[9-12] Building a Culture of Math Learning Session 1 Facilitator's Guide

Summary

Effective teaching of mathematics requires cultivating a culture of math learning within the classroom - this culture encourages students to take academic risks, to persevere when content becomes challenging, to utilize a myriad of mathematical tools and models to approach new problems, to share their own thinking, and to offer feedback on the thinking of others. To cultivate this kind of culture, teachers must model through words and actions the importance of grappling with content to build a deep understanding; they must equip students with the content knowledge and problem solving tools to find multiple pathways to a given solution; and they must facilitate regular opportunities for students to engage in the practices of mathematics, including analyzing their own misconceptions and refining their approaches as part of the learning process.

Throughout this content cycle, teachers will explore these instructional moves and connect them directly to the mathematical content and standards for mathematical practices within the *Kentucky Academic Standards* (*KAS) for Mathematics*. While this content cycle will do a deep dive of the 3 Standards for Mathematical Practice indicated below, the *KAS for Mathematics* require teachers to implement all 8 Standards for Mathematical Practice. To support teachers in elevating different SMPs during their instruction, the *KAS for Mathematics* tag relevant MPs to every content standard. The inclusion of those tagged MPs does NOT mean those are the only ways students can engage in the practices while learning that content. The inclusion of tagged MPs also doesn't mean that those practices automatically happen throughout instruction on that content standard. How instruction is designed will determine how students engage with the content. This content cycle will support educators in purposefully planning and designing instruction to provide students with opportunities to engage in the practice standards while engaging with the content standards.

This content cycle focuses specifically on:

- SMP1. Make sense of problems and persevere in solving them
- SMP4. Model with mathematics
- SMP3. Construct viable arguments and critique the reasoning of others

See the ***Mathematics Professional Learning Modules*** for additional learning around the Standards for Mathematical Practice or for guidance/support with implementing the *KAS for Mathematics.*

Essential Questions

- How do the Standards of Mathematical Practice support teachers in creating and sustaining a culture of learning in math classrooms?
- How can teachers explicitly introduce and authentically incorporate the Standards of Mathematical Practice within their instruction?
- How can teachers create a "culture of error" where students feel comfortable taking academic risks, struggling through high-quality tasks and discussing their misconceptions to advance their own learning?

- Specifically, how can an emphasis on problem-solving (SMP 1), modeling to understand "concepts before procedures" (SMP 4) and justification of answers (SMP 3) create an environment where students are encouraged to own their own learning?

Enduring Understandings

- Teachers should communicate that perseverance, which requires a willingness to take risks and make mistakes, is a critical part of the learning process.
- In order for students to own their own learning, teachers intentionally design instruction which places equal value on the development of mathematical content and mathematical practices.
- True conceptual understanding of math comes from connecting multiple representations (concrete, representational/pictorial, and abstract).
- To build deep and enduring understanding of math, teachers must place emphasis on the "how" and "why" and push students to justify their answers,
- Meaningful teacher and peer feedback allow students to monitor their progress toward learning outcomes and provides students with opportunities to reflect on their own learning.

Key Components of Cycle

The Learning Cycle includes the following components to support shifts in instruction:

- **Shared Learning:** Learning sessions where teachers learn new knowledge and skills aligned to the topic of the content cycle. This might be designed in a variety of ways, including reading and discussing an article, studying a classroom video or doing some group practice of a particular planning component.
- **Planning & Practice:** Opportunities for teachers to apply the content they are learning within this content cycle to review/revise classroom instruction. This could include analyzing units/lessons using tools to evaluate alignment to the *KAS for Mathematics*, rehearsing lessons, watching and reflecting on videos of their classroom practice, etc.
- **Student Progress Monitoring:** This is an opportunity for teachers to examine student progress aligned to the topic of the cycle. This can include formative student work analysis, end of unit assessments, culminating tasks, etc.

