

Adapting Mathematics Instructional Materials to Align with College- and Career-Ready Standards: A Case Study

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Working Team:

This project was a collaboration between Student Achievement Partners and Illustrative Mathematics. The team members responsible for the creation and facilitation of the sessions were:

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Background and Pilot Design

“This project resulted in teachers altering their thinking about how to align materials to the Standards. They all developed a better understanding of the math which led, most importantly, to teachers becoming better teachers.” – Director of Math Achievement, The Partnership Schools

“We saw from the beginning that teachers learned a lot about the progressions in the Standards and the Standards for Mathematical Practice. What we saw by the end of the pilot is that teachers were able to make better decisions about their instructional materials. The questions they were asking themselves and each other during planning changed significantly.” – Math Coordinator, Explore Schools

Why

Districts across the country are working to implement rigorous college- and career-ready standards, but their existing instructional materials do not adequately reflect the changes needed in practice.¹ Existing materials, even those that claim to have been revised to align with more rigorous college- and career-ready standards like the Common Core State Standards (CCSS), have significant gaps and areas of misalignment. The deficiencies in the materials make it difficult if not impossible for teachers to adequately prepare their students to meet expectations at each grade level.

We know that instructional materials matter a great deal in teacher effectiveness.² Nonetheless, many districts are using materials they have identified as insufficient until purchasing cycles line up with the broader availability of better-aligned materials.³ The result: far too many teachers are in classrooms with instructional materials they know to be inadequate, with very few supports in place to help them adapt or supplement that material.

This project has focused on building and piloting models that can increase teacher and district capacity to adapt instructional materials with the intent of improving their alignment to the expectations of college- and career-ready standards. A team from Illustrative Mathematics worked with two pilot districts in order to develop teachers’ content knowledge so they could adapt, build, and pilot test materials, with the end goal of creating a widely shareable process that can be used by teachers and districts across the country.

1. Rachel Leifer and Denis Udall, “Support the Common Core with the Right Instructional Materials,” *Phi Delta Kappan* 96, no. 1 (September 2014): 21–27.

2. Chingos and Whitehurst, “Choosing Blindly: Instructional Materials, Teacher Effectiveness and the Common Core,” Brown Center on Education Policy at Brookings, (April 10, 2012), <http://www.brookings.edu/research/reports/2012/04/10-curriculum-chingos-whitehurst>.

3. For more on this conundrum, see report by Pace and Stanford University researchers Milbrey McLaughlin, Laura Glaab and Isabel Hilliger Carrasco, *Implementing Common Core State Standards in California: A Report from the Field*, which articulates the difficulties of educators in California who took action when they realized their current materials and curricula needed improvements to align with rigorous standards.

Who

The pilot was conducted with two networks of schools in New York City.

Explore Schools (“Explore”) is a network of four K–8 charter schools in Central Brooklyn. The schools serve approximately 1,800 students. Approximately 17% of students receive special education services, 3.8% are English Language Learners, and 79.2% receive free and reduced lunch. The team at Explore Schools consisted of teachers and math coaches that represented each of the schools in grades 3–5.

The Partnership Schools is a network of six K–8 Catholic schools in the Bronx and Harlem. The schools serve approximately 2,000 students, 80% of whom receive free or reduced lunch. Of the student population, 38% are English Language Learners and 10% receive special education services. The team at the Partnership Schools consisted of the teachers and learning specialists from grades 3–5, as well as the district-level math specialist.

Both networks were selected for the mathematics pilot because they a) use a commercially available elementary program (*Investigations*⁴, published by Pearson, at Explore Schools and *Math in Focus*⁵, published by Marshall Cavendish, at the Partnership Schools), b) had identified gaps in the programs and had the capacity and interest to take on a project to adapt them, and c) expected at the outset of the project to continue to use the current materials for at least one more school year.

What

A team from Illustrative Mathematics worked directly with teachers, coaches, and district math specialists to develop teacher content knowledge of the fraction progressions and develop their ability to review and adapt a single unit in their instructional materials to meet the criteria for alignment to the CCSS.

