Kendall Hunt Background information for Illustrative Mathematics HS

Kendall Hunt Publishing has been in business for 75 years and is the premiere publisher of innovative, hands-on, inquiry-based science, mathematics and gifted curricula for grades K-12. Our award-winning research and standards-based programs are available in both print and digital components that fully engage students, teachers and parents. In January of 2019, Kendall Hunt partnered with Illustrative Mathematics. With this collaboration, we are the only provider of the free, IM-certified math curriculum for students in grades 6-12.

Driven by student discourse, the IM Certified™ high school program is a rich, engaging core program built around focus, coherence, and rigor. The curriculum is a trusted, expert-authored program developed to equip all students to thrive in mathematics. It is a problem-based core curriculum rooted in content and practice standards to foster learning and achievement for all. Every lesson in this program are designed with a focus on independent, group, and whole-class instruction. This format builds mathematical understanding and fluency for all students. Teachers will also use Warm-ups and Cool-downs to help guide lesson pacing and planning.

Students learn by doing math, solving problems in mathematical and real-world contexts, and constructing arguments using precise language. Teachers can shift their instruction and facilitate student learning with high-leverage routines that guide them in understanding and making connections between concepts and procedures. In a mathematics class, students should not just learn *about* mathematics, they should *do* mathematics. This can be defined as engaging in the mathematical practices: making sense of problems, reasoning abstractly and quantitatively, making arguments and critiquing the reasoning of others, modeling with mathematics, making appropriate use of tools, attending to precision in their use of language, looking for and making use of structure, and expressing regularity in repeated reasoning. This problem-based curriculum makes rigorous high school mathematics accessible to all learners. The key to all students achieving mathematical proficiency is the balance of the three components of rigor:

Conceptual understanding: Students need to understand the why behind the how in mathematics. Concepts build on experience with concrete contexts. Students should access these concepts from a number of perspectives in order to see math as more than a set of disconnected procedures.

Procedural fluency: We view procedural fluency as solving problems expected by the standards with speed, accuracy, and flexibility.

Application: Application means applying mathematical or statistical concepts and skills to a novel mathematical or real-world context.

Illustrative Mathematics believes that these three aspects of mathematical proficiency are interconnected: procedural fluency is supported by understanding, and deep understanding

often requires procedural fluency. In order to be successful in applying mathematics, students must both understand and be able to do the mathematics.

About These Materials

These materials were created by Illustrative Mathematics. They were piloted and revised in the 2018–2019 school year.

Units contain between 10 and 25 lesson plans. Each unit has a diagnostic assessment for the beginning of the unit (*Check Your Readiness*) and an end-of-unit assessment. Longer units also have a mid-unit assessment. In addition to lesson and assessments, modeling prompts are provided to be used throughout the year.

The time estimates in these materials refer to instructional time. Each lesson plan is designed to fit within a class period that is at least 45 minutes long. Some lessons contain optional activities that provide additional scaffolding or practice for teachers to use at their discretion.

There are two ways students can interact with these materials. Students can work solely with printed workbooks or pdfs. Alternatively, if all students have access to an appropriate device, students can look at the task statements on that device and write their responses in a notebook or the print companion for the digital materials. It is recommended that if students are to access the materials this way, they keep the notebook carefully organized so that they can go back to their work later.

Teachers can access the teacher materials either in print or in a browser. A classroom with a digital projector is recommended.

Design Principles

Developing Conceptual Understanding and Procedural Fluency

Each unit begins with a pre-assessment that helps teachers gauge what students know about both prerequisite and upcoming concepts and skills, so that teachers can gauge where students are and make adjustments accordingly. The initial lesson in a unit is designed to activate prior knowledge and provide an entry point to new concepts, so that students at different levels of both mathematical and English language proficiency can engage productively in the work. As the unit progresses, students are systematically introduced to representations, contexts, concepts, language and notation. As their learning progresses, they make connections between different representations and strategies, consolidating their conceptual understanding, and see and understand more efficient methods of solving problems, supporting the shift towards

procedural fluency. Practice problems, when assigned in a distributed manner, give students ongoing practice, which also supports developing procedural proficiency.

Applying Mathematics

Students have opportunities to make connections to real-world contexts throughout the materials. Frequently, carefully-chosen anchor contexts are used to motivate new mathematical concepts, and students have many opportunities to make connections between contexts and the concepts they are learning. Many units include a real-world application lesson at the end. In some cases, students spend more time developing mathematical concepts before tackling more complex application problems, and the focus is on mathematical contexts. Additionally, a set of mathematical modeling prompts provide students opportunities to engage in authentic, grade-level appropriate mathematical modeling.

