

An Introduction to the Modeling Cycle within the *KAS for Mathematics*

Facilitator's Guide

Module Overview:

Developed by the Kentucky Department of Education (KDE), this professional learning module is intended to support the successful implementation of the modeling process within the *Kentucky Academic Standards (KAS) for Mathematics* in classrooms across the state. This Facilitator's Guide is built to support a deep exploration of the components of the modeling cycle through the lens of students and teachers.

While the duration and scope may be customized to accommodate local needs and conditions, it is recommended that the sequence of the sessions be maintained since the sessions build upon one another. Skipping sections may result in less effective learning about how the modeling cycle can support coherence and equity in the mathematics classroom.

Goals:

As a foundational resource for the *KAS for Mathematics*, the Guidelines for Assessment and Instruction in Mathematical Modeling Education (GAIMME) helped inform the modeling process outlined on page 7 of the standards. Throughout this professional learning, we will draw upon the [KAS for Mathematics](#) and the [GAIMME Report](#) as we:

- Explore the components of the modeling cycle.
- Engage in a modeling task through the lens of a student and a teacher.
- Look for opportunities to incorporate components of the modeling cycle within available instructional resources.

Intended Audiences:

Participants may include, but are not limited to, classroom teachers, team leads/department chairs, special educators, intervention specialists, staff who actively support mathematics teaching and learning and pre-service classroom teachers. In addition, schools/districts may choose to have anyone planning to conduct observations and/or walkthroughs within mathematics classrooms participate in this learning in order to develop a shared understanding of the expectations related to the modeling process within the *KAS for Mathematics*, as that should be guiding the instruction witnessed in the classroom. This might include district leadership, school administrators and/or instructional specialists/coaches.

Facilitators may include, but are not limited to, regional cooperative staff, district leadership, school administrators, instructional specialists/coaches, intervention specialists, department chairs, special educators, classroom teachers and higher education faculty. Facilitators might want to consider ways to promote this professional learning experience. One [example](#) has been provided for potential language for facilitators to promote this professional learning opportunity with educators.

In acknowledgment of the dedication and expertise demonstrated by the educators in attendance at the session, it is fitting to provide certificates or proof of learning hours at the conclusion of this learning experience. These certificates serve as tangible evidence of a commitment to continuous professional development and lifelong learning. Participants who complete the provided professional learning survey linked within the facilitator notes will receive a certificate of completion from the KDE. Please remember: Educators can use the PLBB to find learning sessions, but it is the local school district who determines if they are acceptable for credit based on their district policies. See 704 KAR 3:035 for more details.

Using This Facilitator’s Guide:

This facilitator’s guide provides suggestions for structuring the two-part series, including recommended activities to prompt meaningful investigation of the *KAS for Mathematics* and guidance on talking points to use alongside the provided PowerPoint presentation. The recommended learning activities and optional extension activities are provided to aid in developing participant knowledge and familiarity with the modeling process as outlined within the *KAS for Mathematics*. Additionally, facilitators may want to consider how to support the delivery and/or continued application of the learning within each session at the local level.

Module Connections to Curriculum Based Professional Learning

Curriculum-based professional learning in mathematics must be grounded in the *KAS for Mathematics*, evidence-based instructional practices and the district-selected high-quality instructional resource (HQIR).

When structuring these types of high-quality professional learning experiences, they should include (1) the sharing and processing of learning to build a common understanding, (2) a chance for educators to internalize and practice the knowledge, understandings and skills they are developing and then (3) space for reflection where results are analyzed to inform next steps.

The organization of this module aligns tightly to that structure, as Section 1 is designed to build a common understanding whereas Section 2 gives educators a chance to apply what they are learning within the context of delivering lessons from the HQIR in their classrooms.

For more support with how this module might fit within the local vision of quarterly professional learning cycles, access the KDE’s [Structuring Professional Learning Cycles](#).

Module Sessions:

Completing this module in its entirety will take approximately four hours. Facilitators may choose to print copies of the materials listed below, have participants print their own copies, or have participants access the materials digitally. If participants are responsible for printing their own copies, please specify that and provide necessary links within the invitation to the session.

