



Seeing the Future:

How the Common Core Will Affect Mathematics and English Language Arts in Grades 3-12 Across America

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Pascal (Pat) D. Forgiione Jr., Ph.D.
Distinguished Presidential Scholar and Executive Director

Dear Colleague:

Two powerful catalysts have been stimulating major changes in the landscape of education reform over the past five years. First, the Common Core State Standards (Common Core) have been adopted by nearly 90% of the states. Second, the Race to the Top assessment initiative has created an unprecedented opportunity for the state-governed organizations to build “next generation” assessment systems. The Common Core are tougher standards — in some cases much tougher — than existing state standards. So it is widely anticipated within the K-12 community that the initial student “passing rates” in the spring of 2015 — when the new Consortia assessments replace current state No Child Left Behind tests — will drop sharply in most states.

But this fact and the need for the higher academic expectations upon which the assessments are based are not understood more broadly by the public. There is a thirst for information and evidence to evaluate the merits and benefits of these major, yet disruptive, reform initiatives. Many want to understand the value educators see in the Common Core and in the new assessments being developed, and how these are expected to help students in their communities become better prepared for success in college and careers.

This situation is further compounded by the reality that many current school board members, legislators and parent leaders took office after their state adopted the Common Core and joined an assessment consortium. These leaders want to ensure that the investments in professional development, instructional resources, new assessment systems and the technology infrastructure required to deliver them are both important and strategic to their goal of improving student learning.

This publication has been developed to help such leaders and the public evaluate these important questions by exploring how the Common Core and new assessments are expected to impact teaching and learning in America’s classrooms. Fourteen content experts who are working in states from Maine to California, in elementary grades through college, and in mathematics and English Language Arts/Literacy, review sample test items and tasks and discuss their implications for the classroom. These examples are drawn from PARCC, Smarter Balanced and the Illustrative Mathematics Project and illustrate both the central instructional shifts required by the Common Core and the assessment enhancements under development by the Assessment Consortia.

You should be aware that the educators we interviewed as part of this publication are engaged in common standards implementation work in some way and are generally strongly supportive of the Common Core. Thus, their commentary does not represent a balance of perspectives, but rather puts forward the case made by advocates.

This resource highlights the mission of the K-12 Center to drive advances in K-12 measurement and assessment that support improved student achievement. We endeavor to be a trusted source of timely and useful information for K-12 education. We welcome your feedback at mail@k12center.org.

Pascal D. Forgiione, Jr.

Common Core standards bring historic shift in U.S. education

In communities across America, education is changing. In some states, students and parents already are experiencing it, and in all but six others change will be taking effect within the next two years.

This change in 44 states and the District of Columbia has been set in motion by the nation's new Common Core State Standards for Mathematics and English Language Arts and Literacy.¹

The adoption of common standards is a historic shift for American education.

In the past, each state developed its own academic content and performance standards, and the rigor of these expectations varied greatly. A student who had always scored at the highest performance level in one state could move to another and be found to be below grade level expectations.² With the Common Core, most of the nation's schools for the first time will focus on the same core content and will share performance expectations for Grades K-12 in math and English Language Arts. They will also share a common definition of proficiency that will allow them to gauge how well their students are doing compared to others nationwide and compared to the entry requirements for postsecondary education.

Yet key questions remain for many parents, legislators and school officials as communities invest time and resources to reach this goal:

- How will the Common Core change classroom instruction and are those changes truly important to the future success of our students?
- Will new assessments developed for the Common Core do a better job than current ones in measuring the skills and knowledge required for college or careers, especially in high growth fields?
- How can parents and guardians support students as they work toward these new and more challenging expectations?

Why Common Standards?

Before moving into the discussions with educators, let us provide a very brief overview of how and why these new standards were developed, and what states hope to gain by working together on the standards and assessments.

If you are wondering whether new standards and new assessments will lead to significant educational improvement, you are not alone. After all, we went through standards-based reform in the 1990s and states added high-stakes tests and accountability systems in Grades 3-8 and high school in the early 2000s. The result: Academic achievement improved only slightly and students in several other countries have surpassed our students.³



Nancy Doorey

Nancy Doorey is the Director of Programs for the K-12 Center. She has taught at elementary through graduate levels and served on state and local school boards. She also does consulting for a variety of educational reform and policy groups.

Dedication ...

Most of us had the very good fortune to learn from some incredible teachers. They believed in us, encouraged us to dream boldly and accepted nothing but our best efforts. In working on this publication, we were privileged to get to know 14 such educators. Their commitment, knowledge and passion inspired us, as we are sure they will inspire you. To them and to the many like them in America's classrooms, past and present, we want to say Thank You!

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This publication was developed by the K12 Center at ETS with the skillful assistance of the editorial and design team at Hollister Creative.

In 2008, as the United States was sliding into recession, the National Governors Association was working on multiple fronts to help governors improve the economic and social health of their states. Recognizing that “education is a tremendously important lever for ensuring competitiveness and prosperity,” the association partnered with Achieve, Inc. and the Council of Chief State School Officers to study U.S. trends and international best practices.⁴

The joint study group learned from economists that the combination of U.S. outsourcing and automation has dramatically altered the kinds of jobs available to the U.S. labor force and increased the skills required for jobs in which employment is expected to grow. Stronger foundational skills in math and reading are required, as is the ability to “bring facts and relationships to bear in problem-solving, the ability to judge when one problem-solving strategy is not working and another should be tried, and the ability to engage in complex communication with others.”⁵

The group also learned that academically top-performing countries not only have *higher* standards but also have *fewer* standards per grade level (see Figure 1), allowing teachers more time to ensure that students develop deep understanding of the material and can apply their knowledge and skills to solve complex problems.

The group’s report, *Benchmarking for Success: Ensuring U.S. Students Receive a World-Class Education*, contained a five-step action plan to improve state education systems and ensure that students graduate from high school with the skills required by colleges and employers. The first of those five steps reads:

Upgrade state standards by adopting a common core of internationally benchmarked standards in math and English Language Arts for grades K-12 to ensure that students are equipped with the necessary knowledge and skills to be globally competitive.

In response, 49 states signed on to the Common Core State Standards Initiative (CCSSI). They agreed to build upon the best work of states to date and work collaboratively to develop a shared set of core standards in English Language Arts and mathematics. The CCSSI called for standards “reflecting the knowledge and skills that our young people need for success in college and careers” and providing “a consistent, clear understanding of what students are expected to learn, so teachers and parents know what they need to do to help them.”⁶

The three guiding principles⁷ were:

1. *Create a coherent staircase, from K through 12, culminating in the skills and knowledge required to be successful in entry-level courses in college or vocational certification programs.*

2. *Ensure that evidence supports that the skills/knowledge included are prerequisites to postsecondary readiness; and*
3. *Ensure that, at each grade level, the standards are few enough in number to ensure that teachers have time to teach and students to practice and develop deep understanding.*

After broad review and several rounds of revision, the new standards were released in June of 2010. Since that time, they have been adopted by states serving nearly 90% of the public school students in the nation.

In response to a request from the states participating in the development of the Common Core, the U.S. Department of Education created a competitive grant program for consortia of states seeking to develop next generation state assessments that not only test whether students have gained the knowledge and skills to meet new standards, but also return useful results promptly to teachers, students and parents. In response, 44 states and the District of Columbia coalesced into two assessment consortia.⁸ The goal of each consortium is to develop a set of assessments and support resources that all its member states will use, rather than each state developing its own assessments, as they do now.

Why Multi-State Assessment Consortia?

Budget constraints made worse by the recession have widened the gap between the skills assessed by states in their annual testing programs and the skills needed for postsecondary success. Over the last decade, many states dropped their writing assessments and reduced the number of complex, open-ended math and reading problems in order to reduce costs. Despite that, top students tend to move on to postsecondary education without a problem. But startling numbers of students who earn high school diplomas and go on to colleges and universities are told upon entry that they are unprepared to take college-level courses for credit. More than 44 percent of students entering two-year public colleges and nearly 27 percent of those entering four-year public universities must start out by taking remedial courses for which they don’t earn credits.⁹

The U.S. Department of Education recognized the need for new assessments and allocated \$350 million from the 2010 federal stimulus package for competitive grants for the development of a new generation of assessment systems. To drive economies of scale and ensure greater consistency in academic expectations across states, the grant required that a) applicants be consortia of 15 or more states, and b) these states agree to use the same passing scores for accountability purposes.¹⁰

The grant program further required that the new assessment systems utilize technology to the maximum extent appropriate for development,

delivery and scoring of the assessments. Building up the technology infrastructure needed for the assessments will also support classroom instruction because the Common Core call for students to gain proficiency with various technologies, such as the use of spreadsheets and dynamic graphing software for analysis and modeling of complex problems in mathematics and the use of search engines and collaboration tools for research.

With new standards, classroom instruction must change in important ways to address them. To that end, each of the consortia included in their design “digital libraries” through which they will make available an ever-increasing collection of high quality, vetted resources for teacher professional development, instruction, and student and parent support. All of the resources will be aligned with the Common Core and the new assessments.

In a nutshell, then, the primary reasons that states have embraced the development of shared assessment systems could be summarized as:

1. What gets tested gets taught, so they all want to ensure that they are testing the complex skills required for postsecondary success.
2. They all want to provide teachers, parents and students with the highest quality supports and resources that can be collectively developed and/or acquired.
3. By sharing costs, expertise and resources, they are better able to ensure quality for their students and teachers.

Will the Shifts Bring Improvements?

We are several years away from knowing whether the new standards, assessments, and related support resources will bring about the desired improvements in instruction and, ultimately, in student achievement.

Figure 1

Number of math topics per grade level in top-performing countries versus in a typical U.S. state's standards

Grade Level	Number of Math Topics	
	Typical State's Standards, 2008	Highest-Performing Countries
1	22	3
2	22	3
3	22	7
4	22	15
5	29	20

Focus in the Mathematics Curriculum: A Symptom or a Cause. Presented by William H. Schmidt, Education Policy Center, Michigan State University. The Brookings Institute Presentation, January 23, 2008.

But the consortia are on track for delivering higher quality assessments, according to a preliminary evaluation conducted by the National Center for Research on Evaluation, Standards and Student Testing. The evaluation concluded that the tests being developed “will represent many goals for deeper learning, particularly those related to mastering and being able to apply core academic content and cognitive strategies related to complex thinking, communication, and problem-solving. ...These expectations reflect a dramatic increase in intellectual rigor relative to current state assessments.”¹¹

There are still many hurdles ahead for the states that have adopted the Common Core. The largest is the one faced by classroom teachers, who must make substantial shifts in their classroom practices – addressing fewer topics but demanding much deeper understanding, mastery of more challenging texts, and more sophisticated problem-solving and writing skills. In some cases, teachers may need to master new content before supporting students to also master it.

Every community will need to support our teachers, as well as our students, as they work toward student mastery of these significantly more challenging standards. Most have been conscientious in addressing the expectations that had been set for them. But the world has been changing and we, as a nation, have some catching up to do.

Now let's hear from some exceptional teachers and instructional leaders as they discuss the changes that have begun to take place in classrooms across the country.

— by Nancy Doorey

¹ See www.corestandards.org for the history of this initiative.