When

The pilot project spanned February 2015–October 2015:

Training Dates	Session Topic	Focus
February 2015	Learning Walks and Teacher Interviews	<ul style="list-style-type: none"> • Understand how teachers are currently using the instructional materials • Understand how the districts approach content and planning • Set goals for the project

4. Market Share (2013) – K-2: 13.0%; 3-5: < 3% according to Robert M. Resnick, Ph.D. and Glenn, Sanislo, *The Complete K-12 Report: Market Facts & Segment Analyses 2015* (Rockaway Park, New York: Education Market Research/Simba Information, 2015).
 5 Market Share (2013) – K-2: 5.6%; 3-5: 3.6% ibid

Training Dates	Session Topic	Focus
March 2015	Understanding the Trajectory and Big Ideas of Fractions (2 days)	<ul style="list-style-type: none"> Understand the fraction progression within CCSS Understand the Big Ideas⁶ of fractions and progressions within those ideas
April 2015	Reviewing Materials and Making Adaptations	<ul style="list-style-type: none"> Decide what is misaligned and needs to be eliminated from current materials Find and/or create materials to supplement necessary gaps
May 2015	Feedback and Revision	<ul style="list-style-type: none"> Use the EQuIP student work protocol as a tool to examine tasks and think about their alignment. Understand the Standards for Mathematical Practice, connections to content standards, and what they look like in instructional materials
June 2015	Practicing and Refining the Process	<ul style="list-style-type: none"> Apply the learning about the grade 3–5 fractions progression to make adaptations to current fractions units Apply the process to new topics (Multiplication and Division in grade 3)
October 2015	Finalizing Adapted Units	<ul style="list-style-type: none"> Apply learning from previous sessions to create a unit plan that details how to adapt instruction

Results

As an outcome of this work, many lessons have been learned with regard to the tools and understandings teachers need to be effective at the task of curriculum analysis and adaptation. In order to measure the growth of teacher knowledge, a survey was administered to teachers at the beginning and end of the project. The [survey](#) asked teachers questions about their planning process as well as their mathematical knowledge for teaching. Some questions were adapted from Deborah Ball’s work on the subject.⁷ As the results below show, there was growth in both districts over the course of the project.

6. “Big Ideas” is a term used within Illustrative Mathematics’ Course Blueprints to summarize the most important mathematical ideas of a given unit. “Big Ideas” provide more detail to the content that should be addressed within given clusters or standards.

7. Deborah Loewenberg Ball, Mark Hoover Thames, and Geoffrey Phelps, “Content Knowledge for Teaching: What Makes it Special?” <http://harringtonmath.com/wp-content/uploads/2013/11/Content-knowledge-for-teachers.pdf>.

Teacher Scores on Pre- and Post-Pilot Survey (New York City Networks)		
	Approach to Planning (average score)	Mathematical Knowledge for Teaching (average score)
February 2015	4.03	4.82
June 2015	6.59	5.18
Change	+2.56	+36

The improvement of teachers' scores in their approach to planning allowed them to make better decisions about how to evaluate and adapt the instructional materials they were using. The written responses from teachers below illustrate the shift in their understanding of how to adapt materials.

Teacher responses to survey:

Before the pilot:

4. How do you determine the alignment of a lesson to the Common Core?

It is usually stated in each topic/lesson and the scope & sequence from the Math coach.

After the pilot:

4. How do you determine the alignment of a lesson to the Common Core?

Examine the lesson and compare to common core standards. Include items in the lesson that are in CC standard that are not part of text book lesson.

Often, teachers will find that their instructional materials feature content that distracts from the focus called for by CCSS. By analyzing the materials, teachers can make decisions about what to eliminate as well as places where the approach to content needs to be strengthened in order to meet the full demand of the CCSS. The process and work that the teachers in this pilot did in adapting instructional materials to align with the CCSS have provided insights into a thoughtful, logical, and manageable approach to adaptations work. The pilot resulted in specific templates and resources that can be used by any district across the country to analyze and adapt their current materials:

- Step 1: Understand the Standards
 - [Making Sense of Standards Worksheet](#)
- Step 2: Analyze Instructional Materials
 - [Lesson Analysis Worksheet](#)
 - [Reflection Questions](#)
- Step 3: Make Adaptations
 - [Adaptations Worksheet](#)

Through this process, both districts made adaptations to their instructional plan for teaching fractions. The plans highlight adaptations made to the original materials:

- [Explore Schools' adapted pacing guide for grade 4 fractions](#)
- [The Partnership Schools' adapted pacing guide for grade 3 fractions](#)

Illustrative Math, in conjunction with teachers in the districts, also created two new open license tasks:

- Grade 3: [Comparing Fractions Game](#)
- Grade 4: [Comparing Fractions Using Benchmarks Game](#)

In addition, teachers used a generalized process to think about adapting future units:

- [Summary of Adapting Process](#) (one-page for teacher reference)

This document, and the materials and tools contained within, are a work in progress. It is our hope that teachers in schools and districts will find them a helpful starting point as a resource they can incorporate to adapt materials in their local context.

