



2023 Mathematics Framework for California Public Schools: Grades TK-12

Imagine IM from Imagine Learning response to the California Mathematics Framework Chapters approved on July 12, 2023 by the Instructional Quality Commission (IQC)

Imagine IM's response to the 2023 California Mathematics Framework Chapters

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Mathematics for All: Purpose, Understanding, and Connection

Summary

Students learn best when they are actively engaged in questioning, struggling, problem-solving, reasoning, communicating, making connections, and explaining. The research is clear that powerful mathematics classrooms thrive when students feel a sense of agency (a willingness to engage in the discipline, based on a belief in progress through engagement) and an understanding that the intellectual authority in mathematics rests in mathematical reasoning itself. In other words, mathematics makes sense (Boaler, 2019 a, b; Boaler, Cordero & Dieckmann, 2019; Anderson, Boaler & Dieckmann, 2018; Schoenfeld, 2014).

Imagine IM Response

Imagine IM is designed as a problem-based curriculum, an approach that is well aligned with the recommendations in California's framework. Specifically, the framework calls for particular strategies and methods that are built into Imagine IM.

- The framework's emphasis on Universal Design for Learning (UDL) is well aligned with Imagine IM's lesson design, as it uses principles of UDL both to make activities accessible to all students, and to inform the specifics of the supports for students with diverse abilities.
- Imagine IM was built for coherence and connections. That is, IM does not "begin with one or two content standards and choose tasks which develop that standard." There's interweaving, for example, using supporting work to build major work (Chapter 1, page 27, lines 637–638 from Mathematics Framework).
- "Abstract formulations should follow experiences with multiple contexts that call forth similar math models" (Chapter 1, page 31, lines 756–767 from Mathematics Framework). One of Imagine IM's organizing principles is that students should encounter plenty of examples of a mathematical or statistical idea in various real-world and mathematical contexts before that idea is named and studied as an object in its own right. It's not just about the contexts in which the math idea is presented, but giving students space and time to interact or play with the idea in intuitive ways and to talk about it in terms that make sense to them. A good example to look at is the introduction to equivalent ratios in Grade 6, Unit 2, Lessons 1 through 5, where students experiment with color mixtures and batches of recipes before equivalent ratios are named and defined.
- "Problems (tasks which students do not already have the tools to solve) precede teaching of the focal mathematics which are necessitated by the problem" (Chapter 1, page 26 lines 610–611 from Mathematics Framework). This is central to Imagine IM's problem-based approach.
- "In these classrooms, mathematics represents far more than just calculating. Active-learning experiences enable students to engage in a full range of mathematical activities exploring, noticing, questioning, solving, justifying, explaining, representing, and analyzing" (Chapter 1, page 7, lines 161–164 from Mathematics Framework). These can be directly connected to instructional routines like Notice and Wonder and Co-Craft Questions.
- Refer to the Teacher Course Guide, "Design Principles," "What is a Problem-based Curriculum?," "A Typical IM Lesson," "How to Use the Materials," and "Supporting Students with Disabilities" for additional examples.



Teaching for Equity and Engagement

Summary

- Plan Teaching Around Big Ideas
- Use Open, Engaging Tasks
- Teach Toward Social Justice

- Invite Student Questions and Conjectures
- Center Reasoning and Justification

Imagine IM Response

As a coherent curriculum, Imagine IM lessons are organized around big ideas in the standards, attending to cluster headings (which are an example of a place to find "big ideas") as strongly as individual standards.

One issue with using "open tasks" as a cornerstone of math instruction is that without an instructional model, teachers/ coaches/math leaders struggle with how to identify appropriate tasks that lead to grade-level work and how to implement them. Imagine IM offers a solution to both of these issues. Teachers and coaches don't need to spend hours creating or searching for tasks — they are built into the curriculum materials with guidance for planning and implementation and instructional routines for increasing access for all learners. Chapter 2 mentions a number of key strategies that are explicit features of Imagine IM.