² <http://www.edexcellence.net/publications/theproficiencyillusion.html>

³ www.k12center.org/rsc/pdf/brt-data-profile-trends-achievement-2010.pdf

⁴ *Benchmarking for Success: Ensuring U.S. Students Receive a World-Class Education.* National Governors Association, Council of Chief State School Officers and Achieve, Inc., 2008.

⁵ *Ibid*, pg. 9. Citing a study by Levy and Murnane, 2004 entitled, *New Divisions of Labor: How Computers are Creating the Next Job Market.*

⁶ <http://www.corestandards.org/>

⁷ <http://engageny.org/resource/common-core-in-mathematics-overview>

⁸ *This is referring to the two Comprehensive Assessment Consortia funded under the Race to the Top Assessment program. In addition, the USED awarded grants to two consortia of states for the development of Alternate Assessments for students with significant cognitive disabilities and to two consortia of states for the development of new assessments of English language proficiency for English learners. For summaries of the designs of all six assessment consortia, go to <http://www.k12center.org>.*

⁹ *Alliance for Excellent Education. Saving Now and Saving Later: How High School Reform Can Reduce the Nation's Wasted Remediation Dollars.* 2011 pg. 3 <http://www.all4ed.org/files/SavingNowSavingLaterRemediation.pdf>

¹⁰ *USED. Race to the Top Assessment Program Notice Inviting Applications.* U.S. Federal Register, April 9, 2010.

¹¹ *National Center for Research on Evaluation, Standards and Student Testing. On the Road to Deeper Learning: The Status of Smarter Balanced and PARCC Assessment Consortia.* University of California, January, 2013.

In elementary school, more challenging reading, more informational texts and more use of evidence

In elementary school, students acquire the critical building blocks of literacy. They learn how letters and words combine to convey meaning, master the conventions of writing, and develop the foundational comprehension skills that they will need all through life. With the Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects (ELA/Literacy), elementary students will be asked to read more challenging works at earlier ages, distill the meaning from different types of print and multimedia resources, and demonstrate comprehension by citing specific evidence from those texts when expressing their reasoning orally and in writing. To explore the ramifications of the new standards, a team of ELA experts examined three sample test items that could be used either in instruction or on the assessments. Participants in the discussion were :

- Tara Affholter, a Grade 5 teacher at Lincoln Elementary School in Ellensburg, WA.
- Gail E. Militello, a K-12 instructional specialist for English/Language Arts and Reading in the Williamsville Central School District in East Amherst, NY.
- Timothy Shanahan, professor of urban education at the University of Illinois.

On international assessments designed to allow comparisons of student performance across countries, American students do very well at understanding and responding to works of literature like novels, plays or poetry. But they don't do as well when compared with their international counterparts in reading and understanding non-fiction or technical texts such as those they would encounter in college or the workplace.¹

“When you read international comparisons of American students with other students around the world ... ours do significantly better in literature than they do when it comes to reading the kinds of text you have to read in the workplace,” says Timothy Shanahan, one of the writers of the Common Core for ELA/Literacy. “Around the world, it seems to be the reverse. Students in other countries tend to do better with the stuff that matters to them economically and in terms of their governance.”

To create greater balance, one of the chief focus points of the new Common Core standards is to improve American students’ abilities to closely read and build their knowledge from non-fictional “informational texts” and to demonstrate their understanding by citing evidence from the texts themselves.

Informational text is any text that conveys factual information about real-world subjects like science, history or the everyday news, and under the Common Core students from elementary school will be exposed to more informational text and taught the skills needed to comprehend it. Studies have found that,

on average, only 7% of the reading materials used in grades K through 5 are informational texts.²

The Common Core standards require a major shift here, calling for an equal balance between literary and informational texts in the elementary school years. The rationale for the shift is to both build students’ vocabulary and general knowledge about the world and to improve their readiness for later studies. “It’s not just college readiness,” Shanahan says. “For elementary students, it’s high school readiness. Every high school student is going to take an English class, but they also are going to take a world culture or history class ... a science class ... or math class. Most of the coursework they do is going to be non-literary. ... They need to know how to build their knowledge of a variety of topics from informational text.”

Drawing Evidence from the Text

To explore the new emphasis on close reading of informational texts, the panel of experts examined a sample Grade 3 assessment task developed by the PARCC Assessment Consortium titled “How Animals Live” (see illustration on Page 7). In the task,



Timothy Shanahan

Timothy Shanahan is professor of urban education at the University of Illinois at Chicago. He is past president of the International Reading Association, and helped write the Common Core State Standards for ELA. He is a former first-grade teacher.

¹ Thompson, S., Provasnik, S., Kastberg, D., Ferraro, D., Lemanski, N., Roey, S., and Jenkins, F. (2012). *Highlights From PIRLS 2011: Reading Achievement of U.S. Fourth-Grade Students in an International Context (NCES 2013-010)*. National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, DC. Government Printing Office.

² Coleman, David . “Bringing the Common Core to Life,” presentation at Chancellors Hall · State Education Building · Albany, NY, April 28, 2011.

One of the big shifts in reading and writing instruction with the Common Core ELA Standards is a greater emphasis on using text evidence to support or explain the readers' conclusions and inferences drawn from text. In this Evidence-Based Selected Response item from the PARCC Assessment Consortium, students are asked to use evidence from a sample of informational text to answer a two-part multiple-choice question.

How Animals Live

WHAT STUDENTS SEE:

By Lisa Oram

How are animals grouped?

What All Animals Need

Almost all animals need water, food, oxygen, and shelter to live.

Animals get water from drinking or eating food. They get food by eating plants or other animals.

Animals get oxygen from air or water. Many land animals breathe with lungs. Many water animals breathe with gills.

Animals need shelter. Some animals find or build shelter. Other animals grow hard shells to protect themselves.

Ways of Grouping Animals

Animals can be grouped by their traits. A trait is the way an animal looks or acts. Animals get traits from their parents. Traits can be used to group animals.

Animals with Backbones

Animals with backbones belong to one group. A vertebrate is an animal with a backbone. Vertebrates' backbones grow as they get older. Fish, snakes, and cats are all vertebrates. Vertebrates can look very different.

Fish are vertebrates that live in water. Fish have scaly skin. They breathe through gills.

Amphibians are vertebrates. They can live in water. They can also live on land. Amphibians breathe through gills when they are young. They also get oxygen through their skin. As they grow, they develop lungs. Toads and frogs are amphibians.

A butterfly begins life as an egg. A caterpillar, or larva, hatches from the egg. A larva is a young insect. The caterpillar eats and grows. Soon it spins a hard covering, or chrysalis, around itself. The larva is now a pupa. It grows and changes. It becomes an adult butterfly. The butterfly breaks open the chrysalis and crawls out. Butterflies lay eggs. After laying eggs, butterflies die. Then the life cycle of the butterfly is complete.

Some Vertebrate Life Cycles

Vertebrate life cycles can be different. Some vertebrates go through many changes as they grow. Others hardly change at all.

A Frog's Life Cycle

Frogs go through many changes. They start life in the water as eggs. Tadpoles hatch from the eggs. They breathe with gills and live under water. The tadpole grows lungs and legs, and turns into an adult. Most adult frogs live near water.

A Mammal's Life Cycle

Most mammals develop inside their mother's body. Young mammals drink milk from their mothers. They have either hair or fur. Many young mammals look a lot like their parents soon after they are born.

Passage "How Animals Live" From SCOTT FORESMAN SCIENCE: HOW ANIMALS LIVE by Lisa Oram. Copyright © 2006 Pearson Education, Inc., or its affiliates. All rights reserved.

Read all parts of the question before responding

Part A

What is one main idea of "How Animals Live?"

- a. There are many types of animals on the planet.
- b. Animals need water to live.
- c. There are many ways to sort different animals.
- d. Animals begin their life cycles in different forms.

Part B

Which detail from the article best supports the answer to Part A?

- a. "Animals get oxygen from air or water."
- b. "Animals can be grouped by their traits."
- c. "Worms are invertebrates."
- d. "Almost all animals need water, food, oxygen, and shelter to live."

students are asked to read a 390-word, science-based passage detailing different ways to group and characterize animals. In a pair of multiple-choice questions, students are then asked to demonstrate understanding of what they have read by citing evidence from the text. In Part A, they are asked to select “one main idea” of the passage from four choices. In Part B they are asked to select “which detail from the article best supports the answer to Part A” from the choices supplied. In both questions, all the choices for answers are passages taken directly from the text, and students must get both parts right in order to earn credit.

Being asked to use evidence from the text distinguishes a task like this from those students might have encountered on assessment tests in the past, and makes it more rigorous and challenging.

“Typically in the past we might have seen the Part A question: What is the main idea of ‘How Animals Live,’” notes Tara Affholter, a Grade 5 teacher in Washington State with more than 20 years of classroom experience, who has helped craft assessment tasks for the Smarter Balanced Assessment Consortium. “What’s different is Part B, which asks for details to support the answer. That’s



Gail Militello
Gail Militello is a K-12 instructional specialist for English/Language Arts and Reading in the Williamsville Central School District in upstate New York. An educator with 21 years of experience, she taught Grades 3-8 in the 10 years prior to becoming a curriculum coordinator.

where the close reading and evidence demands of the Common Core standards are weaving themselves into this item.”

“It’s not only that they come up with the right answer, but more importantly, to be able to justify where they found it,” says Gail E. Militello, a K-12 instructional specialist for English/Language Arts and Reading, who has 21 years of experience. “What made them choose that answer and believe that was the correct response?”

An ongoing challenge in creating tests of reading comprehension has been ensuring that students must read the passage first and are not able to answer based solely on prior knowledge.

GRADE 4 | SAMPLE ASSESSMENT ITEM

As elementary students grow as readers, the Common Core ELA Standards require them to develop the ability to closely read and analyze text in a more sophisticated way and make inferences. In this task from the Smarter Balanced Assessment Consortium, students read a 730-word fictional passage — and then re-read a key section — to find text evidence to answer the question. This is the third question students respond to about this story.

Grandma Ruth

WHAT STUDENTS SEE:

Read this part of the text again.

“It turns out my mother loved the name Ruth. That’s how I got my name and how my father got these: he let Ty Cobb name me after Babe Ruth.”

I tried to swallow but couldn’t. I hoped that she wasn’t going to say what I thought she was going to say.

Then she said it.

“In this shoebox are the ten baseballs Ty Cobb gave my father. They are signed by some of the most famous ballplayers in history, including one that has one single signature on it: Babe Ruth’s.”

My grandma pulled the ball out, unwrapped it, and held it out for us to see. The ball was scarred almost beyond recognition. It had dog bite marks, dirt scuffs, and fraying seams. Right in the middle was a big signature in black ink

that I had somehow overlooked. It was smudged now and faded, but it still clearly said “Babe Ruth.” I began to shake inside.

But my grandma just looked at the ball and smiled sweetly. She said softly, “Even though it doesn’t look like much, this ball has brought our family a lot of joy in its time. I remember when I was your age, Naomi, I almost rubbed the signature right off from tossing it up and down all the time. You see, I’ve always felt that a baseball should be used for a lot more than looking. My dad, your great-grandfather, used to say the same thing.”

Select three sentences that show that Naomi is worried she has done something wrong.