Necessary Conditions for Adapting Mathematics Instructional Materials

A Culture of Trust

Before starting the process of adapting instructional materials, teachers must have the confidence and assurance that they have support from those in administrative positions in their school or district to feel free to modify and adapt the math instructional materials used at their grade level. Teachers must feel they have the approval and support of the district/school administration when engaging in decision making around curriculum materials. They also must possess the authority to make changes to the materials that they use in their classrooms. Without this support and authority, the adaptations that they make to instructional materials might not bring change to the curriculum actually taught.

Collaborative Teamwork

The work of adapting instructional materials is most effective when done in teacher teams, either by grade level or, preferably, in grade-level bands. When teachers bring their different strengths to a group, the collective wisdom and perspectives promote a collaborative spirit and often yield more thoughtful outcomes. Working in a team can therefore be a much more valuable experience than a single teacher doing this difficult work alone.

Key Understandings Necessary to Engage in Adapting Instructional Materials

There are key understandings that are essential in order to adapt instructional materials that align with the CCSS. Teachers who are engaging in the process of adapting instructional materials need to have opportunities to develop these key understandings:

- The meaning and trajectory of the CCSS Content Standards
- The role of the CCSS Standards for Mathematical Practice and their connection to the content standards
- [The Major Work of each grade](#)⁸
- The grade-level mathematical “Big Ideas”⁹
- Knowledge of their own grade-level instructional materials

Focus on Process Rather Than Product

Each step in this process takes time and focus. The benefit of working through the process is a deeper understanding of the standards, the materials, and ways to adapt and modify thoughtfully and with purpose. The time and focus put into each step builds the understanding and capacity of

8. Not all content in a given grade is emphasized equally in the Standards. Some clusters require greater emphasis than others based on the depth of the ideas, the time that they take to master, and/or their importance to future mathematics or the demands of college and career readiness. These topics that require greater emphasis are designated as Major Work of the grade.

9. As defined by Illustrative Mathematics’ [Unit Blueprints](#)

teachers to make thoughtful, knowledgeable decisions that benefit them and, more importantly, the students they teach.

The Three Steps in Adapting Instructional Materials will be further explained in the next section. They are:

1. **Understand the Standards** including both content standards and standards for mathematical practice.
2. **Analyze the current instructional lesson, task, or sequence** in terms of alignment with the Common Core.
3. **Adapt the instructional materials** to better align to the standards.

Adapting Step 1: Understand the Standards

Developing an understanding of the CCSS and the instructional shifts they require is an essential component in the process of adapting instructional materials. There are many resources that can be used to provide teachers with the information necessary to develop their understanding of the Content Standards and Standards for Mathematical Practice. Some educators may find reading and dissecting the finer details of the CCSS enough to gain insight into what students need to know and be able to do. Others may find more meaning in a close reading of resources geared toward instruction and outcomes.

With this distinction in mind, there are valuable resources available to support understanding of the instructional shifts and the progression of understandings from one grade level to the next required by the CCSS.

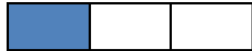
- The Standards require three shifts in instruction: 1) focus, which requires teachers to significantly narrow and deepen the way time and energy is spent in the math classroom; 2) coherence, or the careful connection of topics within and across grades, and 3) rigor, which is the balance of conceptual understanding, application, and procedural fluency. Student Achievement Partners has created two Professional Development modules to help teachers better understand these shifts. Each PD module -- "[Introduction to the Math Shifts](#)" and "[Deep Dive into the Math Shifts](#)" -- includes a facilitator's guide and a PowerPoint presentation.
- The shift towards focus requires that more time and intensity is spent on topics in K-8 that matter most to students' success in Algebra. At each grade level, clusters are designated as comprising the [Major Work of the grade](#).
- The [Progressions Documents for the Common Core Math Standards](#) were developed by the Common Core Writing Team to "note key connections among standards, point out cognitive difficulties and pedagogical solutions, and give more detail on particularly knotty areas of the mathematics."¹⁰
 - Illustrative Mathematics has published further support specific to the fractions progression. [This module](#) has a short video and task examples for seven different units associated with understanding the fractions progression in the standards from a teacher's perspective.
- The [Course Blueprints](#) provide teachers with units and a possible ordering of the school year for each K-8 grade and high school course. While there are many possible orders of the standards that might make sense, the Blueprints provide one example of an order and grouping of standards that comes logically from the Standards themselves. Each unit includes Big Ideas to help teachers better understand the important mathematical ideas of the standards.

