



# Roadmap to Implementing High Quality Mathematics Instruction

## Resource Overview

The Roadmap to Implementing High Quality Mathematics Instruction seeks to:

- Ground instruction in the *Kentucky Academic Standards (KAS) for Mathematics*, thus reaffirming a commitment to equitable learning opportunities for all students in Kentucky;
- Support intentional integration of evidence-based instructional practices; and
- Expand educator familiarity with strategies to interweave the development of social emotional competencies with the development of mathematics content.

A completed Roadmap serves as a sample answer to the question, “*How do we decide which roads to take through this world of mathematics?*”, demonstrating how to cultivate vibrant student learning experiences that incorporate evidence-based instructional practices while valuing educator expertise and autonomy.

### Intended Audiences:

This Roadmap is intended for educators looking for support with:

- *Continuous improvement*, as the Roadmap encourages self-reflection around current understanding of the standards and instructional approaches, considering shifts to those approaches when needed/appropriate;
- *Collaboration*, as the Roadmap offers educators opportunities to build collective agency around high-quality mathematics instruction and empowers educators to determine how to approach moving forward in a way that is manageable but meaningful.

Educators in schools/districts with adopted [High-Quality Instructional Resources \(HQIRs\)](#) should look to that HQIR as a starting point for the Roadmap with an array of pedagogical supports to help meet the needs of all learners. The Roadmap then becomes a place to collect those supports that align with the instructional vision for this specific learning experience. For those using an HQIR, this Roadmap might serve more to support the intellectual prep that goes into a lesson, rather than as a tool for instructional planning.

### Intended Purpose:

Using this Roadmap offering educators the opportunity to consider:

- What is your *goal for this learning experience*? What are your *success indicators*? In what ways will this learning experience *advance student access to and mastery of the KAS for Mathematics*?
- What evidence-based instructional practices will be prioritized throughout facilitation? What might be some strategies or approaches you are considering? How will you decide which strategies or approaches to take?
- Are there authentic opportunities to interweave social and emotional support for students in service of engaging students with mathematics? If so, what design considerations might you choose? How do those design considerations support the evidence-based practice you chose to prioritize in this learning experience?

### A Note About Navigating the Roadmap:

- Map markers are included as virtual flags marking progress through the Roadmap. These markers align with the purpose of the Roadmap as described above.
- As the Standards for Mathematical Practice and Effective Mathematics Teaching Practices are the same K-12, embedded bookmarks within the Roadmap offer ease of navigation without opening additional tabs. Bookmarks support engaging with the practice descriptions while maintaining the ability to quickly return to the section of the Roadmap being considered. As a result of embedding these resources, the Roadmap includes several pages that may or may not be utilized.



The Roadmap to Implementing High Quality Mathematics Instruction seeks to **ground instruction in the *KAS for Mathematics*, thus reaffirming a commitment to equitable learning opportunities for all students in Kentucky.** Here's a preview of the first step:

<i>KAS for Mathematics</i>	Cluster:	Learning Experience:
<b>Identify the Target of the Standard:</b>		
<input type="checkbox"/> <b>Conceptual Understanding</b> refers to understanding mathematical concepts, operations and relations. Conceptual understanding is more than knowing isolated facts and methods; students should be able to make sense of why a mathematical idea is important and the kinds of contexts in which it is useful. Conceptual understanding allows students to connect prior knowledge to new ideas and concepts.		
<input type="checkbox"/> <b>Procedural Skill/Fluency</b> is the ability to apply procedures accurately, efficiently, flexibly and appropriately. It requires speed and accuracy in calculation while giving students opportunities to practice basic skills. Students' ability to solve more complex application and modeling tasks is dependent on procedural skill and fluency		
<input type="checkbox"/> <b>Application</b> provides a valuable context for learning and the opportunity to solve problems in a relevant and a <u>meaningful</u> way. It is through real-world application that students learn to select an efficient method to find a solution, determine whether the solution(s) makes sense by reasoning and develop critical thinking skills.		
<b>Identify the Practice Standard:</b> May reference <a href="#">Engaging the SMPs: Look fors &amp; Question stems</a>		
<input type="checkbox"/> <a href="#">MP.1</a> . Make sense of problems and persevere in solving them.	<input type="checkbox"/> <a href="#">MP.5</a> . Use appropriate tools strategically.	
<input type="checkbox"/> <a href="#">MP.2</a> . Reason abstractly and quantitatively.	<input type="checkbox"/> <a href="#">MP.6</a> . Attend to precision.	
<input type="checkbox"/> <a href="#">MP.3</a> . Construct viable arguments and critique the reasoning of others.	<input type="checkbox"/> <a href="#">MP.7</a> . Look for and make use of structure.	
<input type="checkbox"/> <a href="#">MP.4</a> . Model with mathematics.	<input type="checkbox"/> <a href="#">MP.8</a> . Look for and express regularity in repeated reasoning.	