“Historically, comprehension assessments can be skewed by the amount of background knowledge students bring to the test,” Militello says. “Here the assessment design is that the answer lives within the text itself. Through re-reading and careful analysis, any reader can access the evidence if he or she has the skill set and the stamina to revisit the text again and again.”

With this approach, once students acquire the skills for close reading, “all students develop the confidence to be successful with a text, even if at first glance it appears rigorous, challenging or even intimidating,” says Militello, whose New York State district is already implementing instruction based on the Common Core.

The ability to closely read is a skill that applies equally across subject areas, from literature to history to science and the arts.

“One of the great things about the Common Core is that it makes students think about their reading skills across all content areas,” Affholter says. “Reading and writing will be embedded in them all.”

With such broad reading instruction, students will acquire what is called “academic vocabulary” — words and concepts that are central to understanding content and assignments that are used across a variety of subject areas. Academic vocabulary includes such terms as “abbreviate” or “analyze,” for example, or “extract” or “highlight.”

“It can’t be exposure just once,” Affholter says. “It has to be exposure over and over again” in subject after subject. After several years of complaints about No Child Left Behind narrowing the curriculum, the Common Core standards give elementary teachers permission to, once again, expose students to a wide range of topics, including science, social studies and the arts, as part of their core education.

To emphasize that point, the new standards are not actually called the Common Core State Standards for English Language Arts. They are the standards for “English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects.”

Closely Reading Fiction

As students mature as readers, they not only need to use evidence in texts to support their reasoning, they must develop the ability to analyze text in a more sophisticated way and make inferences.

To see how that would look in an elementary level assessment, the ELA experts examined a sample Grade 4 assessment task called “Grandma Ruth” from the Smarter Balanced Assessment Consortium. (See illustration on Page 8.)

In this task, students read a 730-word fictional passage that describes things a girl learned about her grandmother after playing with a baseball stored away in her grandmother’s closet. Students are then asked to respond to three questions designed to measure comprehension. The first asks them to provide evidence for a central idea in the story, the second to use context to determine the meaning of a word, and the third to identify supporting details for an inference.

The third part of the task, which is shown on page 8, presents a “high level” challenge, Affholter says, because students are asked to re-read the last third of the passage and select three sentences to support an inference about what the girl, Naomi, is feeling.

After several years of complaints about No Child Left Behind narrowing the curriculum, the Common Core standards give elementary teachers permission to, once again, expose students to a wide range of topics, including science, social studies and the arts, as part of their core education.

“That is really cool,” she says. “No choices are given. You have to really read this text closely to show where Naomi thinks she has done something wrong.

“It’s that evidence piece again,” she notes. “In their own minds students are going to have to slow down and justify ‘does this sentence really show this?’”

Designed as an online task, “Grandma Ruth” illustrates one of the ways technology can be used within items. When picking the sentences to answer the inference question, students can highlight them in the electronic text with the cursor.

An electronic approach may be new to some students, and this will require that they be provided instruction and opportunities to utilize computers and electronic searches as part of their school work.

“But once the students get there, they’re going to be fluent,” Affholter says. “These kids grow up in that technology world now. They live with clicking and dragging and highlighting.”

A task like this demonstrates how the Common Core emphasizes close reading in fiction as well as non-fiction, and trains students to be better readers and writers by spotlighting the structure of texts.

A story like “Grandma Ruth” is packed with details and “demands a high level of inferencing” based on those details, Militello says.

“It is helping students see that the author is very purposeful in word choices and only through close reading can you see that,” she adds. “For example, Naomi tiptoes into grandma’s room. Why is she tiptoeing? You begin to infer that there is some reason she doesn’t want people to know what she’s doing. A reader has to pick up on the clues that the author put into that story.”

The task also reaffirms that attention to literary writing will not be lost under the Common Core (or eliminated, as some have feared).

“Grandma Ruth” has a rich literary style that any English teacher could love. “There are a lot of details and descriptions in there,” Affholter says. “You really can appreciate the craft of the story.”

At the same time, she notes, parents and teachers need to recognize that there “needs to be a balance between fiction and non-fiction,” especially in the elementary grades.

The goal of the Common Core is to develop readers with the skills to closely read all kinds of text, and to recognize that different kinds of reading require different skills.

“That is really important,” Shanahan says. “They need to know, what does scientific reading look like, what does historical reading look like, what does literary reading look like? ...They need to know what kind of reading is appropriate for any particular task.”

Writing with Evidence

The close reading emphasized under the new Common Core ELA Standards will help students learn how to use evidence and details from text to improve comprehension and reasoning. Greater attention to evidence and details also will help them learn to become stronger and more effective writers.

In states that have had writing assessments to date, tasks have tended to focus solely on narrative writing, such as the telling of an opinion or an experience. While still valued as a means for students to learn to express their views, this style of writing is rarely called for in postsecondary courses or training programs. Instead, clear and well-reasoned writing based on evidence drawn from multiple sources is the norm. The close reading skills discussed above lay the foundation for such writing skills.

To explore the impact of close reading on the development of writing skills, the ELA team examined a sample writing task developed by the Smarter Balanced Assessment Consortium titled “Why There Should be a Longer School Day” (see illustration on Page 11). In this Grade 5 task, students are asked to read a rough draft of a paragraph a student has written for the school newspaper and provide more

details to support the student’s argument in favor of a longer school day. Unlike most tasks, students are not asked to draw details from a written prose sample, but from a schedule of a longer school day. They are then asked to rewrite the paragraph and place supportive details in appropriate places in the text.

Focusing on revision, and asking students to make the revision from provided details, takes the task into more rigorous territory.

“This is a great question,” Affholter says. “Students have not had to do this on state assessments. They’ve had chances to revise their own writing and while some do a really good job, the majority don’t, because they feel they’ve already said it all. This is going to make them really look closely, to add those details and be specific on the evidence to add.”

The structure of the task also gives students an analytical distance they might not have when revising their own work.

“When you look at the standards, they talk about peer reviewing and this really speaks to that,” Militello says. “Sometimes it’s easier to look at someone else’s writing than your own because you know what you intended to say. When you look with a fresh pair of eyes, you don’t have that predisposition. ... This is something very new.” Learning to edit a peer’s work can help students become better reviewers of their own work.

Because it isn’t a typical writing task, the item provides a richer measure of a student’s writing ability. “This item threw me at first,” Shanahan says. “Clearly, students are supposed to do revision in the Common Core but this isn’t exactly like a revision task. If you really look at it, it is a text analysis task.

The first thing you have to do is read that first paragraph and be critical of it: What is missing? What is wrong?

“Normally, [a student] would say ‘This lacks detail, it only tells this, that is a generalization,’” he explains. “But instead of asking students to write this kind of analysis, this task says ‘Fix it. If you think that’s what is wrong with it, here’s some information you could use.’ You have to do a critical analysis of the first paragraph and then fix it with the information from the schedule.”



Tara Affholter

Tara Affholter is a fifth grade teacher at Lincoln Elementary School in Ellensburg, WA. Now in her 21st year of teaching, she is a National Board Certified Teacher, an adjunct professor at Central Washington University and helped score fourth grade writing for the Washington State assessment exams.

The use of a schedule as source material poses a more sophisticated challenge for students in the task. A schedule is essentially a primary source, and while the details students need are all there, they are not labeled, clued or in a familiar format.

“It is really high level to pull apart that schedule,” Affholter says. To determine what to add in their revision, she says, students need to catalog all the classes included in a longer schedule, while noting that the schedule also includes regular art and music classes and homework support time.

“All the information is there,” Militello notes. “They just need to extract the reasons.”

In the multi-media world of the 21st century, the ability to extract evidence from diverse sources including

print and electronic texts, videos and charts will become more and more important.

“Under the Common Core, we’re going to see emphasis on evidence across the curriculum because it can be used in everything,” Affholter says. “The other day I had my students study a picture, Paul Revere’s ‘Boston Massacre,’ and had them pull out evidence of what they saw. Then I had them read about [the massacre] and asked how that was different from what Revere showed. ... I’m trying to make them think at higher levels and understand things in a deeper way.”

“That is the whole focus of the Common Core,” Militello says. “We are in an information explosion and with everything coming at us from the Internet, TV and other sources, we need to be much more critical thinkers, not just taking things at face value.”

GRADE 5 | ASSESSMENT TASK

With the Common Core ELA Standards, students not only will learn to use evidence and details from text to improve comprehension, but will also use such evidence and details to become more effective writers. In this writing task from the Smarter Balanced Assessment Consortium, students are asked to read a rough draft of a student’s writing and then improve it with details drawn from another text source. Students may compare the schedule for the longer school day to their current schedule.

Why There Should Be a Longer School Day

WHAT STUDENTS SEE:

The following is a rough draft of a paragraph that a student is writing for the school newspaper about why there should be a longer school day. The draft needs more details to support the student’s reasons for having a longer school day.

Schools should have a longer school day for students. First, students could learn more about different subjects if the school day were longer. Also, students could get extra help from teachers. More hours in class each day would also mean more vacations scattered throughout the year!

Now look at the following daily schedule for a school that has switched to a longer school day.

- 8:00** Morning Announcements
- 8:20** Reading Language Arts
- 9:30** Foreign Language
- 10:30** Morning Recess
- 10:45** Mathematics
- 11:45** Lunch
- 12:45** History
- 1:45** Art or Music
- 2:15** Afternoon Recess
- 2:45** Science
- 3:30** Homework Preparation
- 3:45** After-School Tutoring or Sports

Revise the paragraph by adding details from the daily schedule that help support the reasons for having a longer school day.

At middle school level, emphasis on rigorous thinking to meet more sophisticated challenges

One of the key goals of the Common Core State Standards for English Language Arts (ELA/Literacy) is to help students become more rigorous thinkers, which will make them stronger and more skillful readers and writers. Rigorous thinking requires students to do more than just remember what they read; they have to be able to interpret, analyze and evaluate this information in sophisticated ways. In ELA/Literacy, this is seen in the growth in ability that takes students from relatively unchallenging tasks such as memorizing facts and giving Who-What-When-Where-Why summaries of text to sophisticated challenges such as analyzing texts and synthesizing information from multiple texts. David Coleman, one of the writers of the Common Core for ELA/Literacy, describes the overall goal as ensuring students can “read like a detective and write like an investigative reporter.”¹ To explore how the Common Core will impact ELA/Literacy at the middle school level, a team of experts examined sample tasks for both state assessments and classroom use. The participants were:

- Christina Hank, secondary curriculum director for the Medina City School District in Medina, OH.
- Kris Shaw, a language arts and literacy consultant for the Kansas Department of Education.
- Timothy Shanahan, professor of urban education at the University of Illinois at Chicago.

Because effective rigorous thinking involves a progression from lower-level abilities to higher ones, parents may sometimes hear the upper levels referred to as “higher-order thinking skills” or “higher-level thinking.” Whatever term is used, the goal is the same with the Common Core ELA/Literacy standards: Students will be expected to handle more sophisticated language and more complex tasks in reading and writing, so that they are well prepared for the expectations they will face in the workplace or in college.

“The Common Core is intentionally getting away from that lower memorization level and moving more

toward an analytical level of thinking,” says Kris Shaw, a language arts and literacy consultant who is also active with the International Reading Association. “There’s also an intentional connection for students between what they learn in school and what they’re going to take on after high school in college or a career. They realize ‘I’m not just learning things in school to give to my teachers; I’m learning things so I can apply those things when stepping out into the world.’”