10. Common Core Standards Writing Team. (2013, March 1). Progressions for the Common Core State Standards in Mathematics (draft). Front matter, preface, introduction. Grade 8, High School, Functions. Tucson, AZ: Institute for Mathematics and Education, University of Arizona., p.4

- For example in the Grade 3 unit *What Are Fractions?* The Big Ideas are the following:
 - understand fractions as built out of unit fractions
 - compare fractions
 - work with simple examples of fraction equivalence
- The [Coherence Map](#) is an interactive website that illustrates the coherent structure of the Standards in K—8. It is a helpful resource to help teachers understand see the links between concepts within and across grades. It also illustrates how Supporting Work relates to the Major Work of each grade.
- Illustrative Mathematics also provides [highly vetted tasks](#) and lessons that are aligned with the Content Standards at each grade level, and are designed to elicit and promote student engagement in the Standards for Mathematical Practice while also satisfying the three aspects of rigor. It is sometimes most helpful to see illustrations of the standards in the form of tasks. This is an effective approach for a standard that may be confusing or unclear when reading it.
- Illustrative Mathematics has [resources](#) that illustrate the Standards for Mathematical Practice and provide elaborations of each practice. This resource can be helpful as teachers work towards understanding the content standards and Standards for Mathematical Practice.

All or some of these resources can be used to support teachers as they engage in Step 1: Understanding the Standards. The [Making Sense of Standards Worksheet](#) is a template that can be used by teacher teams at a single grade level or when tracing the progression of understanding across grade levels. Once teams have decided which unit or domain will be their focus, they can use the standards within that unit or domain in the framework of the worksheet. The example below shows an excerpt of this worksheet for a grade 3 fractions unit.

Unit Name: **Third Grade Fractions**

Content Standard	Mathematical Example using number or representations	Name of IM Task that aligns with this standard	Rephrase standard in your own words
3.NF.1 Understand a fraction $1/b$ as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by a parts of size $1/b$.	 <p>1 of 3 equal parts is shaded. The part shaded is $\frac{1}{3}$ of the whole.</p>	3.NF. Naming the Whole for a Fraction	$\frac{1}{3}$ is one part of a whole that is divided into three equal parts. Two of those equal parts can be recorded as $\frac{2}{3}$.

This deeper look at the standards is necessary to understand what the standards mean and the big mathematical ideas which will provide the foundation to do the analysis and adaptation in Steps 2 and 3.

Adapting Step 2: Analyze Instructional Materials

Analyzing the instructional materials that are currently being used in a school or district is the next step in the Adapting Instructional Materials Process. Often, teachers will find that their instructional materials feature content that distracts from the focus called for by CCSS. By analyzing the materials, teachers can make decisions about what to eliminate from them as well as places where the approach to content needs to be strengthened. Then, teachers must have an understanding of how well the materials they are using align with the Standards, including whether they are Major or Supporting Work of the grade level, and also how well the Big Ideas are represented in their materials and how the whole unit fits together.

The [Educators Evaluating the Quality of Instructional Products \(EQuIP\) Rubric](#) is a useful resource designed to determine the quality and alignment of lessons and units to the CCSS. For the purposes of the pilot, teachers used a simplified worksheet that allowed them to evaluate materials against the indicators in Dimension I: Alignment to the Depth of the CCSS of the EQuIP rubric. The [Lesson Analysis Worksheet](#) is a slimmed-down document that allows teachers to look at individual lessons in their instructional materials. Teachers identify how well aligned the lessons are to the Big Ideas of the targeted standards, thus identifying how they target the full depth of the standards. Teachers make use of their work identifying the Big Ideas in Step 1 and use them to identify how they may need to eliminate or modify individual lessons. The excerpt below shows this worksheet being used to analyze Math in Focus' chapter on fractions in grade 3.

Unit Name: Understanding Fractions					
Big Idea: Fractions are numbers					
Lesson Analysis					
Lesson that relate to this Big Idea	Standards		Standards Alignment in the Lesson		
	Content	SMP	Yes	Partly	No
Math In Focus 14.1 Understanding Fractions	3.NF.1	coded as MP.4 (doesn't seem correct)		X Lesson has lots of problems with denominators outside of the expectation. No number lines used.	

Once teachers have analyzed the lessons, they can use the [Reflection Questions](#) to help frame their thinking from individual lessons to the bigger picture and provide a way to document this step in the process.

Adapting Step 3: Make Adaptations

When the work in Steps 1 and 2 is complete, the last step in the process is to make adaptations to the instructional materials. In this step there are many options and considerations based on what was discovered in the analysis of the current instructional materials. In the majority of cases, this step will involve elimination of unaligned content to ensure that materials reflect the focus required by the CCSS. Then the next priority is to bolster the materials with specific instruction and student tasks that fully address the expectations of the standards. This process is described in full below.