- "Educators need to build classroom environments where all students' ideas are valued" (Chapter 2, page 7, lines 115–116 from Mathematics Framework). Imagine IM attends to this by helping teachers establish a collaborative math community.
- "Use an approach where questions are introduced first, then allow students time to consider ways they might solve and discuss and reason with other students" (Chapter 2, page 42, lines 886–888 from Mathematics Framework). In the problem-based lesson structure, activities within Imagine IM begin with a launch to pose questions and set the context before students think independently and with others to solve.
- "Value the different ways questions and problems can be approached and learned" (Chapter 2, page 9, lines 172–173 from Mathematics Framework). Different ways to represent the same idea are built into Imagine IM. There are opportunities for students to use informal representations; instructions may recommend particularly useful representations (tape diagrams, double number lines, etc.). In addition, the 5 Practices activities that are designed so that different students might respond with different representations and activities explicitly ask students to create different representations of the same idea, with opportunities to notice connections, similarities, and differences.
- 5 Practices for Orchestrating Productive Mathematical Discussions (Chapter 2, page 42, lines 895–896 from Mathematics Framework). The 5 Practices routine is used throughout Imagine IM.
- Number Talks (Chapter 2, page 21, line 335 from Mathematics Framework). Number talks are routines used throughout Imagine IM.
- "Invite student questions and conjectures" (Chapter 2, page 32, line 620 from Mathematics Framework). Notice and Wonder routine, Are You Ready for More? activities, and Explorations problems.
- "Multilingual learners can learn and thrive" (Chapter 2, page 10, line 192 from Mathematics Framework). Imagine IM's mathematical language routines support teachers with language development.



Number Sense

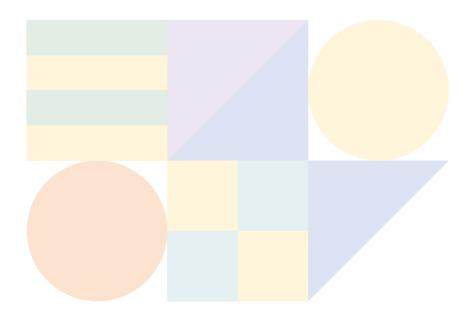
Summary

Number sense is multifaceted, and while components can be easily recognized, the concept is difficult to define. The operating definition of number sense for this chapter is a form of intuition that students develop about a number (or quantity). As students increase their number sense, they can see relationships between numbers readily, think flexibly about numbers, and notice patterns that emerge as one works with numbers. Students who have developed number sense think about numbers holistically rather than as separate digits and can devise and apply procedures to solve problems based on the particular numbers involved. In summary, "number sense reflects a deep understanding of mathematics, but it comes about through a mathematical mindset that is focused on making sense of numbers and quantities" (Boaler, 2016).

Imagine IM Response

Imagine IM intentionally attends to conceptual understanding and fluency, where fluency is understood to mean being able to perform computations appropriate to the grade level with speed, accuracy, and flexibility. Additionally, the attention paid throughout to providing continuous, ample ways to engage in the standards for mathematical practice contributes to students' development of number sense over time.

- The Number Talk instructional routine is used throughout Imagine IM, and these are focused on thinking about numbers and operations flexibly.
- It is very common that whenever students are solving a problem about a context, they are invited to reflect on the meaning of their solution in the context. There are many examples of this, one in activity 7.5.3.2 (Cliffs and Caves), question 3.
- The best place to look to learn more about how Imagine IM develops number sense would be lessons that address the OA, NBT, NF, and NS domains.





Exploring, Discovering, and Reasoning with and about Mathematics

Summary

This framework situates mathematics learning in the context of investigations that allow students to experience mathematics as a set of lenses for understanding, explaining, predicting, and affecting authentic contexts (as defined in Chapter 1). The capacity to use mathematics to understand the world influences every aspect of life, from advocating for just policies in our communities to outlining personal finances to completing everyday tasks like cooking and gardening.

Imagine IM Response

This chapter is a meditation on MP3, MP7, and MP8. Imagine IM attends deliberately to engaging in the standards for mathematical practice.

Imagine IM Examples

Any activity that indicates an opportunity to engage in MP3, MP7, or MP8 is a place where students are building the skills outlined in this chapter.

CHAPTER 5

Data Science

Summary

All California students should graduate from high school with data literacy and have access to options to learn an introduction to data science in their K–12 experience. Data literacy refers to the ability to reason with and about data, to make good decisions based on data, to ask questions of data, and to use statistical reasoning. Data science is an emerging discipline that includes understanding principles of data collection, data manipulation, data analysis, inference, and interpretation and communication.

Imagine IM Response

Guidance for K–5 and 6–8 are well aligned to Imagine IM K–5 and 6–8. The high school statistics standards are addressed in Imagine IM AGA (Algebra 1, Geometry, Algebra 2). We will work toward a more complete alignment with the CA framework recommendations in our development work on IM 9–12 for California.