The shift to the Common Core already has had an effect on the proposed assessment tasks being developed by the PARCC and Smarter Balanced Assessment Consortia. A study by the CRESST Center at UCLA found that the large majority of test items in most state assessments used in the past were low level and did not require much more than memory or low level thinking abilities, while the assessments now being developed are forecasted to contain many more higher level items aimed at deeper and more extensive analysis of information.² “We’re expecting something different out of students that hasn’t been expected of all students in the past,” says Christina Hank, a former English teacher who now coaches colleagues in the ELA/Literacy standards in Ohio. “Now it’s not just the facts. We’re asking them to go further and deeper, think more and be more independent.”

“The Common Core is really pushing students to go outside of themselves,” says Timothy Shanahan, professor of urban education at the University of Illinois at Chicago. “The comprehension questions require close reading of the text, and the writing tasks have our middle school students summarizing text, analyzing text or synthesizing information across multiple texts.



¹ Coleman, David. “Bringing the Common Core to Life,” presentation at Chancellors Hall, State Education Building, Albany, NY, April 28, 2011.

² <http://www.cse.ucla.edu/products/reports/R823.pdf>

“They are writing about ideas that actually are coming out of what they read,” he stresses, “not just their personal opinions or experiences. Students must gain the skills needed to build their knowledge of a topic from texts and to then clearly communicate their new understandings.

Comprehension and Vocabulary

Vocabulary – word meanings – plays an important role in listening and reading comprehension. The more words that students know, the better they will be able to interpret an author’s words to understand a text. But vocabulary is not just a list to be memorized. Good readers don’t just know the meanings of a lot of words, though they usually do, but they are able to analyze the implications of an author’s word choices and to determine meanings based on reasoning from other text information. To see how that would play out at the middle school level, the experts looked at a sample Grade 6 assessment task developed by the PARCC Assessment Consortium based on Jean Craighead George’s novel “Julie of the Wolves” (see illustration at right). The task is part of a group of items designed to assess a cluster of reading standards, but it focuses on vocabulary.

Based on literature and formatted as multiple-choice, the task may seem familiar on the surface, but it challenges students to look at vocabulary in a new and interconnected way. In Part A of the two-part task, they are asked to define the word “regal” from four choices that are supplied, and in Part B they are asked which of four phrases taken directly from the text of the novel best helps them understand the meaning in this context. Students must answer both parts correctly to receive credit.

The two-part structure of the task “holds students accountable at a different level,” Hank says. “In previous [multiple-choice] assessments a student could really guess and had a 25 percent chance of getting it correct. On this, they would have to guess correctly on both pieces, to guess correctly on what the word means, but also guess correctly on the context of it from the reading.”

The choice of the word “regal” in the task also reflects the rigor of the Common Core approach, because it connects in a key way to the story, in which a girl lives

with a pack of wolves on the Alaskan tundra.

“That is really important,” Shaw says. “It points to the characterization of what the author was trying to get across about the wolf” that is leader of the pack.

“It does a better job of telling us how well the student comprehends the text,” Hank adds. “If they really comprehend it, they would be able to answer this well, but if they didn’t comprehend, then this would be much harder to answer.”



Kris Shaw

Kris Shaw is the language arts and literacy consultant for the Kansas State Department of Education. She is a consultant for Smarter Balanced and Dynamic Learning Maps to develop English Language Arts assessments. She serves on committees for the Council of Chief State School Officers and the International Reading Association.

GRADE 6 | ASSESSMENT TASK

Rigorous thinking requires students to be able to interpret, analyze and evaluate what they read in sophisticated ways. This two-part Evidence-Based Selected Response item from the PARCC Assessment Consortium assesses students’ ability to do that through vocabulary used in a passage from Jean Craighead George’s novel “Julie of the Wolves,” in which a girl lives with a pack of wolves on the Alaskan tundra. Part A resembles vocabulary questions that have traditionally appeared on reading assessments, but unlike some past assessments it focuses on a word that is key to the meaning of the story. Part B takes the item in a new direction, asking students to show the context within a passage that helps determine the meaning of the academic vocabulary word. Students must answer both parts correctly to receive credit.

Julie of the Wolves

WHAT STUDENTS SEE:

SAMPLE ITEM	
Part A	
What does the word “regal” mean as it is used in the passage?	
<input type="checkbox"/> a. generous	<input type="checkbox"/> b. threatening
<input type="checkbox"/> c. kingly	<input type="checkbox"/> d. uninterested
Part B	
What of the phrases from the passage best helps the reader understand the meaning of “regal?”	
<input type="checkbox"/> a. “wagging their tails as they awoke”	<input type="checkbox"/> b. “the wolves, who were shy”
<input type="checkbox"/> c. “their sounds and movements expressed goodwill”	<input type="checkbox"/> d. “with his head high and his chest out”

PARCC Assessment Consortium

For more information on this task, visit http://www.parcconline.org/sites/parcc/files/GR%206%20PARCC%20ELA%20Item%201_1.pdf

The choice of the word, and the way students are asked to justify the definition with text evidence, pushes students to more sophisticated thinking.

“This is so interesting because it’s asking the meaning of a single word.” Shanahan adds. “It’s about as narrow a bit of comprehension work as you could do, yet look at the cool reasoning it’s requiring the kids to do.”

The other tasks based on “Julie of the Wolves” used passages from the text to test students’ understanding of the girl’s feelings for her father; asked them to pick a word to describe her feelings from four provided and find a sentence in the text to support the choice; and finally to write a narrative beginning where the sample passage ends, based on evidence in the available text.

If taken in sequence, the four tasks demonstrate in microcosm how sophisticated thinking builds — and how the Common Core requires students to explain their reasoning by citing text evidence.

“That’s a really hard thing for kids to do,” Hank says. “That part where it’s asking ‘how do you know what you know?’ That’s not just hard for struggling students; that’s hard for gifted kids, that’s hard for middle of the road kids, that’s hard for everyone. ... We’re asking them to do so much more to prove something.”

Evidence and analysis

Promoting the ability of students to “prove something” by using evidence from text is a central tenet of the new Common Core ELA/Literacy Standards. Students will need to be able to do it not only with literary texts such as “Julie of the Wolves,” but also with nonfiction informational texts.

The Common Core places greater emphasis on informational texts than previous ELA standards — hence the use of the abbreviation ELA/Literacy. Elementary students will see a 50-50 balance between informational texts and literary texts, while high schoolers will work with 70 percent informational text across their school day (English and literature classes will still have heavy emphasis on literature). This shift creates a shared responsibility among ELA, science and social studies teachers to ensure that students gain the skills needed to build their knowledge of a topic from scientific, historical, technical and other types of informational texts.

To see how use of informational text can help promote greater depth of knowledge, the team of language experts examined two Grade 7 classroom tasks developed by the PARCC Assessment Consortium that are based on materials about the life of aviator Amelia Earhart. In the first task, students are asked to read a 1,600-word “Biography of Amelia Earhart”

GRADE 7 | CLASSROOM TASK

With the new Common Core ELA/Literacy Standards students will experience more challenging texts at every grade level and be asked to do more writing in response to reading, such as summarizing text, analyzing text or synthesizing information across multiple texts. In this Prose Constructed Response item from the PARCC Assessment Consortium, students are asked to demonstrate the ability to read closely in order to summarize information contained in a 1,600-word biography of aviator Amelia Earhart. While the item resembles questions that have traditionally appeared on reading assessments, it differs from traditional summary prompts by asking students to focus on a particular aspect of Earhart’s life, requiring them to identify supporting evidence from the text and organize it into a summary of her quest to become an aviator.

Biography of Amelia Earhart

WHAT STUDENTS SEE:

Student Directions

Based on the information in the text “Biography of Amelia Earhart,” write an essay that summarizes and explains the challenges Earhart faced throughout her life.

Remember to use textual evidence to support your ideas.

Answer:



and craft an essay explaining the challenges of her life. In the second task, they are asked to compare the biography with two other sources and write an analysis of how well the different texts demonstrate that Earhart was courageous.

The essay task based on reading the single biography simulates what students need to do with any research project — closely read source material and glean essential details to support a claim or conclusion (see illustration on Page 14).

“The Common Core is intentionally getting away from that lower memorization level and moving more toward an analytical level of thinking. There’s also an intentional connection for students between what they learn in school and what they’re going to take on after high school in college or a career.”

— Kris Shaw, Language Arts & Literacy Consultant, Kansas Department of Education

Yet it is a significant departure from much of what students have been asked to do in recent years on state writing assessments and perhaps, as a result, in classroom writing assignments.

While existing assessments call upon students to demonstrate they can write well, Shanahan notes, “students are usually asked to write about pretty

much the knowledge in their head: ‘Share your opinion and tell us why you believe this. Tell us about some experience you have had or your favorite place.’”

“It’s on-demand writing,” Shaw says. “They don’t have to read anything. It’s all from prior knowledge, and kids can kind of make stuff up addressing the prompt. With this task, they actually have to summarize from something they have read, and ... pull it all together.”

That will require an adjustment by teachers as well as students, because past instruction and assessments have emphasized the mechanics of good writing, more than the use of content evidence and the higher-order thinking skills of analysis, synthesis or critique.

In recent years, “writing instruction has become very formulaic and mechanical,” Hank says. “We teach the importance of the thesis statement and transition words, for example. In this task, there is still some emphasis on the construction pieces, but it is so much more focused on the content and making sure the content matches the purpose and the audience. ... That is going to change how we teach writing.”

The challenge, Shaw notes, is “how do you [adjust] instruction so that you can get students who can move easily between reading and writing? That is going to be different and we’ll have to work on it.”

Synthesis and Analysis

As students grow as readers and writers, they are expected to take on and master increasingly complex tasks. With greater depth of knowledge comes the ability to draw conclusions, cite evidence, synthesize,



critique and analyze texts. The second Amelia Earhart task examined by the ELA experts demonstrates how middle school students will be challenged to engage in the more advanced thinking skills of research (see illustration on Page 17). The item asks students to read the same 1,600-word biography of Earhart, but also to read a short news account examining where she may have died (“Earhart’s Final Resting Place Believed Found”) and to watch a biographical video (“Amelia Earhart’s Life and Disappearance”) — or read the video transcript.

Students are then asked to use at least two of the three sources to write an analysis of the arguments each author uses to demonstrate Earhart’s bravery, and to support their conclusions with evidence from the text (or video).

“I love in this item that students are analyzing the text,” Shaw says. “We’re at that very highest level of depth of knowledge. They’re having to draw from multiple texts and use their own thinking to come up with an argument and support it with evidence from the texts.”

“Frankly,” Shanahan notes, “that is what people are expected to do in the real world.”

Use of multiple sources forces students to compare the relative value and validity of each source, a skill that will have life-long application in everything from weighing job offers, to buying insurance to comparing reviews of restaurants or films.

“In order for students to be critical thinkers, they need to be able to do this,” Hank says.

It’s also empowering, because students are being asked not only to collect evidence and information but to make informed value judgments about it.

“This is a shift in instruction,” Hank says. “I could stand up in front of the class and show my Powerpoint slides and teach all about her life or I can give the kids access to these texts and let them learn about her on their own. ... In this task, I like that the kids are learning directly from the text, instead of the teacher learning and then pouring that into the students.”