Over the course of this 12-week learning cycle, teachers will:

- Examine instructional materials and tasks using the *KAS for Mathematics* and supporting resources;
- Consider the implications of these materials as they relate to changes in both teacher planning and practice;
- Engage in lesson study, practice in content delivery and peer-feedback, and reflect on progress by regularly revisiting goals and analyzing student data

Note that these components do not necessarily happen in a perfect rhythm. For example, depending on the content, there may be several shared learning sessions before a planning & practice, or there may be several cycles of shared learning and planning & practice before student progress monitoring.

Session	Type of Learning	Objective(s)	Supporting KAS Resources	Assessment of Learning
Session 1	**Shared Learning** Introduction to the SMPs	• Internalize the Standards for Mathematical Practice • Analyze how the SMPs support mathematical understanding and productive struggle	• *KAS for Mathematics* • *Getting to Know the KAS for Mathematics* Module • Engaging the SMPs: Look fors and Question Stems	• **Session tasks:** SMP jigsaw, video observation notes • **Self-reflection**

Preparation:

This Facilitator's Guide is designed to accompany

- [9-12] BCML Session 1 PowerPoint

Participants should be given access to the following documents to engage in the learning for this session:

- [9-12] BCML Session 1 Handout 1

Session Agenda Time (60-90 min)

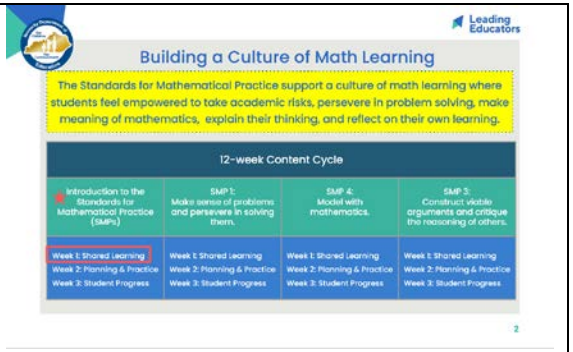
- Slides 1 - 4: Welcome, norms, objectives & agenda **(10 min)**
- Slides 5 - 6: Internalize language of SMPs using KDE's "Engaging the SMPs" resource, jigsaw **(20 min)**
- Slides 7 - 9: Video observation and debrief **(15 min)**
- Slide 10: Criteria for success **(5 min)**
- Slide 11 - 13: Reflection and closing whip around **(10 min)**

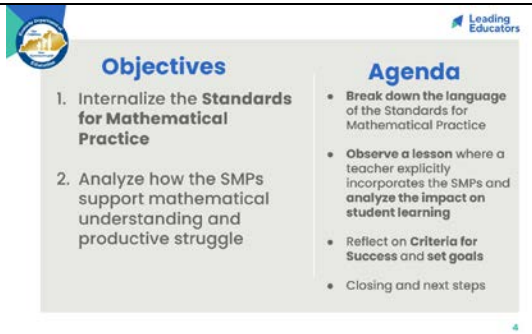
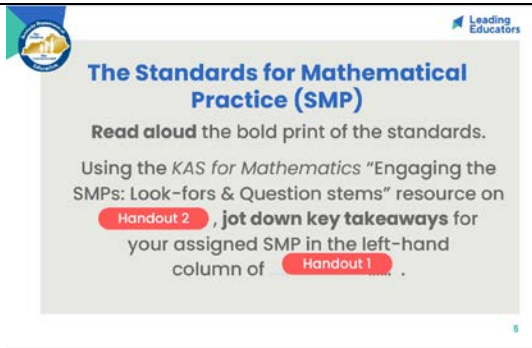
Facilitator Notes	Accompanying Slide
Slide 1: **(2 min)** Welcome teachers to the session. Facilitator says: ○ "For the next 12 weeks, our team will explore the elements of a Building a Math Culture of Learning. For students to be successful mathematicians -- and more importantly, life-long learners -- they must engage with more than just "content" and academic standards. Students must develop and continuously cultivate crosscutting academic practices that allow them to take academic risks, to persevere through new challenges, to utilize their understanding and mathematical "toolkit" to apply learning to real world contexts, and to effectively communicate and defend their reasoning." ○ "The National Council of Teachers of Mathematics has created a framework centered around 8 Standards of Mathematical Practice (SMPs) that illustrate critical student practices that support student learning in math across all content strands and standards. We will use this framework to create our own criteria for success: "What teacher actions support students in building these mathematical practices? What should all students be able to say and do because of these practices? What impact will this have on student learning?" ○ "While there are 8 SMPs, we'll focus this learning cycle on 3 critical SMPs - SMPs 1, 4 and 3 - which will support teachers in building a strong foundation for a culture of math learning in their classrooms." ○ **"While this content cycle will do a deep dive into 3 Standards for Mathematical Practice, the KAS for Mathematics require teachers to implement all 8 Standards for Mathematical Practices. To support teachers in elevating different SMPs during their instruction, the KAS for Mathematics tag relevant SMPs to every content standard. See the *KY Standards Mathematics Professional Learning Modules* for guidance."**	