Imagine IM Examples

Algebra 1, Units 1 and 3. Algebra 2, Unit 7 provides evidence of data literacy opportunities.



Mathematics: Investigating and Connecting, Transitional Kindergarten through Grade Five

Summary

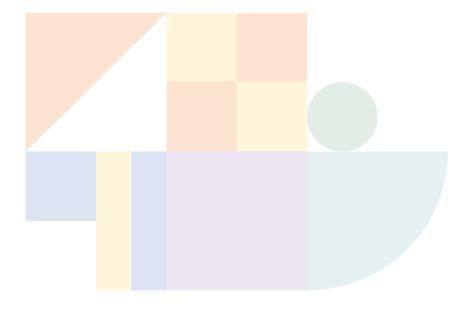
To achieve this in transitional kindergarten (TK) through grade five, students must experience rich mathematical investigations that offer frequent opportunities for students to engage with one another in connecting big ideas in mathematics. Frequent opportunities for mathematical discourse, like implementing math talks, create a climate for mathematical investigations that promote understanding (Sfard, 2007), language for communicating (Moschkovich, 1999) about mathematics, and mathematical identities (Langer-Osuna & Esmonde, 2017).

Imagine IM Response

Imagine IM at K–5 was designed to meet the shifts demanded by the Common Core State Standards for focus, coherence, and rigor, with at least 65% of instructional time spent on Major Work of the Grade as outlined in the Achieve Core's *Publishers' Criteria*.

A problem with using "rich mathematical investigations" as a cornerstone of math instruction is that without an instructional model, teachers/coaches/math leaders struggle with how to identify appropriate tasks that lead to grade-level work and with how to implement these investigations. Imagine IM offers a solution to both issues. Teachers and coaches don't need to spend hours creating or searching for tasks — they are built into the curriculum materials with guidance for planning and implementation and including instructional routines for increasing access for all learners.

- Activities that promote engaging in Mathematical Practice 3 (MP3) are found throughout Imagine IM and are clearly marked.
- A Number Talk is an instructional routine that is used regularly.
- Unit 1 in each grade level includes activities specifically focused on building a mathematical community.





Mathematics: Investigating and Connecting, Grades Six through Eight

Summary

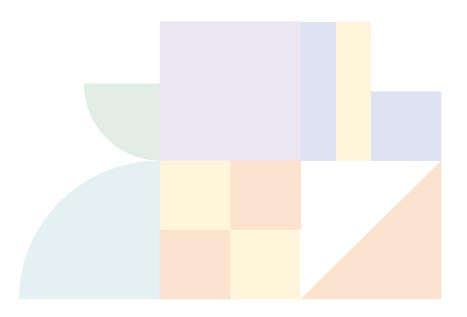
As is made clear throughout the framework, it is crucial in these grades to situate mathematics learning in situations that inspire authentic questions for students and increase the meaningfulness of mathematics in their lives. To facilitate students' curiosity and positive disposition toward mathematics, teachers must look to provide an active learning environment filled with wonder and recognition of connections among the various topics, an environment that affirms for students that their learning is part of the magnificent and coherent body of mathematical understanding. Instruction should provide evidence that students' thoughts in and about mathematics matter; in every hard-won realization, subtle and creative explanation, deeper connection, or complex idea they produce, they convey their understanding as developing mathematicians.

Imagine IM Response

IM 6–8 Math was designed to meet the shifts demanded by the Common Core State Standards for focus, coherence, and rigor, with at least 65% of instructional time spent on Major Work of the Grade as outlined in the Achieve Core's *Publishers' Criteria*. The problem-based instructional model and the embedded instructional routines position teachers to achieve the goals of this chapter in middle school mathematics.

Imagine IM Examples

Refer to the Teacher Course Guide for each grade level. See "Design Principles," "What is a Problem-based Curriculum?," "A Typical IM Lesson," and "How to Use the Materials."





Mathematics: Investigating and Connecting, High School

Summary

This framework draws on many sources that reflect the current state of high-school mathematics and research about effective practices. These include NCTM's Catalyzing Change in High School Mathematics: Initiating Critical Conversations (NCTM, 2018), and Just Equations' report on designing high school mathematics for equity, Branching Out: Designing High School Math Pathways for Equity (Daro & Asturias 2019). NCTM (2018) advances four key recommendations with regard to effecting needed change at the high school level: Each and every student should learn the Essential Concepts (a focused set of 41 concepts for high school) in order to expand professional opportunities, understand and critique the world, and experience the joy, wonder, and beauty of mathematics.