The step of adapting materials can be done with differing degrees of complexity. The two networks in New York City where the Adapting Instructional Materials project was focused approached their adaptations differently. With this in mind, the [Adaptations worksheet](#) has several sections to encourage teachers to consider different types of adaptations that will ensure that materials are focused, coherent, and have a balance of rigor, as required by the CCSS. However, based on the instructional materials being adapted and the experience and knowledge of teachers, districts may choose to use only specific sections of the worksheet. When beginning this work, a more narrowly focused approach is recommended. If teachers have more experience with adapting materials, a more expansive approach can be considered.

The first section of the worksheet focuses on looking at how materials address the shift of rigor. Because there are so many ways that lessons may be adapted to meet the demands of the Standards for rigor, the worksheet encourages teachers to focus on two specific ways to adapt lessons: routines and representations. These were chosen for the following reasons:

- *Representations*: Mathematical representations are often either not present in their curriculum materials or are not well developed or sufficiently used. By incorporating representations like number lines, open number lines, arrays or open arrays, expressions or equations, pictures or diagrams, or graphs (if grade level applicable), teachers are bringing their math instructional materials into better alignment with the CCSS in order to achieve the full depth of the standards.
- *Routines*: Routines, when used regularly and with thoughtful implementation, raise the level of instruction and student learning as required by the CCSS. The structure of routines allows them to be easily incorporated into different classroom contexts. Teachers can access a list and descriptions of these in [Routines Resources](#).

The excerpt below shows how a lesson in grade 3 may incorporate routines:

Choose a lesson to incorporate additional routines, tasks, or activities that could be added to supplement in areas that are not well covered.

Lesson	New routines, tasks, or activities to incorporate
<p>14.2: Understanding Equivalent Fractions</p>	<p>*Draw a number line on the board with pre-plotting whole</p> <p>Warm-Up: Count Around the Classroom. As a warm up, students will count around the classroom by $\frac{1}{4}$, beginning at 0. As students say each number in the sequence, record the number on the number line. Pause periodically for students to articulate where the fraction should be plotted on the number line and their rationale. This will support student counting skills as well as prepare them for the task as they'll use number lines to compare and find equivalent fractions.</p>

The next section of the worksheet focuses on identifying resources that are necessary to add to or replace current materials in order to ensure students get to the depth of mathematics required by the Standards. In cases where Step 2 revealed content that was not addressed by the materials, teachers may look to Open Educational Resources (OER) to supplement or supplant their current materials. This step includes suggestions for high-quality OER.

The last section of the worksheet has teachers analyze the order of lessons in the adapted unit to ensure that there is a thoughtful and coherent progression of ideas.

Completion of this step can be synthesized by having teachers revise any unit plans or pacing guides provided by the publisher or district. Examples of modified pacing guides can be found [here](#).

Index of Links and Tools

Resources Produced During the Pilot

- [Pre/Post Survey and Rubric](#)
- Adapted Instructional Plans:
 - [Explore Schools](#)
 - [The Partnership Schools](#)
- Grade 3: [Comparing Fractions Game](#)
- Grade 4: [Comparing Fractions Using Benchmarks Game](#)

Materials Used During the Pilot:

- PD Slide Presentations:
 - [Understanding the Trajectory and Big Ideas of Fractions \(2 days\)](#)
 - [Reviewing Materials and Making Adaptations](#)
 - [Feedback and Revision](#)
 - [Practicing and Refining the Process](#)
- Worksheets
 - [Summary of Adapting Process](#)
 - [Making Sense of Standards Worksheet](#)
 - [Lesson Analysis Worksheet](#)
 - [Reflection Questions](#)
 - [Adaptations Worksheet](#)

Additional Resources

- [Routines Resources](#)

General Reference Links:

- Common Core Standards for Mathematics - <http://www.corestandards.org/Math/>
- CCSM progressions - <http://ime.math.arizona.edu/progressions/>
- Illustrative Mathematics - <https://www.illustrativemathematics.org/content-standards>
- Illustrative Mathematics Fractions Progressions - <https://www.illustrativemathematics.org/progressions>
- Illustrative Mathematics - Standards for Mathematical Practice –elaborations <https://www.illustrativemathematics.org/practice-standards>
- Student Achievement Partners' Achieve the Core - <http://achievethecore.org/math>
- Achieve's Educators Evaluating the Quality of Instructional Products (EQIP) rubric - http://www.achieve.org/files/EQIPmathrubric-06-17-13_1.pdf