The inclusion of video in the source materials for the Earhart task reflects another shift in instruction and assessment under the Common Core. While video will pose a challenge for schools with limited bandwidth, its use demonstrates the Common Core commitment to providing students with 21st century skills.



Christina Hank

Christina Hank is the secondary curriculum coordinator at Medina City Schools, in Medina, OH. Previously a high school English teacher and ELA specialist at the Ohio Resource Center, she has worked with educators across Ohio to change classroom instruction.

“This goes right to the college and career ready aspect,” Shaw says. “This is what a kid is going to face going into college or a career.”

Turning to electronic media as a resource is already widespread with students and young adults, but instruction and assessment have been slow to catch up.

“When kids want to learn something now, they are 21st century learners,” Hank observes. “If they want to learn to build a skate ramp or to do something to a car, they will hop online and learn how to do it. What we’re struggling with is helping them make the connection between learning for fun and learning for academics.”

Shaw says. “I think we’re lagging behind a little bit. As a teacher, how do I actually teach students how to do this?” The assessment consortia, numerous education organizations and individual states are rapidly developing resources to assist teachers with the instructional shifts called for in the Common Core.

It will also help, Shanahan says, that informational texts like those in the Earhart synthesis task are varied and engaging in both format and content.

“One of the arguments raised against the use of informational text is that it’s inherently boring and that students aren’t going to want to read it,” Shanahan says. “When you look at these items, you say ‘hey these are informational texts, but they’re interesting.’”

Such texts also expose students to diverse presentations of information in a way that requires them to build the unique skills needed for successful handling of technical and other informational texts.

“Don’t even worry about the highfalutin stuff,” Shanahan says. “On the really low end, how often do you see italics, bold print, an index or that sort of thing in fiction? And what about the relationship between the information in the text and the tables and the graphics? We don’t have a lot of that in literature.

“If most of kids’ experience has been with literature, then when they confront such things in the workplace or in college, they are at a disadvantage. If ... you give kids substantial experience with a wide range of texts, you increase the chances they will be able to handle all that stuff.”

GRADE 7 | CLASSROOM TASK

One of the goals of the new Common Core ELA/Literacy standards is to ensure that students have 21st-century skills that are needed for success in college or careers. Among those are the ability to use both print and electronic media to conduct research and to be able to compare and synthesize ideas across multiple texts. In this Prose Constructed Response item from the PARCC Assessment Consortium, students are asked to read three diverse texts about the life of aviator Amelia Earhart (including a video). Unlike writing assessments in the past, they are asked to delve deeply into the multiple texts to gather evidence to analyze a given claim, simulating the research process needed to write an analytical essay.

Amelia Earhart Research Simulation (Analytical Essay)

WHAT STUDENTS SEE:

Student Directions

You have read three texts describing Amelia Earhart. All three include the claim that Earhart was a brave, courageous person. The three texts are:

“Biography of Amelia Earhart”

“Earhart’s Final Resting Place Believed Found” (news account)

“Amelia Earhart’s Life and Disappearance” (video and/or transcript)

Consider the argument each author uses to demonstrate Earhart’s bravery.

Write an essay that analyzes the strength of the arguments about Earhart’s bravery in at least two of the texts. Remember to use textual evidence to support your ideas.

Answer:

In high school, close reading, critical thinking and analysis across multiple texts gain focus

Critical thinking is essential to success in life. It is especially important when trying to use and sort through large amounts of information of varying quality and reliability. In the digital age, that is the task facing both students and adults as they navigate the limitless resources now available through the Internet, along with traditional print resources. That is also why the new Common Core State Standards for English Language Arts and Literacy (ELA/Literacy) place great emphasis at the high school level on critical thinking and close reading — and much more than in the past — stress the ability to use, compare and analyze multiple texts on a topic. To consider the impact of the new ELA/Literacy standards on high school instruction and assessment, a team of ELA experts examine sample tasks for both state assessment and classroom use. Participants were:

- Morgan Dunton, English Language Arts specialist for the Maine Dept. of Education and a former high school English teacher.
- Carole Mullins, ELA content specialist for the Office of Next Generation Learners of the Kentucky Dept. of Education.
- Timothy Shanahan, professor of urban education at the University of Illinois at Chicago and one of the writers of the Common Core State Standards for ELA/Literacy.

The emphasis on reading and working with multiple texts is a key part of the Common Core high school goal to graduate students who are college- and career-ready. By building the skills to read complex texts and write well-supported arguments, the Common Core seeks to reduce the amount of remedial coursework that colleges have had to give first- and second-year students and reduce the amount of literacy training businesses have had to provide new workers.¹

“The idea is that in college or a job we don’t just read single texts, we read multiple texts and need to be able to make comparisons, and also draw information from multiple sources and use it,” says Timothy Shanahan, a college professor and writer of the Common Core standards for ELA/Literacy. “We need to be able to make comparisons and synthesize information, both in discussion and in writing.”

At colleges, “there has been a pretty widespread dissatisfaction among professors who teach freshmen and sophomores in the literacy levels of their students,” adds Shanahan. “There are obviously big concerns about the students’ reading abilities but probably even bigger concerns about their writing. Students are not terribly well versed in writing research papers, or even doing the work [gathering information] to write research papers.”

The need for high level reading, writing and critical thinking skills is just as acute in the business world, notes Morgan Dunton, English Language Arts specialist for the Maine Department of Education.

“I can’t imagine an industry that doesn’t rely on staying current and doing independent research,” she says. “Clearly, if they are going to keep up with their industry, whatever it is, they have to be constantly

gathering information. As we heard at a recent forum in Maine at which a game warden, a respiratory therapist and a chemical engineer commented on the skills needed today, the skills we are asking students to develop are universal, for college or career.”

Close Reading of Literature

When developing the ability to closely read one or more complex texts, students benefit by working with both literature and nonfiction “informational” texts. The Common Core ELA/Literacy standards stress both, though there is now more emphasis on “informational” texts at all grade levels. To see how close reading and writing could be assessed through literature, the high school experts examined two Grade 10 assessment tasks developed by the PARCC Assessment Consortium based on two poems retelling the myth of Daedalus and Icarus (see illustration on Page 19). One was written by the poet Ovid as part of his masterwork, “Metamorphoses,” during the time of the Roman Empire. The other, titled “To a Friend Whose Work Has Come to Triumph,” was written by 20th century poet Anne Sexton.

The Ovid poem, translated into fairly formal English, gives a straightforward and traditional account of the myth, in which Icarus ignores his father’s advice, flies too close to the sun and plunges into the sea. The Sexton poem, written in contemporary, conversational English, tells the story in the spirit of a young and adventurous Icarus.



Morgan Dunton

Morgan Dunton is an English Language Arts specialist for the Maine Department of Education. An English teacher and lifelong Mainer, she is also president of the Assembly of State Coordinators of ELA.

¹ <http://www.achieve.org/files/BenchmarkingforSuccess.pdf>



Good authors choose words and craft metaphors very carefully to create vivid visual images and emotional understandings. In one of the tasks based on the poems, students are asked to read them closely and write an essay that analyzes the differences between the authors' portrayals of Icarus's experience of flying, using evidence from each text to support their conclusions.

While analyzing poetry has long been a staple of high school English classes, this Common Core task is a departure from past assessments in several key ways.

"As a high school teacher, the task feels like something I would ask students to do in my classroom," Dunton says. "But having worked on state assessments for a decade, I don't feel like it's something we've typically done for accountability [in assessments]."

"The sophistication of the texts and the fact students are asked to analyze authors' techniques and use evidence from the texts when writing about them demonstrate the greater rigor and expectations of the Common Core."

— Carole Mullins, ELA content specialist,
Kentucky Department of Education

"The sophistication of the texts and the fact students are asked to analyze authors' techniques and use evidence from the texts when writing about them demonstrate the greater rigor and expectations of the Common Core," notes Carole Mullins, a 29-year educator and National Board Certified English

GRADE 10 | ASSESSMENT TASK

With the Common Core State Standards for ELA there is greater emphasis on using text evidence to support conclusions and inferences drawn from text, greater emphasis on the consideration of information from more than a single source and more writing in response to reading by summarizing or analyzing text or synthesizing information across multiple texts. In this Prose Constructed Response Literary Analysis Task from the PARCC Assessment Consortium, students read two poetic accounts of the "Daedalus and Icarus" story. They then must draw evidence from the texts and cite this evidence clearly to demonstrate their conclusions and reasoning in writing. Students are also required to demonstrate that they can apply the knowledge of language and conventions when writing (an expectation for both college and careers).

Daedalus and Icarus

WHAT STUDENTS SEE:

Student Directions

Use what you have learned from reading "Daedalus and Icarus" by Ovid and "To a Friend Whose Work Has Come to Triumph" by Anne Sexton to write an essay that analyzes how Icarus's experience of flying is portrayed differently in the two texts. Develop your essay by providing textual evidence from both texts. Be sure to follow the conventions of standard English.

Answer:



teacher from Kentucky. “Now we’re doing truly academic college- and career-readiness writing,” she says. “Students need to take this assignment piece by piece, break it apart and come to an overall understanding that will be reflected in their writing. This is what we need to be doing, instead of having kids out there in a cloud writing from prior knowledge.”

“These two poems truly represent what is going on with the Common Core,” Dunton adds. “These poems are probably familiar in 10th grade for your honors level students or AP track students, but they are poems we probably would have avoided in general English classes. What the Common Core is doing is rethinking those tracks to increase the rigor and challenge for ALL students” so that all will be ready for the postsecondary path of their choice.

That was dramatically evident to Mullins, when she introduced the task to the advisory team for her regional Teacher Leader Network in Kentucky.

“The first feedback from our group for Grades 9-12 was ‘uh-oh, oh me, oh my, I have not really gone in-depth with poetry like that,’ she recalls. “But then they said ‘OK. If this is the direction, we know how to address it. It’s different but we can do this.’”

Greater emphasis on close reading and text evidence will require shifts in instruction and professional development in both English and content areas like

social studies to show teachers how to support students doing analysis or comparisons of texts.

“If you were to give this task to students tomorrow, when they are used to the kinds of assessments we have had, it would be hard for them to do the kind of close reading they’re going to have to do,” Dunton says. “They have to engage with that text at a deep level to truly understand the ideas.”

In the Ovid and Sexton poems, she would want students to discuss the importance of tone, point of view and treatment of ideas in each work and how each writer uses language to get key ideas across. “I would want students to use specific examples of language to support an analysis of tone and treatment,” she says. “I would hope students would have had instruction in close reading prior to this to look for signposts and key words within these texts.

“Your very capable students can write an essay that analyzes something, but students that maybe are struggling a little bit may need more support,” she adds. “It really depends on that preparation. There will have to be a lot of practice.”

Analyzing Multiple Texts

With the explosion of resources from the Internet and mobile technology, students face more daunting challenges than ever as they seek reliable information for research or writing assignments. For that reason, the new ELA/Literacy standards seek to help students develop fluency with all forms of informational text, and the critical thinking ability to weigh the validity of each. To achieve that goal, the Standards take a broad view of what constitutes an informational text, including video, film and Internet resources, along with print-based resources such as books, magazines, newspapers or textbooks.

“You can’t tell me there’s anybody who is going to survive and earn a livable wage that is not going to need these skills.”

