Points • Slide 55 ➢ A group of researchers created two emotion regulation exercises to help students regulate their anxiety prior to taking a test. ➢ In the first exercise, students were asked to think about their emotions and thoughts before the exam and express them in writing. ➢ This exercise targets the cognitive component of anxiety by asking students to write about and express their thoughts and concerns. This might help them develop insights and aid in their emotion regulation by "offloading" their worries and freeing up cognitive resources for taking the test. ➢ In the second exercise, students read a text explaining that the anxiousness they feel before stressful events is meant to be helpful instead of harmful. ➢ This exercise targets the physiological component of anxiety and asks students to reinterpret signals of anxiousness as a resource that can improve their performance on the test. Instead of interpreting their physiological sensations (such as a racing pulse) as a sign of anxiety, the exercise reinterprets these sensations as a beneficial and energizing force. ➢ Students who completed these exercises 10 minutes before taking an exam improved their performance compared to student who did not complete the exercises, and this was especially true for students from lower-income backgrounds. Specifically, the percentage of students from lower-income backgrounds who failed the course was reduced by 21 percent. ➢ Additionally, students who read the text reinterpreting their anxious sensations from negative to beneficial were more likely to re-appraise their anxiety as beneficial later in life. 57. Distribute the *Emotion Reappraisal* handout, and have participants review it for a few moments. 58. Display the discussion slide (slide 56) and have participants		Materials: *Emotion Reappraisal* handout guide (See "Materials and supplies") Slide 56: Discussion

Timing	Topic/Steps/Activities	Facilitator Notes	Resources/ Materials
	discuss the prompts with a neighbor at their tables. If time permits, invite a couple of volunteers to share their responses with the larger group. 59. Pause for questions before proceeding.		
10 minutes	 **Closing** 1. Display the final reflection slide (slide 57) and share the following key points.  **Key Talking Points** • Slide 57 ➢ Throughout the module we've provided space for discussion and brainstorming on how you can take what you've learned during this session and apply it to your own classrooms and student populations. ➢ As we come to the end of the module (or series, if the facilitator knows the audience has been through modules 1 and 2), we are going to engage in a deeper final reflection together. 2. Pass out the *Incorporating Kernels of Practice into Instruction* handout. 3. Allow participants time to work independently on addressing the three questions on the slide and to fill out their handouts. 4. Have participants move into pairs or small groups to share out their thoughts and to brainstorm together. 5. Facilitate a large-group discussion with participants sharing out their conversations and brainstorms. 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.		Slide 57: Final reflection Materials: *Incorporating Kernels of Practice into Instruction* handout. (See "Materials and supplies") Slides 58-62: About REL Northwest; Contact us; References (5 slides)