Slide 2:

(2 min) Facilitator says:

- "Here you'll see our 12-week arc of learning. Can I have someone read out our guiding principle in the yellow box?"
- "In green, you'll see our four major topics of learning. For each topic of learning, we'll engage in a three-week learning cycle that will include a shared learning session, a planning and practice session, and a student progress session. Our first topic of learning will include an overview of all 8 Mathematical Practices, so we can get a big picture idea of what excellence in math learning should look like for students. In the next 3 topics, we'll narrow our focus to cover just one SMP so we can better internalize and apply our learning. As you'll see, the three SMPs we will focus on are:
    - Standard for Mathematical Practice 1: Make sense of problems and persevere in solving them.
    - Standard for Mathematical Practice 4: Model with mathematics.
    - Standard for Mathematical Practice 3: Construct viable arguments and critique the reasoning of others."
- **"While this content cycle will do a deep dive of 3 Standards for Mathematical Practice, the KAS for Mathematics require teachers to implement all 8 Standards for Mathematical Practices. To support teachers in elevating different SMPs during their instruction, the KAS for Mathematics tag relevant SMPs to every content standard. The inclusion of those tagged SMPs does NOT mean those are the only ways students can engage in the practices while learning that content. It also doesn't mean that throughout instruction on that content standard those practices automatically happen. How instruction is designed will determine how students engage with the content. See the *KY Standards Mathematics Professional Learning Modules* for guidance."**
- **[CLICK for animation]** You'll see that today we are starting with Topic 1: Introduction to the Standards for Mathematical Practice (SMPs).
- **[CLICK for animation]** Our first session in this topic will be shared learning, where we can build a bank of common experiences and language to use throughout this content cycle.



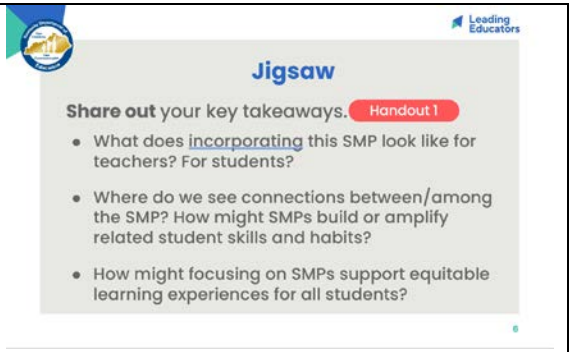
Slide 3: **(5 min)** Review team norms and/or facilitate a quick team connector/icebreaker.	
Slide 4: **(1 min)** Ask teachers to popcorn out the objectives and agenda.	
Slide 5: **(1 min)** Teachers popcorn out just the bold text of the SMPs on Handout 1 (left column). Facilitator then assigns teachers 2-3 SMPs to per teacher (depending on cohort size) to jot down notes for. Teachers will jigsaw and share out findings after jotting. **(4 min)** Teachers take 4 minutes to capture notes for their assigned SMPs, using the guiding questions in the blue box at the top of the left-hand column. Teachers should jot all notes in the left-hand column. The right-hand column will be used for a video observation activity.	

