



# AGA

**Algebra 1****Geometry****Algebra 2****by Matthew R. Larson, Ph.D.***K–12 Curriculum Specialist for Mathematics  
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DEVELOPMENT**

## Principles of Effective Mathematics Programs

### The Curriculum

The power of the curriculum to affect how much students learn in mathematics is well established (Marzano, 2003; Schmoker, 2011). The National Council of Teachers of Mathematics (2014, p. 70) has argued that “an excellent mathematics program includes curriculum that develops important mathematics along coherent learning progressions.”

That is precisely how we designed HMH AGA. The program’s scope and sequence incorporate the latest research on learning progressions. The curriculum makes connections between and among various mathematical topics, and it is coherent, focused, and rigorous.

The coherence and focus of the HMH AGA curriculum ensure that students learn the important mathematics in each course at a deep level while simultaneously connecting what they learn to the bigger ideas of mathematics. The rigor of the HMH AGA curriculum means that an appropriate proportion of the tasks students work on to develop their understanding as well as their proficiency require complex thought and reasoning.

### Research-Informed Instructional Practices

A coherent, focused, and rigorous curriculum is only one component of a mathematics program that helps ensure the success of all students. The second critical component is an instructional approach based on research-informed instructional practices. The overarching message in NCTM’s publication *Principles to Actions: Ensuring Mathematical Success for All* is that “effective teaching is the nonnegotiable core that ensures all students learn mathematics at high levels” (NCTM, 2014, p. 4). NCTM offers eight research-informed instructional strategies to support effective teaching and learning of mathematics. HMH AGA embeds those eight instructional strategies in the curriculum as shown in the table on the following pages.

# Principles of Effective Mathematics Programs

Instructional Strategies	Support for Strategies in HMH AGA
<b>Establish mathematics goals to focus learning.</b> Effective teaching of mathematics establishes clear goals for the mathematics that students are learning, situates goals within learning progressions, and uses the goals to guide instructional decisions (NCTM, 2014, p. 12).	Every lesson in HMH AGA has an Essential Question that serves as the goal for the lesson. Moreover, the program's scope and sequence have been built around learning progressions and the big ideas of mathematics.
<b>Implement tasks that promote reasoning and problem solving.</b> Effective teaching of mathematics engages students in solving and discussing tasks that promote mathematical reasoning and problem solving and allow multiple entry points and varied solution strategies (NCTM, 2014, p. 17).	Every lesson in HMH AGA includes Focus on Higher-Order Thinking (H.O.T.) problems that engage students in justifying and critiquing reasoning, analyzing relationships, explaining errors, and so on. Every lesson concludes with a Performance Task that challenges students to solve a complex problem.
<b>Use and connect mathematical representations.</b> Effective teaching of mathematics engages students in making connections among mathematical representations to deepen understanding of mathematics concepts and procedures and as tools for problem solving (NCTM, 2014, p. 24).	HMH AGA uses verbal descriptions, mathematical symbolism, tables, and graphs/drawings to teach concepts. For instance, when students learn to graph a family of functions, they examine the effects of parameters in the functions' equations by making tables of values, drawing graphs, and describing the graphs in terms of transformations of the parent function's graph.
<b>Facilitate meaningful mathematical discourse.</b> Effective teaching of mathematics facilitates discourse among students to build shared understanding of mathematical ideas by analyzing and comparing student approaches and arguments (NCTM, 2014, p. 29).	Every lesson in HMH AGA includes Reflect questions and Elaborate questions that elicit students' understanding of the lesson concepts. Reflect questions with the inline head "Discussion" are particularly well-suited for having students share and compare their reasoning.
<b>Pose purposeful questions.</b> Effective teaching of mathematics uses purposeful questions to assess and advance students' reasoning and sense making about important mathematical ideas and relationships (NCTM, 2014, p. 35).	The Teacher Editions for HMH AGA include Questioning Strategies that you can use to generate mathematical discourse, determine what students currently know, and advance their learning
<b>Build procedural fluency from conceptual understanding.</b> Effective teaching of mathematics builds fluency with procedures on a foundation of conceptual understanding so that students, over time, become skillful in using procedures flexibly as they solve contextual and mathematical problems (NCTM, 2014, p. 42).	Every lesson in HMH AGA begins with one or more Explores that allow students to develop their understanding of the lesson's concepts through investigation and discussion. The Explores are followed by Explains that teach the procedures based on the concepts. One of the Explains, typically the last one in a lesson, addresses how the concepts and procedures can be used to solve real-world and mathematical problems.

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<b>Support productive struggle in learning mathematics.</b> Effective teaching of mathematics consistently provides students, individually and collectively, with opportunities and supports to engage in productive struggle as they grapple with mathematical ideas and relationships (NCTM, 2014, p. 48).	Every lesson in HMH AGA has a “5E” framework: Engage (Essential Question) – Explore – Explain – Elaborate – Evaluate. Students focus on the goal of the lesson in the Engage, develop an understanding of concepts in the Explores, become fluent with procedures and apply concepts in the Explains, communicate their understanding of concepts in the Elaborate, and practice procedures and problem solving in the Evaluate.
<b>Elicit and use evidence of student thinking.</b> Effective teaching of mathematics uses evidence of student thinking to assess progress toward mathematical understanding and to adjust instruction continually in ways that support and extend learning (NCTM, 2014, p. 53).	Every lesson in HMH AGA has Reflect, Your Turn, and Elaborate questions for formative assessment. Every module has Ready to Go On? and Module Assessment Readiness, and every unit has Unit Assessment Readiness, all of which provide summative assessment. Performance Tasks at the lesson, module, and unit levels also provide summative assessment.

## Embedded Professional Development Support

As authors we appreciate that you are being asked to teach more mathematics at deeper levels than ever before. Teaching mathematics effectively is a complex endeavor and it takes time to integrate new instructional strategies into your practice. Toward that end HMH AGA embeds professional development resources into the curriculum. My coauthor Juli Dixon

and I model successful teaching practices and strategies in real classrooms in a series of professional development videos. These videos are an invaluable resource as you work collaboratively with your colleagues to ensure all students successfully attain your state’s standards and grow in your own knowledge of mathematics and highly effective instructional strategies.

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