Introduction to the Modeling Cycle: Session 1

Purpose	Before	During	After										
<p>Use the <i>KAS for Mathematics</i> and the GAIMME Report to:</p> <ul style="list-style-type: none"> Explore the components of the modeling cycle. Engage in a modeling task through the lens of a student and a teacher. 	<p>Facilitator Materials:</p> <ul style="list-style-type: none"> Introduction to the Modeling Cycle Facilitator’s Guide Introduction the Modeling Process PowerPoint Printouts of the slides based on grade band for the gallery walk <p>Participant Materials:</p> <ul style="list-style-type: none"> Video Launch: <ul style="list-style-type: none"> Primary, Intermediate, Middle High School Handout 1 Engaging the SMPs: Look fors and Question Stems Effective Mathematics Teaching Practices (NCTM) <p>General Materials:</p> <ul style="list-style-type: none"> Chart paper Sticky Notes Markers Deck of Cards 	<p>Estimated time: 2.5 hours</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;">Slides</th> <th style="width: 85%;">Outline</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1-4</td> <td> Introduction: <ul style="list-style-type: none"> Launch Session Goals </td> </tr> <tr> <td style="text-align: center;">5-15</td> <td> The Modeling Cycle in the <i>KAS for Mathematics</i> <ul style="list-style-type: none"> Capturing Initial Thinking Connecting to the KAS </td> </tr> <tr> <td style="text-align: center;">16-84</td> <td> Task Exploration <ul style="list-style-type: none"> Exploration introduction Grade-Band Exploration: <ul style="list-style-type: none"> 19-33: Primary 34-50: Intermediate 51-66: Middle 67-84: High </td> </tr> <tr> <td style="text-align: center;">85</td> <td>Reflection</td> </tr> </tbody> </table>	Slides	Outline	1-4	Introduction: <ul style="list-style-type: none"> Launch Session Goals 	5-15	The Modeling Cycle in the <i>KAS for Mathematics</i> <ul style="list-style-type: none"> Capturing Initial Thinking Connecting to the KAS 	16-84	Task Exploration <ul style="list-style-type: none"> Exploration introduction Grade-Band Exploration: <ul style="list-style-type: none"> 19-33: Primary 34-50: Intermediate 51-66: Middle 67-84: High 	85	Reflection	<p>Plan ahead for Session 2.</p> <p>Opportunities for Extended Exploration:</p> <ul style="list-style-type: none"> Establishing the Learning Environment and the KAS for Mathematics Explicit Teaching and Modeling and the KAS for Mathematics Writing for Publication in Mathematics
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85	Reflection												

Introduction to the Modeling Cycle: Session 2

Purpose	Before	During	After										
<p>Use the KAS for Mathematics and the GAIMME Report to:</p> <ul style="list-style-type: none"> Look for opportunities to incorporate components of the modeling cycle within available instructional resources. 	<p>Facilitator Materials:</p> <ul style="list-style-type: none"> Introduction to the Modeling Cycle Facilitator’s Guide Introduction to the Modeling Cycle PowerPoint <p>Participant Materials:</p> <ul style="list-style-type: none"> Excerpt from the GAIMME Report: <ul style="list-style-type: none"> Elementary Secondary Modeling Task Consideration SWOT Analysis Template KDE PL Survey <p>General Materials:</p> <ul style="list-style-type: none"> Sticky Notes Markers 	<p>Estimated time: 1.5 hours</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 20%;">Slides</th> <th style="width: 80%;">Outline</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">86-88</td> <td> Introduction: <ul style="list-style-type: none"> Session Goals Launch </td> </tr> <tr> <td style="text-align: center;">89-92</td> <td>Getting Started with the Modeling Cycle</td> </tr> <tr> <td style="text-align: center;">93-98</td> <td>The Modeling Cycle and Instructional Resources</td> </tr> <tr> <td style="text-align: center;">99-100</td> <td> Reflection <ul style="list-style-type: none"> Stoplight Reflection KDE PL Survey </td> </tr> </tbody> </table>	Slides	Outline	86-88	Introduction: <ul style="list-style-type: none"> Session Goals Launch 	89-92	Getting Started with the Modeling Cycle	93-98	The Modeling Cycle and Instructional Resources	99-100	Reflection <ul style="list-style-type: none"> Stoplight Reflection KDE PL Survey 	<p>Opportunity for Extended Exploration:</p> <p>This section can help educators recognize the presence or absence of opportunities to engage in the modeling process within their adopted instructional resource, equipping them with the knowledge to identify when the resource does not include adequate opportunities for students to engage in the modeling process.</p> <p>Options for extended exploration can be found on slide 97.</p>
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Building a Community:

Building a community is important for any group that will work together, especially if participants have not worked together before. The concept is the same as building a safe, respectful, productive classroom climate. Incorporating community-building into each session builds trust, shows participants they are valuable as individuals and engages them in the learning process. It is also useful for creating a professional learning network where participants can be supported in their work. Community-building can be as simple as allowing participants to introduce themselves and their role in the school/district, developing or refining group norms, allowing for questions and/or the sharing of reflections throughout the module. Time allotted for community-building will allow participants to have a voice and be engaged as active contributors and learners.

Depending on how facilitators envision this module work moving forward, it might be valuable to consider how to tailor these norms to the specific group of educators the facilitator will be working with on a continual basis. As an example, this 3.5 minute [video](#) references group norms that are really a list of qualities the group is willing to commit to each day. The suggested group norms will likely apply across

participant groups, but there is value in building community by inviting participants to provide input into those norms - especially for participants who will be meeting regularly. Cocreating group norms may help build community within and across school/district participants.

Throughout the module, participants will be expected to collaborate in a variety of ways. Attending to the group norms will be critical for participants to actively participate and accept collective responsibility for the successful attainment of the module goals.

Helpful Hint:

It is important to realize that while you are the facilitator of these work sessions, you may not have all the answers to the questions asked by participants. When this happens, reflect on this quote from Graham Fletcher, “Every teachable moment doesn’t need to be a teachable moment, in that moment.” If participants ask questions, you are not prepared to answer, offer to seek out answers to those questions and share with the larger group. If the question is pressing and doesn’t appear to be addressed in this module, you may email questions and/or feedback to kdemath@education.ky.gov.

Facilitator Notes:

The slides contain facilitator notes intended as a companion to the [Introduction to the Modeling Cycle PowerPoint slides](#).

Potential Language for Facilitators to Promote this Professional Learning Opportunity with Educators:

MODELING (LIKE REAL LIFE) IS OPEN-ENDED AND MESSY

In the course of a student’s mathematics education, the word “model” is used in a variety of ways. Modeling with Mathematics might include utilizing manipulatives, demonstration, role modeling and conceptual models of mathematics, all valuable tools for teaching and learning; however, these examples are different from participating in The Modeling Cycle. During our session together we will use the [KAS for Mathematics](#) and the [GAIMME Report](#) to:

- Explore the components of the modeling cycle.
- Engage in a modeling task through the lens of a student and a teacher.
- Look for opportunities to incorporate components of the modeling cycle within available instructional resources.

Attention: This session is NOT designed as a “sit and get”. However, this session IS designed for those who want to work together to cultivate a clearer picture of mathematical modeling (what it is and what it isn’t). We can’t wait to learn alongside you!

Source:

Bliss, K. M., Fowler, K. R., & Galluzzo, B. J. (2014). Math Modeling: Getting Started and Getting Solutions. Philadelphia, Pennsylvania; Society for Industrial and Applied Mathematics (SIAM). <https://m3challenge.siam.org/wp-content/uploads/siam-guidebook-final-press.pdf>

GAIMME: Guidelines for Assessment and Instruction in Mathematical Modeling Education, Sol Garfunkel and Michelle Montgomery, editors, COMAP and SIAM, Philadelphia, 2016. View the entire report, available freely online, at <https://siam.org/Publications/Reports/Detail/Guidelines-for-Assessment-and-Instruction-in-Mathematical-Modeling-Education>.