

Engaging Students in Math Practices

When the most recent mathematical content standards were written, authors recognized the need for changes to instruction in addition to new content standards. Called Practice Standards in the Common Core State Standards (CCSS) and Process Standards in other states, these instructional practices were based on research from National Council of Teachers of Mathematics (NCTM) and the National Research Council's report *Adding It Up*. The NCTM process standards included problem solving, reasoning and proof, communication, representation, and connections. Similarly, *Adding It Up* detailed five strands of mathematical proficiency: adaptive reasoning, strategic competence, conceptual understanding, procedural fluency, and productive disposition. The NCTM process standards and *Adding it Up* strands of mathematical proficiency led to the Standards for Mathematical Practice, which provide guidance for learners at all grade levels. The overarching goal of this course is to familiarize teachers with the Standards for Mathematical Practice in a way that is applicable across all states and to help develop students who are mathematically proficient.

This course provides an in-depth look at the eight mathematics practice standards that are applicable in all classrooms regardless of the content standards in your state. It allows teachers to explore ways to implement each standard in the classroom to ensure that students are given the opportunity to develop these practices in their own lives.

Course Objectives

By the end of this course, you will be able to

Module 1

- Distinguish between the eight mathematical practice standards.
- Compare and contrast the role of the mathematical practice standards and the role of the mathematical content standards.
- Extrapolate changes in instruction required to implement the mathematical practice standards.

Module 2

- Explain the major components of Mathematical Practice Standard 2 (MP2): reason abstractly and quantitatively; and Mathematical Practice Standard 3 (MP3): construct viable arguments and critique the reasoning of others.
- Evaluate a specific mathematical learning context and provide evidence of how MP2 and MP3 are applied or not applied in the situation.
- Hypothesize and reflect on why proficiency in mathematics requires students to be able to reason abstractly and quantitatively and to be able to construct viable arguments and critique the reasoning of others.

Module 3

- Extrapolate the meaning of Mathematical Practice 4 (MP4): model with mathematics; and Mathematical Practice 5 (MP5): use appropriate tools strategically.
- Design lesson plans that use appropriate tools strategically.
- Generate specific examples of mathematical modeling at the appropriate grade level.

Module 4

- Explain the components Mathematical Practice 7 (MP7): look for and express regularity in repeated reasoning; and Mathematical Practice 8 (MP8): look for and make use of structure in mathematics.
- Generate specific examples of and strategies for generalizing and seeing structure in mathematics.
- Generate specific examples of and strategies for looking for and making use of structure in mathematics.

Module 5

- Explain the components of MP1: make sense of problems and persevere in solving them; and Mathematical Practice 6 (MP6): attend to precision.
- Generate specific examples and strategies for ensuring students make sense of problems and persevere in solving them.

- Generate specific examples of and strategies for ensuring students attend to precision in mathematics.

Module 6

- Generate specific examples where more than two practice standards intersect in preparing proficient mathematics learners.
- Implement strategies from this course in your own classroom.

Course Syllabus

<p>Module 1</p>	<p>Introduction to the Mathematics Practice Standards</p> <ul style="list-style-type: none"> • Module Welcome • Video 1: The Common Core Mathematics Classroom • Reading 1: What Are the Standards for Mathematical Practice? • Reading 2: ASCD Express—Content and Practice Standards Define New Roles in Math Classrooms • Video 2: The Importance of Mathematical Practices • Knowledge Check • Application: Mathematics Practice Standards Lesson Plan • Post-Module Reflection
<p>Module 2</p>	<p>Reasoning and Explaining</p> <ul style="list-style-type: none"> • Module Welcome • Reading 1: Higher-Order Thinking Is for Everyone • Video 1: Mathematical Practice #2 • Video 2: Mathematical Practice #3 • Reading 2: <i>EL</i>—Go Figure: Math and the Common Core • Knowledge Check • Application: Critique Reasoning and Explaining • Post-Module Reflection

<p>Module 3</p>	<p>Using Tools and Modeling</p> <ul style="list-style-type: none"> • Module Welcome • Reading 1: Use of Tools in the Context of Mathematical Modeling • Video 1: Mathematical Practice #4 • Video 2: Mathematical Practice #5 • Reading 2: A Dutch Primer: Calculators for Enrichment in the Early Years • Knowledge Check • Application: Using Tools and Modeling • Post-Module Reflection
<p>Module 4</p>	<p>Generalizing and Seeing Structure</p> <ul style="list-style-type: none"> • Module Welcome • Reading 1: Patterns, Patterns, Patterns • Video 1: Mathematical Practice #7 • Video 2: Mathematical Practice #8 • Reading 2: <i>EL</i>—From Arithmetic to Algebra • Knowledge Check • Application: Implementing Structure and Generalizations • Post-Module Reflection
<p>Module 5</p>	<p>Developing Habits of Mind</p> <ul style="list-style-type: none"> • Module Welcome • Reading 1: Problem Solving: The Essence of it All • Video 1: Mathematical Practice #1 • Video 2: Mathematical Practice #6 • Reading 2: <i>EL</i>—Problem-Solving Time • Knowledge Check • Application: Promoting Problem Solving • Post-Module Reflection