— Morgan Dunton, English Language Arts specialist, Maine Department of Education

Though there are no technology standards for ELA/Literacy, “technology is woven all the way through in the oral and written language standards,” Shanahan says, and students are expected to be “using the Internet as a way of conducting research and gaining access to multiple sources of information.”

To explore how Common Core assessments might measure students’ abilities to gather, analyze and synthesize information from Internet and other sources, the experts examined an ambitious,

GRADE 11 | ASSESSMENT PERFORMANCE TASK

The new Common Core State Standards for ELA/Literacy place great emphasis at the high school level on critical thinking and close reading and stress the ability to use, compare and analyze multiple texts on a topic. This multi-part Grade 11 Performance Task from the Smarter Balanced Assessment Consortium simulates a real-world research and writing assignment on the topic of nuclear power. Students use a variety of text and video resources from a simulated web search and then write an argumentative report on the subject of nuclear power. The sample research sources appear at right and the research questions below.

To see the entire scoring guide for this task, go to <http://www.smarterbalanced.org/wordpress/wp-content/uploads/2012/09/performance-tasks/nuclear.pdf>

Nuclear Power: Friend or Foe?

WHAT STUDENTS SEE:

Research Questions

After you have reviewed the research sources, answer the questions below. Your answers to these questions will be scored. Also, they will help you think about the sources you have read and viewed, which should help you write your report. Answer the questions in the spaces provided below each question.

1. From the sources you have reviewed, summarize 3 major arguments that support, and 3 major arguments that oppose, the use of nuclear power for generating electricity. For each of the arguments, cite at least one source that supports this fact or point of view.

Argument/Fact in Favor of Nuclear Power	Source Supporting This Argument
1.	
2.	
3.	
Argument/Fact in Opposition to Nuclear Power	Source Supporting This Argument
1.	
2.	
3.	

2. Evaluate the credibility of the arguments and evidence presented by these sources. Which of the sources are more trustworthy and why? Which of the sources warrant some skepticism because of bias or insufficient evidence?

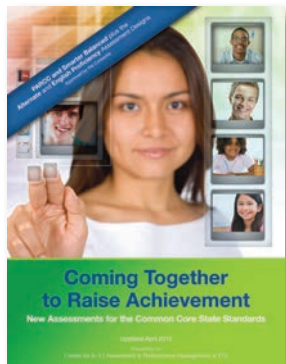
Answer:

Write a Report

Write an argumentative report that recommends the position that your congresswoman should take on the plan to build a nuclear power plant in your state. Support your claim with evidence from the Internet sources you have read and viewed. You do not need to use all the sources, only the ones that most effectively and credibly support your position and your consideration of the opposing point of view.

Answer:

For a description of the new assessments being developed by the Assessment Consortia and the role Performance Tasks will play in them, go to www.k12center.org and download “Coming Together to Raise Achievement: New Assessments for the Common Core State Standards.”



multi-part Performance Task developed by the Smarter Balanced Assessment Consortium. The Grade 11 task “Nuclear Power: Friend or Foe?” simulates a real-world work assignment by asking students to imagine they work for a member of the U.S. Congress and have been given the job of researching the pros and cons of nuclear power. In a compressed time period like those they could experience in the work world, they must use their research to write a report advocating support or opposition. The task is available to educators on the Smarter Balanced website, along with examples of the types of student work that might be expected within the Performance Task component of the new state assessments that will begin in the spring of 2015.

The two-part task is preceded by a 20-minute classroom activity designed to create a common baseline understanding of the topic. Students explore various aspects of nuclear

power and analyze data supplied in a pie chart of current sources of power in the U.S. In the first part of the Performance Task, students are then given 50 minutes to read, analyze and take notes on several sources of information provided in a simulated Google web search. In a graded note-taking chart, they are asked to summarize points in favor of or in opposition to nuclear power, cite a source for each point and evaluate the credibility of each source.

In the second part of the task, students are given 70 minutes to review their notes and sources and then plan, draft and revise an argumentative report either supporting or opposing the construction of a nuclear power facility in their Congressional district.

Scoring for both parts is based on rubrics that are available to students during the task.

With two parts, an introductory discussion and a total running time of 140 minutes, this sample Performance Task is “one of the most ambitious that you’ll see at any of the grade levels” from the two assessment consortia developing new test items, Shanahan notes. “It’s certainly not multiple-choice anything.”

Not all Performance Tasks used in the annual assessments will be as complex as “Nuclear Power.”

However, the task’s component parts zero in on research, writing and critical thinking skills stressed by

the Common Core — and provide a strong model for how to make classroom instruction more rigorous and aligned to postsecondary expectations.

“I think this could be very appropriate for 11th grade students if the instruction has prepared them for it,” Mullins says. “Your upper level classes or your AP classes could take this and roll right now, but there’s got to be a lot of time and instruction to get the average student to be able to perform well on this.”

“I think this represents where we want students to be,” Dunton adds. “It’s a good target to be shooting for but ... helping teachers understand how to do this with all students is the critical transition issue. It’s not that students can’t do it, but we really have to create a cultural mind shift to help everyone understand this is for ALL students.”

“We talk about getting our students there,” Mullins stresses, “but we have to get our teachers there first.”

Close reading skills and critical thinking will be especially important in the research portion of the “Nuclear Power” assessment by virtue of the sources provided in the simulated web search.

To gauge the validity of the sources, students have to read (and listen) carefully to the print and video resources, and even do a little sleuthing to get a full picture.

For example, of the possible sources shown in the illustration on Page 21, one is Wikipedia, which seems objective but is group-sourced by the public. Another is a video of a NASA official giving an opinion, but no supporting evidence. Two are letters to the editor from the public. One is a CNN-TV report. And one, which looks like a straightforward economic analysis, turns out to be from a Libertarian website, with a distinct point of view.

Mullins likes that the task supplies a research chart to help students navigate, organize and assess the information.

“I think that’s one of the strong pieces of this,” she says. “Even as big as this task is, it is broken down and scaffolded. I think students will respond to that once they’ve had the instruction on how you don’t just jump in, don’t just read it and start writing about it. It says ‘let’s critically think about it, get some notes and decide what is the most important information.’ I like that.”



Carole Mullins

Carole Mullins is an English/ Language Arts content specialist for the Kentucky Department of Education. A 29-year educator, she is a former National Board Certified English teacher, high school administrator and co-director of the Mountain Writing Project.



“Absolutely,” Dunton says. “I think this is great to inform instruction. It’s what we need to inform classroom practices.”

In the writing portion of the assessment, students are assessed on traditional aspects of writing: statement of purpose, focus and organization, use of accepted conventions of grammar and usage. But unlike many past writing assessments, students must cite evidence from multiple texts, rather than writing “on demand” from a prompt and expressing opinions or previous knowledge.

“They’re giving explanations of how they drew a particular inference, why they drew that conclusion or how they connected up information,” Shanahan says. “They’re using information from the text to explain and support their judgments. Students have to be able to not only interpret what the author says but respond critically, compare a text to other texts, and analyze the craft and structure of a text.”

That ability is important because nearly every job in the 21st century is changing to require a greater

degree of reading and writing ability — from game wardens who have to read changes in law, to police who have to file reports from their squad cars, to mechanics who need to read detailed manuals and do online research.

“You can’t tell me there’s anybody who is going to survive and earn a livable wage that is not going to need these skills,” Dunton says.

Consumers will need those skills, too.

“It’s not uncommon that someone needs to collect information and write a letter to their insurance company,” Shanahan says. “If you want to participate in this society effectively and not get ripped off or lost, you’re going to have to be able to do these kinds of things.”

Teachers, too, are facing change in the way they do their jobs as they work to help students meet the literacy needs of the workplace.

“This process we are going through today represents a shift in our industry not unlike what has happened in other industries,” Dunton says. “In Maine when we lost a lot of manufacturing jobs, folks who used to work on factory lines in shoe mills had to be retrained to support a knowledge economy.

“Now all that shift in the wider world is catching up to us in the field of education,” she adds. “Retraining teachers and supporting them and shifting the way they do their work is not unlike retraining in all those industries that have been devastated by the economy, technology or other things.”

Change will not come immediately, and it will take a sustained effort. But our teachers know it’s the right thing for us to do,” Mullins notes. “We’re taking our kids in the right direction.”

GRADE 11 | CLASSROOM TASK

The Smarter Balanced classroom task “Nuclear Power: Friend or Foe?” provides a rubric students can use to evaluate the credibility and reliability of the sources provided in the simulated Internet search. The rubric, which is not graded, provides scaffolding support for the close reading and critical thinking required for successfully performing the task.

Nuclear Power: Source Assessment

WHAT STUDENTS SEE:

Research Source	Published by...	Arguments for Nuclear Power	Arguments against Nuclear Power	How reliable is the evidence from this source?

In elementary school, fewer concepts but greater depth to achieve focus, coherence, and rigor

With adoption of the Common Core State Standards for Mathematics, elementary students will learn fewer math concepts in each grade, but will study them in greater depth and detail in order to develop stronger foundational understandings. Starting in elementary school, these standards will provide greater focus, coherence, and rigor in mathematics learning than students have typically experienced in the past. Sometimes a concept will be taught at an earlier grade level. To help parents, teachers, school boards, legislators and other policy makers better understand the impact of the Common Core and the new multi-state assessments being developed, the Center for K-12 Assessment & Performance Management at ETS assembled a team of elementary level math experts to explore the ramifications of the new standards by looking closely at three tasks that illustrate important topics and features of the Common Core. The participants were:

- Karl-Henry Romain, a math specialist who is training teachers in Grades K-5 in Common Core mathematics for the Little Rock, AR, School District.
- Rebecca Rosen, a third grade teacher at Whitney Avenue Elementary School in the San Juan Unified School District, in Sacramento County, CA.
- Kristin Umland, co-chair of Illustrative Mathematics, a non-profit initiative seeking to provide high-quality mathematics tasks to support the implementation of the Common Core.

Starting in elementary school, the Common Core Standards for Mathematics were designed to help students develop the mathematical foundation they will need to succeed both in school and in life.

“In the past, US standards and curricula were famous for being ‘a mile wide and an inch deep,’” says Kristin Umland, a university mathematics professor involved in the development of Common Core support materials. “When we try to cover too wide a range of material, we leave students without any depth of knowledge. When they move to the next grade they often don’t have a solid foundation to build on. By focusing on fewer mathematics concepts at each grade level, the Common Core will help break this cycle.”

This focus will be particularly apparent in the early elementary grades. In some states, teachers in Grades 1 through 3 will address half the number of topics they have been responsible for to date, giving twice as much instructional time per topic to ensure students reach the deeper conceptual understandings required by the Common Core. This change mirrors the degree of focus seen in the top-performing countries in the world and will require significant instructional shifts for teachers.



Kristin Umland

Kristin Umland is an associate professor in the Department of Mathematics and Statistics at the University of New Mexico. She is co-chair of Illustrative Mathematics, a community of teachers, mathematicians and mathematics educators working to illustrate the Common Core State Standards in Mathematics.

Another shift in instruction will be greater emphasis on how things “fit together” in mathematics — the “coherence” stressed by the Common Core. When too many topics are covered in a superficial way, as was the case in the past, “it doesn’t seem to students that there is a coherent picture for what they are doing,” Umland notes. “The Common Core is designed to help teachers and students develop and understand mathematics as a story that unfolds and gets richer through the grades.”