Imagine IM Response

Imagine IM 9–12 Math was designed to meet the shifts demanded by the Common Core State Standards for focus, coherence, and rigor, with at least 65% of instructional time spent on Widely Applicable Prerequisites as outlined in the Achieve the Core's Publisher's Criteria. We will work toward a more complete alignment with the CA framework recommendations in our development work on IM 9–12 for California.





Structuring School Experiences for Equity and Engagement

Summary

Mathematics learning should be a deep, conceptual process where students are provided ample time to engage with new ideas and make connections across concepts. With this in mind, approaches that focus on speed or memorization as measures of student achievement and course placement should be replaced with approaches that center deep learning, increased fluidity, and opportunities for upward mobility such that all students have access to more complex math courses. This can be accomplished in a variety of ways. Per the framework, schools should consider replacing archaic tracking practices with adaptive teaching and flexible grouping while offering ambitious mathematics curricula that have been found to benefit students from all backgrounds. Districts might also offer academic support courses, diverge from traditional course scheduling (to include block scheduling, for example), and encourage multidimensional teaching methods that focus on big ideas and connections through open tasks that can be approached by students in different ways. Ultimately, regardless of course structures and student grouping, research has demonstrated that curricula centered around fewer, deeper, and longer tasks have shown to increase understanding for all, including high achievers (Nasir et al., 2014; Boaler and Staples, 2008).

Imagine IM Response

The chapter concludes by saying "textbooks that share deep mathematics tasks that can be worked on across a sequence of multi-day investigations are appropriate" (lines 437-439). Imagine IM is structured to provide deeper, more meaningful opportunities to engage with grade-level mathematics, with more complicated math concepts being developed over several lessons. Students engage with these activities through mathematical discourse in small groups and whole groups while teachers implement the 5 Practices for Orchestrating Mathematical Discussions, guiding them toward deep conceptual understanding — emphasizing foundation building and student reasoning over speed to the solution. In addition, Imagine IM provides opportunities for students to flexibly engage with grade-level materials while maintaining access to higher level courses in the future.

- Multiplication is introduced over the course of two units: Grade 3, Units 1 and 2.
- Fraction division is taught over a series of lessons in Grade 6, Unit 4.
- The Algebra 1 extra support course exists for students who, for many possible reasons, need more support than it is possible to provide in their Algebra 1 course.
- Block schedule guidance and suggested lessons for block schedules are provided for Grade 6 through Algebra 2.
- Inspire Math Video integration activities (K-8) are extensions to the course material and offer opportunities for students to make connections across course content and real-world situations.
- Family Support videos (K–5) provide opportunities for students to engage with mathematical concepts outside of the classroom environment, increasing the

- time they are engaged with new ideas, and allowing them to make authentic connections between the mathematics content and their lives.
- "Are You Ready for More?" questions go deeper into grade-level mathematics and often make connections between the topic at hand and other concepts. Some of these problems extend the work of the associated activity, but some of them involve work from prior grades, prior units in the course, or reflect work that is related to the K-12 curriculum but a type of problem not required by the standards. They are not routine or procedural, and they are not just "the same thing again but with harder numbers." They are intended to be used on an opt-in basis by students if they finish the main class activity early or want to do more mathematics on their own. It is not expected that an entire class engages in "Are You Ready for More?" problems, and it is not expected that any student works on all of them.



Supporting Equitable and Engaging Mathematics Instruction

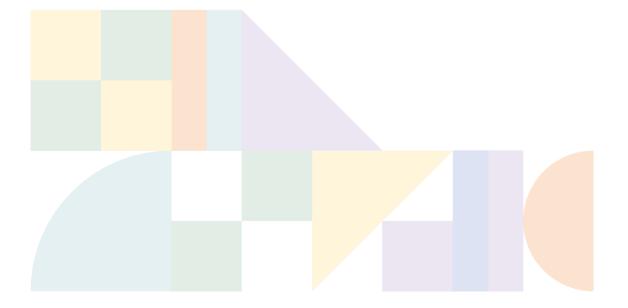
Summary

The vision is for teachers and other educational stakeholders to engage in a learning community that has the same characteristics — respect, commitment, intellectual engagement, and motivation toward continuous improvement — that all educators hope to create for students in California classrooms. To be effective, the learning community must operate in an environment of collaboration and trust among teachers and school leaders, each of whom recognizes that improvement requires time, resources, continuous support, and an appreciation of risk-taking as new instructional approaches are implemented. An environment that realizes these improvement efforts in mathematics teaching and learning should focus on the sustainability of the instructional practices and education programs — and the sustainability of the professional learning cycle itself — by fostering a collaborative school culture that engages educators, administrators, students, parents, guardians, families, education professionals, and community members (Fixsen & Blase, 2009).