Module 6	Making the Practice Standards Intentional <ul style="list-style-type: none">• Module Welcome• Video: Mathematical Practices, Focus, and Coherence in the Classroom• Reading 1: Implementing Math Practices into Instruction• Reading 2: <i>EL</i>—Instigating Thinking in Math Class• Knowledge Check• Application: Implementing Multiple Mathematics Practice Standards• Post-Module Reflection
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Resources

Module 1

Smith, N. (2012). Content and Practice Standards Define New Roles in Math Classrooms. *ASCD Express*, 7(21).

The Hunt Institute. (2011, August 19). *The Importance of Mathematical Practices*. Retrieved December 19, 2013, from YouTube: <https://www.youtube.com/watch?v=m1rxkW8ucAI&feature=youtu.be>

Thompson, J. (2012, June 28). *The Common Core Mathematics Classroom*. Retrieved December 19, 2013, from YouTube: http://www.youtube.com/watch?v=7E-EGbB3N_0

Module 2

Big Ideas Learning (2011, November). *Mathematical Practice #2*. Retrieved December 19, 2013, from YouTube: <http://www.youtube.com/watch?v=sp8r5hlGFsQ>

Big Ideas Learning (2011, November). *Mathematical Practice #3*. Retrieved December 19, 2013, from YouTube: <http://www.youtube.com/watch?v=4Brp578YJrw>

Burns, M. (December 2012/January 2013). Go figure: Math and the common core. *Educational Leadership*, 70(4), 42–46. Retrieved from <http://www.ascd.org/publications/educational-leadership/dec12/vol70/num04/Go-Figure@-Math-and-the-Common-Core.aspx>

Module 3

Big Ideas Learning (2011, November). *Mathematical Practice #4*. Retrieved December 19, 2013, from YouTube: <http://www.youtube.com/watch?v=lnTG8Bdq-ac>

Big Ideas Learning (2011, November). *Mathematical Practice #5*. Retrieved December 19, 2013, from YouTube: <http://www.youtube.com/watch?v=Skocybk5zUg>

van den Brink, J. (2004). A Dutch primer: Calculators for enrichment in the early years.

Curriculum•Technology Quarterly, 13(3). Retrieved from <http://www.ascd.org/publications/ctq/spring2004/A-Dutch-Primer.aspx>

Module 4

Big Ideas Learning (2011, November). *Mathematical Practice #7*. Retrieved December 19, 2013, from YouTube: http://www.youtube.com/watch?v=iZTu_hSjF0g

Big Ideas Learning (2011, November). *Mathematical Practice #8*. Retrieved December 19, 2013, from YouTube: <http://www.youtube.com/watch?v=nDdYEBPZJSI>

Ketterlin-Geller, L. R., Jungjohann, K., Chard, D.J., & Baker, S. (2007). From arithmetic to algebra. *Educational Leadership*, 65(3), 66–71.

Module 5

Big Ideas Learning (2011, November). *Mathematical Practice #1*. Retrieved December 19, 2013, from YouTube: http://www.youtube.com/watch?v=A59NM4gK5rs&list=PLkCODEjk2FRH25fQhq_Wfsk-cKSB5OZVQ&index=1

Big Ideas Learning (2011, November). *Mathematical Practice #6*. Retrieved December 19, 2013, from YouTube: <http://www.youtube.com/watch?v=LITEv64v7vw>

Gurule, K. (2007). Problem-solving time. *Educational Leadership*, 65(3). Retrieved from http://www.ascd.org/publications/educational_leadership/nov07/vol65/num03/Problem-Solving_Time.aspx

Module 6

Hiltabidel, J. (December 2012/January 2013). Instigating thinking in math class. *Educational Leadership*, 70(4). Retrieved from <http://www.ascd.org/publications/educational-leadership/dec12/vol70/num04/Instigating-Thinking-in-Math-Class.aspx>

NCTM (2013, January). *Mathematical Practices, Focus and Coherence in the Classroom*. Retrieved December 19, 2013, from YouTube: <http://www.youtube.com/watch?v=X1GwdACHdtY>