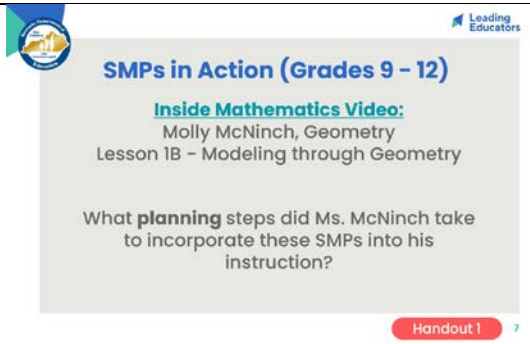
Slide 6:

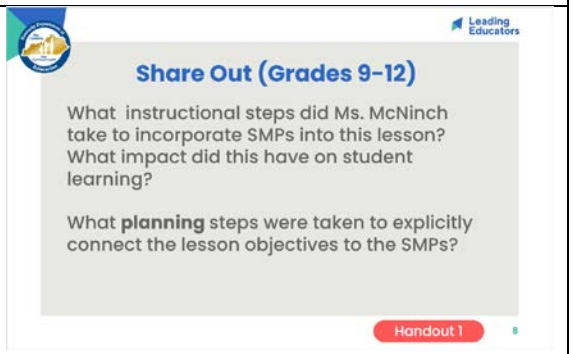
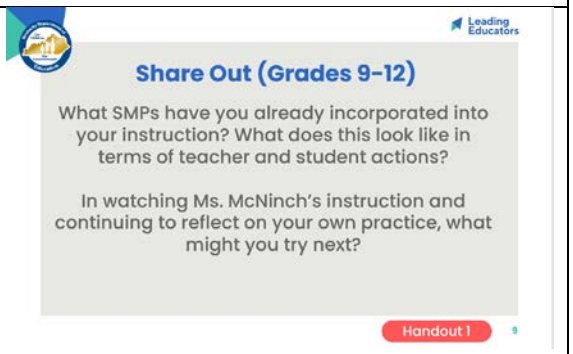
(15 min) Teachers spend 30 sec - 1 min per SMP explaining the key teacher and student competencies embedded within the practice. While each teacher presents, the other teachers jot down notes in the left-hand column of their handout to complete their chart. Facilitator supports discussion by reiterating key takeaways and supporting teachers in making distinctions/connections during their discussion.

Note*: *Listen for and reinforce these key ideas...

- SMP 1 forms the foundation for all other SMPs. In order for students to decontextualize/contextualize, model with mathematics, find patterns, etc. they must first make sense of problems in order to employ the best practices/strategies to access the problems. To support students in persevering through challenges, SMP 1 gives students the language of productive struggle - students should make a plan, try the plan, and iterate should the plan not work. Teachers must create a safe space for learning in order for students to willingly share their work, as well as their misconceptions.
- SMP 2 asks students to contextualize or go from an abstract representation of a problem to a related real-world application of the problem (3 x 5 = 15 → There are 3 baskets with 15 candies in each basket. How many candies are there all together); students must also decontextualize by representing a real-world problem abstractly, such as in an equation.
- SMP 3 requires that students justify and defend their answers - the solution to a problem is not sufficient without the ability to clearly articulate the thought process and rationale for the answer. Additionally, students have the opportunity to critique the reasoning of others by asking questions and posing counter-solutions.
- SMP 4 involves modeling with mathematics. In this way, students demonstrate full command of a standard by being able to represent it multiple ways, e.g. from concrete (base ten blocks) to representational or pictorial (quick ten drawings) to abstract (vertical subtraction sentence). SMP 4 supports SMP 1 by giving students multiple tools to access challenging problems
- SMP 5 is around using tools appropriately - different from SMP 4, SMP 5 focus on using *tools*, not methods, e.g. calculators, rulers, conversion charts, and graphing software. Often times, these tools allow students to arrive at more precise answers in an efficient way.
- SMP 6 focuses on precision - not only in calculations (fluency), but in language (vocabulary, explanations). This may include ensuring students have the correct units in their solution, which can demonstrate true conceptual understanding (e.g. When solving for area, answers should be in units