Imagine IM Response

This chapter is mainly about teacher professional learning. IM was built to be an educative curriculum — that is, planning and using the materials as intended helps teachers to learn and grow in their mathematical knowledge for teaching and capacity to orchestrate discussions and build mathematical community. Imagine IM includes a feature called Teacher Reflection Questions for each lesson or section that provides individual teachers, coaches, and teachers working in professional learning communities concrete ways to reflect on their practice for equity and efficacy.

- Teacher Reflection Questions in every lesson in Imagine IM K-5.
- For 6–12 grades, Teacher Reflection Questions for each section of lessons centered around math content and student thinking, pedagogy, or access and equity.
- Lesson narratives and activity narratives to help build teacher capacity.
- IM-certified professional learning experiences are tightly aligned to implementing the curriculum.





Technology and Distance Learning in the Teaching of Mathematics

Summary

Principle 1: Strategic Use of Technology in a Learning Environment Can Facilitate Powerful Learning of Mathematics. Principle 2: Support for Teachers of Mathematics Accompanies Use of Learning Technologies. Principle 3: Learning Technologies Are Accessible for All Students. Technology plays a vital role in facilitating meaningful learning of mathematics within a distance-learning format. It is important to develop structures that continue to place students at the center of learning, while also being mindful of the varied contexts of at-home supports.

Imagine IM Response

Imagine IM has been thoughtful in the development of its Distance and Unfinished Learning materials. These beliefs include giving every student access to grade-level mathematics, engaging students and attending to their social-emotional learning, and giving students opportunities to synthesize and consolidate their learning.

Imagine Learning Classroom has embedded the Imagine IM Distance and Unfinished Learning resources within the platform at point-of-use for ease of planning and optimal implementation.

- Imagine IM supports teachers in the shift to distance or hybrid learning with guidance and tools that:
- Prioritize time and find ways of doing grade-level mathematics
- Use synchronous time strategically
- Design for access and equity
- Attend to clarity in directions and anticipate potential confusion and barriers
- Adjust pacing expectations
- Consider age-appropriateness

Imagine Learning Classroom offers features and functionality that align with distance learning best practices. Teachers can:

- Adapt and personalize lessons
- Use presentation view during synchronous learning time
- Assign lessons for the whole class, small group, and individual instruction during synchronous or asynchronous learning time
- Incorporate digital practice sets during synchronous or asynchronous learning time

Students can use a variety of methods to show and submit work during asynchronous learning time including upload audio, photos, and more.



The following resources are included to support distance and unfinished learning.

Adaptation Packs

Unit adaptation packs give teachers guidance about addressing unfinished learning from the previous grade or course. These prescribe lessons to add, remove, or modify.

Cool-down Support Guidance

Cool-down supports address newly discovered unfinished learning and identify opportunities to revisit content in future lessons, without stopping to re-teach a concept.

Section Planning Guides

Section planning guides give teachers guidance on optimizing Imagine IM lessons in a virtual learning model. They provide tips on distance learning modifications needed to support each lesson or activity.

Lesson Summary Videos

Lesson summary videos offer a video version of the summaries that appear in the curriculum. The videos provide scaffolds to keep students on track with learning goals during independent work time.

Imagine IM at K–5 includes a number of features to facilitate learning in a digital environment, for remote instruction, or for alleviating some of the burdens of maintaining physical manipulatives. Activities that make use of a physical manipulative tool (for example connecting cubes, 5-frames and 10-frames, pattern blocks) have an associated digital manipulative for students and teachers to use in the platform.

Imagine IM at 6–12 empowers 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.

Imagine IM at 6–8 Math includes over 200 custom digital applets 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. In Imagine IM at 9–12, 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 are not always told when to use them, and student choice in the problem-solving approach is valued.



Assessment in the 21st Century

Summary

There are two general types of assessment, formative and summative. Formative assessment, commonly referred to as assessment for learning, has the goal of providing in-process information to teachers, and students, with regard to learning. Formative assessment is a process teachers and students use during instruction that provides feedback to adjust ongoing teaching moves and learning tactics. It is not a tool, an event, or a bank of test items or performance tasks. Summative assessment, commonly referred to as assessment of learning, has the goal of collecting information on a student's achievement after learning has occurred. Summative assessment measures include classroom, interim or benchmark assessments, and large-scale summative measures, such as the CAASPP or SAT. Summative assessments help determine whether students have attained a certain level of competence after a more or less extended period of instruction and learning, such as the end of a unit that may last several weeks, the end of a quarter, or annually (National Research Council [NRC] 2001).