Use of Digital Tools

These curriculum materials empower high school teachers and students to become fluent users of widely-accessible mathematical digital tools to produce representations to support their understanding, solve problems, and communicate their reasoning.

Digital tools are included when they are required by the standard being addressed and when they make better learning possible. For example, when a student can use a graphing calculator instead of graphing by hand, use a spreadsheet instead of repeating calculations, or create dynamic geometry drawings instead of making multiple hand-drawn sketches, they can attend to the structure of the mathematics or the meaning of the representation.

Lessons are written with three anticipated levels of digital interaction: some activities *require* digital tools, some activities *suggest* digital tools, and some activities *allow* digital tools. In a few cases, activities may prohibit digital tools if they interfere with concept development.

In most cases, instead of being given a pre-made applet to explore, students have access to a suite of linked applications, such as graphing tools, synthetic and analytic geometry tools, and spreadsheets. Students (and teachers) are taught how to use the tools, but not always told when to use them, and student choice in problem-solving approach is valued.

When appropriate, pre-made applets may be included to allow for students to practice many iterations of a skill with error checking, to shorten the amount of time it takes students to create a representation, or to help students see many examples of a relationship in a short amount of time.

The Five Practices

Selected activities are structured using Five Practices for Orchestrating Productive Mathematical Discussions (Smith & Stein, 2011), also described in Principles to Actions: Ensuring Mathematical Success for All (NCTM, 2014), and Intentional Talk: How to Structure and Lead Productive Mathematical Discussions (Kazemi & Hintz, 2014). These activities include a presentation of a task or problem (may be print or other media) where student approaches are anticipated ahead of time. Students first engage in independent think-time followed by partner or small-group work on the problem. The teacher circulates as students are working and notes groups using different approaches. Groups or individuals are selected in a specific, recommended sequence to share their approach with the class, and finally the teacher leads a whole-class discussion to make connections and highlight important ideas.

Task Purposes

- Provide experience with a new context. Activities that give all students experience with a new context ensure that students are ready to make sense of the concrete before encountering the abstract.
- Introduce a new concept and associated language. Activities that introduce a new concept and associated language build on what students already know and ask them to notice or put words to something new.
- Introduce a new representation. Activities that introduce a new representation often present the new representation of a familiar idea first and ask students to interpret it. Where appropriate, new representations are connected to familiar representations or extended from familiar representations. Students are then given clear instructions on how to create such a representation as a tool for understanding or for solving problems. For subsequent activities and lessons, students are given opportunities to practice using these representations and to choose which representation to use for a particular problem.
- Formalize a definition of a term for an idea previously encountered informally. Activities that formalize a definition take a concept that students have already encountered through examples, and give it a more general definition.
- Identify and resolve common mistakes and misconceptions that people make. Activities that give students a chance to identify and resolve common mistakes and misconceptions usually present some incorrect work and ask students to identify it as such and explain what is incorrect about it. Students deepen their understanding of key mathematical concepts as they analyze and critique the reasoning of others.
- Practice using mathematical language. Activities that provide an opportunity to practice using mathematical language are focused on that as the primary goal rather than having a primarily mathematical learning goal. They are intended to give students a reason to use mathematical language to communicate. These frequently use the Info Gap instructional routine.
- Work toward mastery of a concept or procedure. Activities where students work toward mastery are included for topics where experience shows students often need some additional time to work with the ideas. Often these activities are marked as optional

because no new mathematics is covered, so if a teacher were to skip them, no new topics would be missed.

- Provide an opportunity to apply mathematics to a modeling or other application problem. Activities that provide an opportunity to apply mathematics to a modeling or other application problem are most often found toward the end of a unit. Their purpose is to give students experience using mathematics to reason about a problem or situation that one might encounter naturally outside of a mathematics classroom.

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You can learn more and access Kendal Hunt's free IM Certified™ high school content at https://im.kendallhunt.com/

Kendall Hunt also offers print materials and IM Certified™ professional learning. To purchase or learn more about Kendall Hunt's Illustrative Mathematics visit https://k12.kendallhunt.com/program/illustrative-mathematics-high-school

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To request more information, email us at K12info@kendallhunt.com