Having too many topics per grade level often means that students don’t have the time needed to integrate their knowledge and skills or sufficient opportunity to practice applying that knowledge and skills to complex, real-world problems. With the rigor of the Common Core, students will still learn the computational skills at the heart of past instruction, but they will be required to demonstrate deeper levels of mastery of the underlying mathematics and to solve application problems. This will better position them for success in college, careers, and life in general. “It’s like the rigorous training of a soccer player,” Umland explains. “If you are a soccer player getting ready to play in a tournament, you don’t just do ball skills, don’t just run sprints, don’t just do scrimmages. You do all these things to get ready to play the game. That is the sense of rigor we mean in Common Core.”

The Power of the Number Line

If math is a story, the number line is an important thread of the plot. Students encounter this fundamental tool in early elementary grades and if students truly understand it, it can help carry them through topics as diverse as fractions and decimals, middle and high school algebra, calculus and beyond.

It is also essential to success in secondary and post-secondary science courses.

“The number line lays the foundation for work in middle and high school,” Umland says, “because all graphing takes place in a coordinate system, and the coordinate axes are number lines.”

To illustrate the importance of the number line in math instruction, the team examined a fairly simple yet powerful task designed by PARCC for Grade 3 (see illustration at right). The computer-based task asks students to drag and drop several fractions into the correct positions on an interactive number line, rather than choosing from multiple-choice answers.

“The power of this task is that students can see fractions as numbers,” says Karl-Henry Romain, a 16-year educator who serves as the math specialist for Grades K-5 in his district in Arkansas. “Students... can count by unit fractions to find fractions in the same way they count by ones to find a whole number. They can see the size of the fractions as they count the unit fractions that make them. With the number line, they can see how numbers relate to each other.”

“For many students, fractions are thought of as slices of pizza,” Umland adds. “The number line is a representation that helps move them from the idea of a fraction being pieces of a whole to understanding that fractions are real numbers. This is an example of the coherence of the standards,” Umland says. “The number line will carry students through the rest of their school career in a way that just working with slices of pizza can’t.” Helping teachers introduce more powerful representations also will support students to deepen their understanding.

“The number line is a powerful tool that stretches from here to where we want to go with math,” Romain notes. “That students are using and manipulating this tool in this task is powerful. It is a manipulative that is able to show the mathematics.”

This task also illustrates how technology will be used in the new multi-state assessments to engage students and to minimize the extent to which students can guess correct responses, both of which lead to a more accurate measure of the student’s understanding. At the same time, there will be a period of adjustment to taking the online tests, particularly for students who do not have ready access to such technology at home, notes Rebecca Rosen, a third grade teacher at a California elementary school that serves a large population of English language learners.

“It’s just a learning curve,” she says, “but it’s the wave of the future. I’m teaching my four-year-old to write on a tablet. They have to learn to do this. ... It’s just going to take time.”

To ease the technology challenges, Umland notes, free online software can be used to give kids practice and exposure to the kinds of interfaces they might see in electronic testing. She says, “These are things we have to be conscious of and proactive about — we want to be sure that we are assessing what students know about mathematics and not whether they have access to technology at home.”

And everyone needs to realize that measures of mathematical proficiency will be lower in the first few years that the Common Core aligned assessments are being implemented. Because the standards are recognized as being more demanding than previous generations of state standards, it will take a few years for teachers and the parents and community members who support them to figure out how to help students meet the new standards.

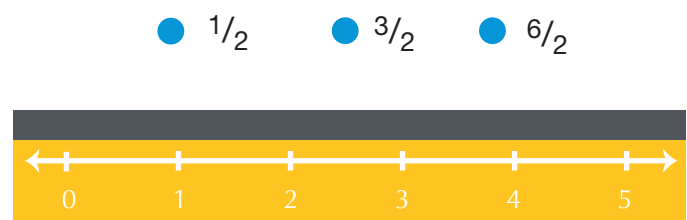
GRADE 3 | ASSESSMENT TASK

If students don’t have a robust understanding of number lines, they will run into challenges in their subsequent math classes. The representation of fractions as numbers on the number line is also a valuable tool that lays the foundation for work in middle and high school, because all graphing takes place in a coordinate system, and the coordinate axes are number lines. This task from the PARCC Assessment Consortium illustrates an effective approach to helping students understand fractions (an area that many students struggle with), the potential for technology enhanced items and rigor. Note that the design of this item, while simple, does not allow for guessing the correct answers.

The Number Line

WHAT STUDENTS SEE:

Drag each fraction to the correct location on the number line.



The fraction number line task is adapted from a task available at <http://illustrativemathematics.org>

For more item specific information visit: <http://parcconline.org/samples/mathematics/grade-3-mathematics-number-line>

“In all honesty, test scores are not going to be what we want them to be at first,” Rosen says. “It’s going to take a couple years. People need to not judge it in the first years, but give it time.”

Fraction Number Sense

Another important facet of the Common Core Standards are the Standards for Mathematical Practice. These eight standards address the processes, proficiencies, and habits of mind that are necessary for students to be successful at math — knowing when to use the right mathematical tools, creating mathematical arguments, and persevering to solve challenging problems. Two key proficiencies stressed by the Standards for Mathematical Practice (see Page 43) are the ability to reason abstractly and quantitatively and the ability to solve mathematical problems based on real world contexts.

Both were evident in a new Grade 4 assessment task the team examined that involves fraction addition and the development of “fraction number sense.” Developed by the Smarter Balanced Assessment Consortium, the task challenges students to determine how many juice bottles they should put into each of three bags so the weight will be in a



Karl-Henry Romain

Karl-Henry Romain is a K-12 curriculum specialist for the Little Rock School District in Little Rock, AR. He has a bachelor’s degree in computer science and a master’s in secondary math education. He has worked in the field of education for 16 years.

particular range if each bottle weighs $3\frac{5}{8}$ pounds (see illustration below). The task is made more challenging by the fact that some weight ranges are not possible.

“This is a question I liked a lot,” Rosen says. “They need to know mixed numbers as well as fractions and there are all the different steps involved in getting an answer. For my students, it would be engaging, and that is one of the things we need to be aware of with the new tasks — getting students’ buy-in. I like that there are multiple [questions to] answer, and you have to read the fine print. My students are going to want to put a bottle in the first bag” — even though it can’t be done within the required weight range.” (Note that 1 bottle weighs too little and 2 bottles weigh too much for the first bag.)

GRADE 4 | ASSESSMENT TASK

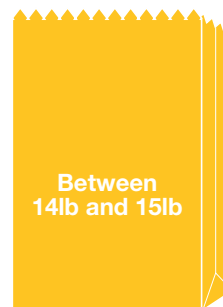
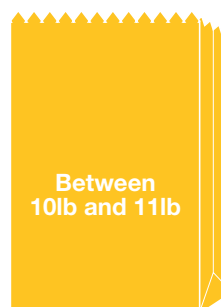
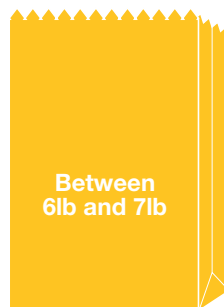
Items that help students apply mathematics to the real world are important to discuss. This task developed by the Smarter Balanced Assessment Consortium is significant not so much because it is a complex application problem, but because it requires students to have “fraction number sense.” The focus here is to both add fractions and mixed numbers and to understand the approximate magnitude of the result.

Fraction Sense

WHAT STUDENTS SEE:

Jared is testing how much weight a bag can hold. He plans to put juice bottles into three bags. He wants each bag to have a total weight within the given range.

- Drag juice bottles into each bag so that the weight is within the given range.
- Leave the bag empty if the given range is not possible using juice bottles.





One of the things teachers and others need to know about the Common Core is that math concepts may be introduced in earlier grades than they have in the past. For example, this task calls on “fraction number sense” – not only the ability to add fractions and mixed numbers but also an understanding of their approximate magnitude. This will be new in many fourth grade classrooms and will take some adjustment in the scope and sequence of the curriculum, as well as lesson planning. But it will make for stronger instruction overall, Romain feels.

“I like the choice of numbers here,” Romain says. “If students understand estimation and see that $\frac{5}{8}$ is a little more than half, they can figure it out. This gives a truer indicator of whether a student understands addition and multiplication of mixed numbers, instead of just checking off A, B, C or D and having a 25 percent chance of guessing correctly.”

For Umland, “If you understand fractions as numbers and not just parts of objects, you can really start to do the kind of estimation this task requires. That ability is incredibly important and one surprisingly few students in the United States develop. A lot of kids get to high school and can’t estimate with fractions.”

Another strength of this task is that because of its design, it can provide teachers with more insight into what students do and do not understand, Umland says. “If they put two bottles in the first bag and three in the second and four in the third, maybe they just made a little mistake but they generally got the right idea. But if they put five in the first bag and nothing in the others, they really didn’t understand what to do.”

Rosen likes the fact that new tasks will give teachers richer feedback, but she worries that students confronting a more complex task “may give up early and not take the path all the way to the end. They may say ‘OK, so none will fit in Bag 1 but three will fit in Bag 2’ and be done with it.”

“In the past, our standards and curriculum have tended to be a mile wide and an inch deep. By trying to cover a wide range of material, we leave kids without any depth of knowledge. When they move to the next grade they don’t have that solid foundation to build on.”

*—Kristin Umland, co-chair,
Illustrative Mathematics*

That possibility is exactly the reason the Common Core include Standards for Mathematical Practice as well as Content Standards, Romain notes.

“The Practice Standards are embedded into these problems,” he explains. “The first Practice Standard is to ‘make sense of problems and persevere in solving them.’ ... We’re not just teaching content but teaching the habits of mind for being successful at mathematics.”

Properties of Multiplication, and More

One of the goals of the Common Core Mathematics Standards is to develop students who can approach problems using different strategies and apply their understandings of mathematics to solve them. To explore how this would work, the team examined a task that could be used by teachers during instruction to determine what their students understand about multiplication, area, place value, and properties of operations (see illustration on Page 29). Developed by Illustrative Mathematics, the task “Karl’s Garden” asks students to determine which of two gardens is larger in area.

“While the statement of the problem in Karl’s Garden is very simple, this task has been designed to identify a fairly common misconception about the distributive property,” Umland says. Students may incorrectly assume that since the perimeters of the two gardens are equal that the areas must also be equal.

The design of the task not only challenges students to devise a strategy for finding the solution; it also provides an example of a visual representation of the mathematics that can be used to build generalized understandings of the distributive property.

“For me, the focus of this task is the decomposition of numbers,” Romain says. “With this problem, we start looking at why we decompose, how decomposition connects with our properties of operation and how understanding these properties of operation connects with algebra.

“I might give this task and tell the students I want them to develop solutions without using calculators or computing area. I would like them to have a discussion of other ways to attack this problem, to study the visual representations of the gardens, and to then explain why the distributive property is different than the associative property. That’s the difference now; we’re teaching mathematical thinking.”

Observers might be surprised to learn that some of this mathematical work was not typically required until middle school but is considered a 4th grade competency in the Common Core.

“We know it is important for students who are learning about multiplication to be able to relate it to area.