Imagine IM Response

Imagine IM offers opportunities for both formative and summative assessment that empower teachers to measure student understanding and progress against learning goals. Students also have tools that promote ownership and accountability for learning.

The Imagine IM instructional design offers regular, embedded options for monitoring student progress and providing constructive feedback.

Each unit begins with a Check Your Readiness diagnostic assessment of concepts and skills that are prerequisite to the unit (Grades 6–12). Teachers can use these to identify students with below-grade needs or topics to address during the unit. The teaching notes include guidance to inform instructional needs. Grades K–5 offer section-level check points.

Student-facing learning goals appear at the beginning of each lesson and invite students into the work of that day.

Each instructional task is accompanied by commentary with expected student responses and potential misconceptions so that teachers can adjust their instruction. There are also monitoring templates to support approaches to the instructional routines or student progress toward section goals.

Each lesson includes a cool-down (similar to an exit ticket) to assess whether students understood the

work of that day's lesson. Teachers may use this as a formative assessment to provide feedback or to plan further instruction.

Each unit includes an end-of-unit written and digital assessment intended for students to complete individually to assess what they have learned at the conclusion of the unit.

Digital assessments allow students to access, record, and submit their questions and answers for a variety of technology- enhanced item types including multiple choice, multiple select, drag-and-drop, cloze, graphing, labeling, constructed response, short essay, and drawing types. These summative assessments feature a blend of automatically scored items and items that are manually reviewed and include an item summary with item types, scoring guidance, and notes. In longer units, a mid-unit assessment is also available. This assessment has the same form and structure as an end-of-unit assessment.

All summative assessment problems include a complete solution and standard alignment. Multiple choice and multiple response problems often include a reason for potential errors.

Imagine IM Examples

See the Teacher Course Guides at all grade levels.



Instructional Materials to Support Equitable and Engaging Learning of the California Common Core State Standards for Mathematics

Summary

Instructional materials for mathematics in California should place a strong emphasis on students' engagement in mathematics in the ways described in the CA CCSSM (or the Standards). Built upon underlying and updated principles of focus, coherence, and rigor, the Standards hold the promise of enabling all California students to become powerful users of mathematics in order to better understand and positively impact the world — in their careers, college, and civic life. This promise is best realized when students are actively engaged in questioning, struggling, problem- solving, reasoning, communicating, and explaining.

Imagine IM Response

Imagine IM was designed to address the shifts in the CCSSM for focus, coherence, and rigor, with as much attention paid to addressing the standards for mathematical practice as the content standards. The problem-based design positions teachers well to engage their students in questioning, struggling, problem-solving, reasoning, communicating, and explaining.

IM is based on best practices outlined in the NRC's How People Learn and NCTM's Principles to Actions, as well as adherence to Achieve's *Publishers' Criteria*, and has been reviewed by experts from EdReports, who agree that Imagine IM meets the targets of those best practices.

EdReports focused on the following components:

- Focus and Coherence
- Rigor and Mathematical Practices
- Instructional Supports and Usability

EdReports first reviews for content coherence and the appropriate focus on the major work of the grade. Imagine IM is designed to align tightly to the standards and was reviewed as "green" on that gateway.

Next, they evaluated the materials for rigor and the balance of conceptual understanding, procedural fluency, and application, as well as opportunities for students to engage in the mathematical practices. Using research sources such as How People Learn Math, Imagine IM was designed as a problem-based curriculum with explicit support for teachers to synthesize student learning and attend to the most important goals. The reviewers found that the program successfully balanced all aspects of rigor, providing students opportunities to engage deeply in the practices.

Finally, they looked for sufficient support for teachers and students to use and learn from the curriculum. Teachers were involved in the design, review, and authoring of the Imagine IM curriculum. The reviewers found that Imagine IM successfully provided differentiation, support for teachers to plan effectively, integration of technology, and accessible materials.

Being "green" on all these aspects indicates that Imagine IM has the pieces that make a curriculum likely to succeed. This allows states whose ESSA requirements state that Title I curricula must be proven effective to adopt. Imagine IM is shown to be based on already proven best practices.