### Supporting Resources:

- [KAS for Mathematics](#)
- [Breaking Down a Mathematics Standard](#)
- [Mathematics Assignment Review Protocol](#)
- [Engaging the Standards for Mathematical Practice: Look fors and Question Stems](#)

### Why are we here?

“When teachers focus on the activities students will do without a clear understanding of the intended learning, it is unlikely students will learn what they need to learn (William & Leahy, 2015).” The standards set forth a statewide baseline of what students should know and be able to do after instruction, but do not address how learning experiences are to be designed or what resources should be used. In order for teachers to support students in understanding the purpose of the learning and what success looks like, teachers must have clarity around what the standards are asking students to know and be able to do.

For educators who have not yet done so, engaging in [Section 1D of the Getting to Know the KAS for Mathematics module](#) (updated in 2022) would be an excellent professional learning investment prior to completing a Roadmap. Entitled “A Closer Look at the Standards for Mathematical Content within the *KAS for Mathematics*”, this learning experience is designed to support educators in:

- Building a shared understanding of the *KAS for Mathematics* document.
- Strengthening the connection between the components of the *KAS for Mathematics* and the way those components can support teachers in the process of designing instruction
- Experiencing how the changes in the *KAS for Mathematics* can and should be reflected in student experiences within Kentucky classrooms.

Teacher clarity around the *KAS for Mathematics* is paramount in this section of the Roadmap. Once teachers have gained clarity on what students need to know and be able to do to meet the standards’ expectations (as supported by the [Breaking Down a Mathematics Standard](#) protocol), they must help students develop that same level of understanding. It is in the assignment that the teacher translates the learning goal into action for the student. That’s where the [Mathematics Assignment Review Protocol](#) comes in. Schools/districts using an HQIR may have already explored the *KAS for Mathematics* and embedded assignments deeply as a part of the HQIR selection process.

Lastly, there’s an optional section for “Notes on Key Lesson Components”. If capturing specific information (such as learning targets and success criteria) would support the school/district instructional vision, teachers might include that information here. Teachers might want to enter notes about sequencing, how this learning experience fits into the bigger picture of what students are learning or a timeline for the lesson. This space is for anything that might support instructional planning and can be revisited throughout the process of developing a Roadmap.

Key “souvenirs” from this section of the Roadmap:

- Put simply, the Standards for Mathematical Content define what students should understand and be able to do. The Standards for Mathematical Practice define how students engage in mathematical thinking. The [Engaging the Standards for Mathematical Practice: Look fors and Question Stems](#) resource provides guidance on ways teachers can design instruction to allow students to engage in the Standards for Mathematical Practice.
- Within the *KAS for Mathematics*, the standards emphasize procedural skill and fluency, building **from** conceptual understanding **to** application and modeling with mathematics, in order to solve real world problems. Having the ability to discern whether a standard is targeting conceptual understanding, procedural skill/fluency and application is not only critical within the planning and delivery of instruction, it is also imperative when considering how to offer students equitable learning opportunities in mathematics classrooms across the state.