squared. With a rectangle that is 7 inches wide and 3 inches tall, 21 inches ***squared*** represent the number of 1 in x 1 in squares it takes to cover the surface of the rectangle). ● SMP 7 centers on finding and using structure in math. Students might be able to see the expression 7 x 14 and convert it into an easier problem by finding the sum of 7 x 10 and 7 x 4 (distribution). This same structure supports student in making sense of factoring in higher level math: 7y + 7x = 7(y+x) ● SMP 8 focuses on repeated reasoning; for example, when dividing 13 by 3, a student might see that we are left with a remainder of 1; by placing a decimal after the ones place to find the tenths place of the quotient, we are left with 1.0 divided by 3, which yields 0.3 with a remainder of 0.10, which necessitates that we begin the process over again to find 0.10 divided 3, yielding 0.03 (a multiple of 10 divided by 3). Instead of continuing to divide, students notice that we will always be left with a remainder (which is a multiple of 10) being divided by 3, thus producing another 3 in the next decimal place of the quotient. We can stop dividing knowing that this process will continue indefinitely and represent our answer as 4.3 repeating.	
Slide 7: **(1 min)** Facilitator says: ● "Now that we understand the language of the SMPs, we'll have an opportunity to see what these SMPs might actually look like in the classroom. During this clip, you'll see Ms. McNinch employing many different SMPs. As you watch, record evidence of his use of the SMPs in the right-hand column of the corresponding row. You might choose to **script what Ms. McNinch says** or **describe the action** she takes. You will also see evidence of students using the SMPs and should record those observations as well." ● **"Remember, the video we're watching isn't perfect instruction - Try to focus on what's effective about the teacher moves we see here. Afterward, we'll share our own experiences with this practice and discuss ways we can continue to evolve and refine our usage of the SMPs."** **(5 min)** Play whole video clip **(2 min)** Facilitator says: ● "Take another 2 minutes to finish up your notes. ● **[CLICK for animation]** In addition, I'd also like you to consider the "behind the scenes" prep and planning Ms. McNinch might have done in order to incorporate these SMPs into this lesson. While we don't see her lesson plan or hear about her planning process in this clip, what prep work can *infer* Ms.	

McNinch did to successfully connect the lesson's objectives with the SMPs? You can include those notes in the right-hand column as well."	
Slide 8: **(6 min)** Teachers share which SMPs they observed and describe the teacher and student actions that demonstrated those SMPs. ***Note: Listen for and reinforce these key ideas...*** ● Ms. McNinch has students engage in a task that requires them to make sense of the problem (SMP 1) and discuss their reasoning with their teammates (SMP 3). ● Students are communicating about their solution and the solution they constructed and deciding on the one best answer would involve critiquing the reasoning of others (SMP 3). ● She reminds students that they will need to model their thinking using diagrams, tables, and pictures (SMP 4). She provides them with concrete representations (different sized cups) to further support conceptual understanding. ● We see students generate conjectures (SMP 1), such as Slant Height * Wide Diameter = 2 * Roll radius, and discuss whether or not that generalization/equation (SMP 2, 8) can be true for all data given ● Students are given calculators as tools to support their exploration (SMP 5) and they consider whether their answers are precise (SMP 6).	
Slide 9: **(2 min)** Teachers share their own experiences with utilizing SMPs. Reflections from the video may prompt teachers to share their own best practices and consider adjustments/new learning based on the video.	

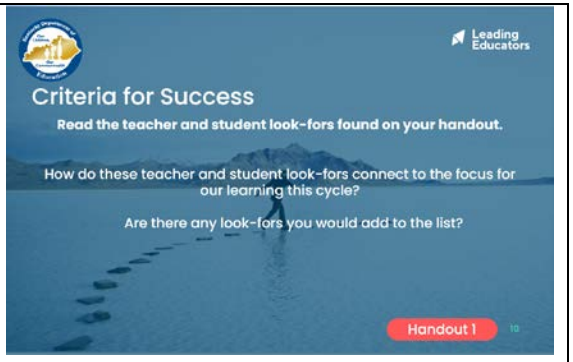
Slide 10:

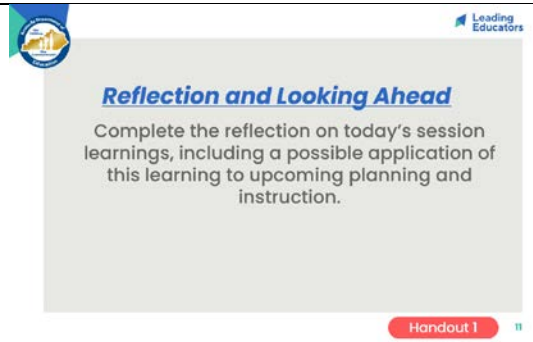
(5 min) Teachers read aloud CFS - teacher and student look-fors. Provide teachers with an opportunity to discuss look-fors, connect look-fors to today's session, and add look-fors.