The Roadmap to Implementing High Quality Mathematics Instruction seeks to **support intentional integration of evidence-based instructional practices**. Here's a preview of the second stop:

Identify Evidence-based Instructional Practice(s)	
<input type="checkbox"/> <a href="#">EMTP 1</a> : Establish mathematics goals to focus learning.	<input type="checkbox"/> <a href="#">EMTP 5</a> : Pose purposeful questions.
<input type="checkbox"/> <a href="#">EMTP 2</a> : Implement tasks that promote reasoning and problem solving.	<input type="checkbox"/> <a href="#">EMTP 6</a> : Build procedural fluency from conceptual understanding.
<input type="checkbox"/> <a href="#">EMTP 3</a> : Use and connect mathematical representations.	<input type="checkbox"/> <a href="#">EMTP 7</a> : Support productive struggle in learning mathematics.
<input type="checkbox"/> <a href="#">EMTP 4</a> : Facilitate meaningful mathematical discourse.	<input type="checkbox"/> <a href="#">EMTP 8</a> : Elicit and use evidence of student thinking.
<b>Teacher Actions:</b>	<b>Student Actions:</b>

### Supporting Resources:

- [Effective Mathematics Teaching Practices \(NCTM\)](#)

### Why are we here?

Each day, teachers make decisions that have the potential to positively impact student learning. According to Fisher, et al. (2021) to create truly equitable learning environments, every teacher must maximize his or her impact on every student in the school, and educators must focus on making a difference together. “The greatest impact on student learning comes from leveraging individual efficacy, or expectations of success, into a collective whole” (p. 28). Goodman, et al. (2020), found that when teachers and entire school teams became increasingly intentional with evidence-based teaching practices, thinking about why they were using them and how to consistently implement the practices, student engagement and learning increased significantly.

In selecting an evidence-based instructional practice for the Roadmap, educators have the opportunity to consider what this learning experience should look like in action - *What is the teacher doing? What are the students doing? Which practice will best support that?* There will potentially be several practices that might feel like a good fit here, but educators are encouraged to limit the scope to a single practice to amplify within the Roadmap for this learning experience. While it is important that instruction is balanced when viewed holistically, having an opportunity to reflect in a purposeful way about specific elements of teacher practice can be really powerful in considering how to maximize impact on student learning. Educators in schools/districts with adopted HQIRs should look to that HQIR as a starting point for this section of the Roadmap, as the HQIR likely provides guidance on what evidence-based instructional practices might be most effective within the learning experience.

Within this section of the Roadmap, educators capture thinking around what the teaching practice will look like when it comes to life within this learning experience. As an example, a teacher choosing to focus on “supporting productive struggle in learning mathematics” may consider the teacher action “helping students realize that confusion and errors are a natural part of learning, but facilitating discussions on mistakes, misconceptions and struggles” as a critical element to elevate within this learning experience. *What might that look like within the context of this specific Roadmap? What might be some anticipated misconceptions? What questions might support facilitating discussion around those misconceptions?* Similarly, *what might it look like and sound like within this lesson for students to be “helping one another without telling their classmates what the answer is or how to solve the problem”?* *Would students need support (such as sentence stems, discussion protocols, etc.) to engage in peer feedback in this way?* Put simply, this section of the Roadmap is a place to connect general evidence-based instructional practices to the context of this learning experience.

Key “souvenirs” from this section of the Roadmap:

- Educators should focus on instructional practices in a way that feels meaningful, but manageable.
- Educators can take different routes and still arrive at the same destination. As the selected evidence-based instructional practice is influenced by the instructional vision for the learning experience and the setting/context in which the learning experience will live, educators may elevate different practices, presenting an opportunity to engage in discussions that celebrate educator autonomy.
- These types of conversations are part of the ongoing work of a professional learning community (PLC) and help to develop both the individual and collective capacity of its members. Through these collaborative conversations, the team focuses on addressing questions such as:
  - What instructional practices worked well?
  - How were the practices implemented in each classroom? What changes need to be made to improve the implementation of these practices?
  - What instructional strategy or practice failed to produce results for the whole group as well the subgroups? What might be possible reasons for these results?
  - Based on the evidence, what are some areas of professional learning that could support the team in effectively identifying and implementing instructional practices to improve student learning?