- "In order to translate our collaborative learning into improved outcomes for student achievement, we as teachers must have our own set of "criteria for success" we can use to set goals and reflect on as we continue to grow our practice."
- "During each topic of learning, we'll review teacher look-fors and student look-fors. On page 4, you'll see that the student look-fors are familiar - they are the same Standards of Mathematical Practice we explored today. Remember, just as the KAS tell us what content standards students should master, the SMPs tell us what practice standards students should be engaging in during their learning."
- "In the left-hand column, you'll see teacher look-fors: these look-fors answer the question: 'What should teachers being doing to ensure that students can engage in the SMPs?'"
- "Take a minute to review the teacher look-fors, called the Mathematical Teaching Practices (MTPs). With a partner, draw parallels between the MTPs (what teachers are doing) and the SMPs (what students are doing as a result."

Note*: *Listen for and reinforce these key ideas...

- There are many connections between the MTPs are SMPs. Teachers may highlight connects between:
  - MTP 7 and SMP 1 - Teachers must create the conditions (learning culture) where students feel safe to take risks in order for students to persevere during challenging work. When teachers communicate growth mindsets to students, they are empowered with language/behaviors that demonstrate that making mistakes is part of the learning process.
  - MTP 3 and SMP 4 - By exposing students to a variety of representations - from concrete to representational/pictorial to abstract, teachers provide students with the tools to model their thinking.
  - MTP 2/MTP 4 and SMP 3 - In order for students to have productive, rich conversations about their own work and the work of peers, they must engage in rigorous tasks. Students cannot have meaningful discussions if the problems they engage with are not grade-level aligned and offer opportunities for a variety of methods for problem solving. Similarly, teachers must model what productive discourse looks like and create systems/structures for students to engage in whole group or small group conversation (sentence stems, protocols, role-specific responsibilities).



• This list of connections is not exhaustive; teachers may find other connections and justify their own rationale for how those teacher practices model, encourage, and support students in engaging with the SMPs. ***Note: Criteria for Success*** • Because this session is an introduction to the SMPs, all of the MTPs and SMPs align to the session's content. Iterate to teachers that they are not expected to show mastery on all indicators after just one session of shared learning. Instead, they should consider these indicators as an "end goal" of what instruction and student actions would look like based on implementation of the SMPs. In the upcoming ***Reflection and Looking Ahead*** activity, ask teachers to select 2-3 indicators that they'd like to focus on as goals for this topic's 3-week cycle. Remind teachers that we will return to these MTPs/SMPs throughout the twelve-week learning cycle; additionally, as we zone in on specific SMPs, the list of relevant MTPs will also narrow.	
Slide 11: **(3 min)** Teachers complete reflection. ***Note: Facilitators may choose to*** • Collect page 4 of Handout 1 as an artifact of teacher learning • Have teachers bring this reflection to 1:1 coaching meeting • Have teachers bring this reflection to future Planning & Practice and Student Progress sessions	

Slide 12: **(5 min)** Facilitator says: ● "For today's closing whip-around, I want to connect all of our new learning to equity, which is the driving force that pushes us to do this work and grow our practice. This is our "why". Take a moment to read our closing question; then I'd like for us to whip around and share our thoughts/build upon one another's." ● Teachers share out.	
Slide 13: **(2 min)** Facilitator previews next session and reminds teachers of any pre-work/action items to be completed before the next meeting. Teachers may also choose to keep their ***Reflections and Looking Ahead*** sheet to refer back to their goals and selected student subgroups during upcoming sessions.