The Roadmap has NCTM’s Effective Mathematics Teaching Practices embedded, however local school/districts may have instructional priorities that are consistent across content areas. In this instance, the KDE’s [Evidence-Based Instructional Practice series](#) might be helpful in considering this section of the Roadmap.



The Roadmap to Implementing High Quality Mathematics Instruction seeks to **expand educator familiarity with strategies to interweave the development of social emotional competencies with the development of mathematics content**. Here’s a preview of the last stop:

<b>Identify the Competency Intended to Support the Evidence-Based Instructional Practice:</b> <small>May reference <a href="#">Integrating SEAD within the KAS for Mathematics</a> resource library</small>				
<input type="checkbox"/> SELF-AWARENESS	<input type="checkbox"/> SELF-MANAGEMENT	<input type="checkbox"/> SOCIAL AWARENESS	<input type="checkbox"/> RELATIONSHIP SKILLS	<input type="checkbox"/> RESPONSIBLE DECISION-MAKING
<b>Specific Design Considerations from <a href="#">Integrating SEAD within the KAS for Mathematics</a> Grade Level Resource</b>				
<b>Teacher Reflection Questions from <a href="#">Integrating SEAD within the KAS for Mathematics</a> Grade Level Resource</b>				

**Supporting Resources:**

- [Integrating SEAD within the KAS for Mathematics](#) resource library

**Why are we here?**

For learning to occur, educators must not only focus on students’ academic learning, but also on the social and emotional factors that affect student learning (McTighe & Willis, 2019). As teachers design instruction which places equal value on the development of mathematical content and mathematical practices, developing trusting relationships within the community of learners will improve the effectiveness of the delivery. Those relationships lay the groundwork for meaningful teacher and peer feedback allowing students to monitor their progress toward learning goals and providing students with opportunities to reflect on

their own learning. 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/communications as part of the learning process.

Educators not familiar with the [Integrating SEAD within the KAS for Mathematics](#) resource library may want to consider investing time in professional learning specific to this resource. Educators unfamiliar with the resource itself may need additional time and support to feel confident completing this section of the Roadmap.

This section of the Roadmap is a place to connect social and emotional strategies to the mathematics and context of this learning experience. Educators should consider the instructional vision for the learning experience: *What is the teacher doing? What are students doing? Which competency might best support the evidence-based instructional practice selected? Within that competency, which specific design considerations feel most connected to the evidence-based instructional practice to support the instructional vision for the learning experience?* Pull any language from the grade-level [Integrating SEAD within the KAS for Mathematics](#) resource that “fits” and supports your instructional vision.

The teacher reflection questions may include, but are not limited to, those from the Teacher Self-Reflection section within the chosen competency of the Integrating SEAD within the *KAS for Mathematics* resource. There is not a right or wrong approach for which questions (or how many) to select. Instead educators should select the questions that feel most natural based on the rest of the Roadmap. To inspire continuous improvement, educators might consider selecting one question that represents an opportunity for growth within their professional practice.

Key “souvenirs” from this section of the Roadmap:

- Educators should focus on the competency/design considerations in a way that feels meaningful, but manageable.
- Educators can take different routes and still arrive at the same destination. As the selected competency/design considerations will be influenced by the instructional vision for the learning experience and the setting/context in which the learning experience will live, educators may elevate different competencies/design considerations, presenting an opportunity to engage in discussions that celebrate educator autonomy.

### References:

- Goodwin, B., Gibson, T., & Rouleau, K. (2020). *Learning that sticks: A brain-based model for K-12 instructional design and delivery*. Alexandria, VA: ASCD.
- Hattie, J., Bustamante, V., Almarode, J., Fisher, D., & Frey, N. (2021). *Great teaching by design*. Thousand Oaks, CA: Corwin Press.
- McTighe, J. & Willis, J. (2019). *Upgrade your teaching: Understanding by design meets neuroscience*. Alexandria, VA: ASCD. (ESSA Level IV)
- National Council of Teachers of Mathematics. (2014). *Principles to actions: Ensuring mathematical success for all*.
- William, D. & Leahy, S. (2015). *Embedding formative assessment: Practical techniques for k-12 classrooms*. West Palm Beach, FL: Learning Sciences International.