Rebecca Rosen

Rebecca Rosen teaches third grade at Whitney Avenue Elementary School in Sacramento, CA. She has a multiple subject teaching credentials and has taught second, third and fourth grades. She holds a master’s degree in curriculum and instruction with a focus in the arts.



This task is also an example of how important it is for students to reason when solving problems instead of memorizing a bunch of unrelated facts. This comes back to the idea of coherence: if you understand a few basic principles, you can use them again and again. You see that these principles work individually and can also be related together,” says Umland.

For Rosen, the task provides an opportunity for teachers to gauge students’ ability to strategize and to see how they work out an effective approach.

“If I were teaching this, I would present it and literally throw it out there with no background and see what they come up with,” she says. “Then I would give them a little more to bite off with hints, and see where they go with the discussion.”

“I would have the kids build it with blocks or graph paper to move them to a visual model,” Romain notes. “I would tell them ‘build Karl’s Garden and then show me the area with an equation.’ Then we could connect it to the distributive property.”

Another asset of the task, for Umland, is how it connects with the Common Core Standards for Mathematical Practice.

“One of the Practice Standards is to use appropriate tools strategically,” she notes. “A lot of people think this means using calculators, but it is much bigger than that. It means all the mathematical tools and other supporting tools” such as physical manipulatives and visual representations.

“The Common Core is really explicit about using pictures and diagrams to represent computational problems,” she says. “If students have that expectation from kindergarten on, it becomes part of their repertoire, their tool kit.”

“I like that with the Common Core students are asked to explain their thinking,” Rosen says. “What is your reasoning for that answer? Some students can’t verbalize it, because it’s difficult for them. But this is something they will have to do. This formative task is real life.”

GRADE 4 | CLASSROOM TASK

While the statement of the problem is very simple in this task created by Illustrative Mathematics, the item has been carefully designed to identify a fairly common misconception related to properties of multiplication, providing both actionable information back to teachers and an opportunity to draw students into a discussion of the larger mathematical properties. The connection here between multiplication and area is seen at an earlier grade than it had been in many states and brings states that have adopted the Common Core in line with the highest-achieving countries. The Common Core expect not only strong computational skills but a deeper understanding of mathematics by students and the ability to apply their knowledge and skills to real-world situations.

Karl's Garden

WHAT STUDENTS SEE:

**Karl's rectangular vegetable garden is 20 feet by 45 feet, and Makenna's is 25 feet by 40 feet.
Whose garden is larger in area?**

Task Commentary for Teachers

The purpose of the task is for students to solve a multi-step multiplication problem in a context that involves area. In addition, the numbers were chosen to determine if students have a common misconception related to multiplication. Since addition is both commutative and associative, we can reorder or regroup addends any way we like. So for example:

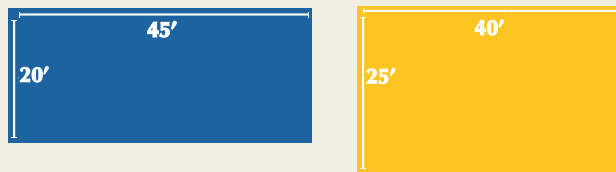
$$\begin{array}{ll} 20 \times 45 = 900 & \text{Karl's garden is 900 square feet} \\ 25 \times 40 = 1,000 & \text{Makenna's garden is 1,000 square feet} \\ 1,000 - 900 = 100 & \text{Makenna's garden is 100 square feet larger than Karl's garden} \end{array}$$

Sometimes students are tempted to do something similar when multiplication is also involved; however this will get them into trouble since $20 \times (5+40) \neq (20+5) \times 40$.

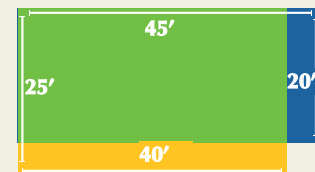
If students happen to display this misconception, then pictures can be used to help them understand why the areas are not equal.

Solution with Pictures

If we draw pictures to scale, we can see this difference visually. First, draw the two rectangles to represent the two gardens; the blue rectangle represents Karl's garden and the yellow rectangle represents Makenna's garden.



Now, draw them overlapping. In the picture at right, the green region shows where the rectangles overlap, the blue strip on the right shows the part of the blue rectangle that is not overlapped by the yellow rectangle, and the yellow strip on the bottom shows the part of the yellow rectangle that is not overlapped by the blue rectangle:



Note that the blue strip is 20 feet by 5 feet and has an area of 100 square feet. The yellow strip is 40 feet by 5 feet and has an area of 200 square feet. Since $200 - 100 = 100$ we know that Makenna's garden is 100 square feet larger than Karl's garden.

In middle school, concepts and practices will be applied to more complex and abstract problems

In mathematics, the middle school years are a crucial time of transition for students. In Grades 6-8, students take the concepts and practices they have learned in elementary grades, apply them to increasingly complex and abstract problems, and lay the groundwork for mastering the higher level mathematics they will encounter in high school. To explore the impact of the new standards at this key transition level, a team of middle school math experts examined three assessment tasks representative of the new expectations. The participants were:

- Jamie Fitzhugh, chair of the mathematics department and a math teacher at P.S. duPont Middle School in the Brandywine School District in northern Delaware.
- Shelbi Cole, director of mathematics for the Smarter Balanced Assessment Consortium, which is developing assessment tasks for 25 states.
- Kristin Umland, co-chair of Illustrative Mathematics, a non-profit initiative seeking to provide high-quality mathematics tasks to support the implementation of the Common Core.

Because middle school is such a key transition time, the principle of “coherence” stressed in the new Common Core State Standards for Mathematics is especially important.

“One of the most important things the Common Core has done is paint a coherent picture of K-12 mathematics,” says Kristin Umland, an expert in the Common Core State Standards for Mathematics. “It shows that math is a story that unfolds across the years, that there is meaning to it, that ideas fit together. Everything works together as part of a bigger whole.”

Coherence is one of the three pillar principles of the Common Core, along with greater focus on fewer concepts at each grade level and a rigorous balance of conceptual understanding, procedural fluency, and mathematical applications. To illustrate how these principles will affect middle school math, the team discussed three tasks related to ratios and proportional relationships, one of several domains in the middle school math standards.

The tasks, Umland says, were chosen because “they embody the principles of focus, coherence, and rigor well,” she says. “They are all related to the ratio/proportionality domain, but they show the variety of ways in which students are expected to understand, represent and apply the concepts described in that domain.”

Putting the Pieces Together

With the Common Core, students in middle school math classes are expected to use all the concepts and practices they have learned, attack problems from different angles and apply what they know to solve real-world challenges. They must realize that some problems may yield more than one correct or valid answer and that many problems can be solved in more than one way.

To see how this would play out in a classroom setting, the math team examined a Grade 6 performance task developed by Smarter Balanced called “Taking a Field Trip.” (see illustration on Page 31).

In this task, students are asked to sort through a variety of factors to plan a field trip for their class. In choosing among three potential sites, students must consider distance, admission fees, cost of transportation and student preferences. They are asked to factor in a subsidy from the school that would pay the first \$200 of any trip, and at the end to summarize both their recommendation and reasoning in writing in a note to the teacher.

“This task is one of our more interesting ones,” says Shelbi Cole, director of mathematics for the Smarter Balanced Assessment Consortium. “What we often find when you write a rich task like this is that you start out writing for fourth graders and it becomes a sixth or seventh grade task. ... One of the clear messages is that what students learned in prior years is important. We’re interested in seeing what students understand about the math and how to apply that in a new context.”

“When I looked at how this task connected to the ratios and rates in the end, that piece of it alone seemed kind of simple,” says Jamie Fitzhugh, a math teacher and department chair at a middle school in Delaware. “But in the context of this problem, the larger task relates to the Mathematical Practice Standards — what does the problem mean, how do



Jamie Fitzhugh

Jamie Fitzhugh, a teacher of mathematics for 18 years, currently teaches at PS duPont Middle School in Wilmington, DE. He holds both a B.A. in secondary mathematics education and a M.Ed. in curriculum and instruction from the University of Delaware.

GRADE 6 | PERFORMANCE TASK

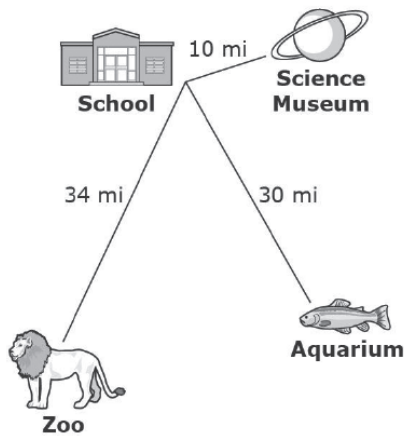
Performance tasks such as this item from the Smarter Balanced Assessment Consortium challenge students to apply their knowledge and skills to respond to real-world problems, a requirement of the Common Core State Standards. They can best be described as collections of questions and activities that are coherently connected to a single theme or scenario. These activities are meant to measure capacities such as research skills, complex analysis and the ability to clearly explain one’s reasoning, which cannot be adequately assessed with traditional selected- or short constructed-response items, but which are essential skills for today’s students to develop. Performance tasks will be part of the summative assessments for students in Grades 3-8 and high school for both Smarter Balanced and PARCC. Performance tasks will also be administered as part of optional assessments given during the school year – within the PARCC Mid-Year Performance Task and the Smarter Balanced Interim Assessment System. The performance tasks can be delivered by computer and will typically take one to two class periods to complete.

Taking a Field Trip

WHAT STUDENTS SEE:




Your class and your teacher are going on a field trip. There are three possible choices for the field trip: an aquarium, a science museum, or a zoo. Your teacher asked students to write down their first and second choices. In this task, you will determine where the class should go on the field trip based on the survey results and the cost per student.

This is a map of your school and the three different field trip locations.



A survey of the 30 students in the class detailed each student’s first and second choices for the field trip and those results were displayed in a chart given to the students. The survey found that 12 students listed the Zoo as their first choice for the field trip, 10 listed the Science Museum as their first choice, and 8 listed the Aquarium as their first choice. The survey also found that 13 listed the Aquarium as their second choice, 11 listed the Science Museum as their second choice and 5 listed the Zoo as their second choice. To see the chart of their individual responses, visit the website listed at right.

1. Based only on the results of the class votes, where would you recommend the class go on the field trip? Show your work or explain how you found your answer.
2. Now we will think about the costs of the trip. How much will each student pay to go on each trip? Show your work or explain how you found your answer.

	 Aquarium	 Science Museum	 Zoo
Distance from School (one way)	30 miles	10 miles	34 miles
Bus Charge	\$6 per mile	\$6 per mile	\$6 per mile
Entrance Fee	\$6 per person	\$10 per person	\$2.50 per person

Here are some more facts about the trip

- The teacher and parent helpers do not pay an entrance fee.
- There are 30 students in the class.
- Only 1 bus is needed.
- The bus charge is for the entire busload of students (not for each student).
- Each student will pay the same amount.
- The school fund will pay the first \$200 of the trip.

3. Daniel thinks that it will cost less to go to the zoo because the entrance fee is only \$2.50 per person. Explain why you agree or disagree with Daniel’s thinking.
4. Write a short note to your teacher stating where you think the class should go on its field trip, based on how you would evaluate all the different factors, including student votes, costs, distance, and what you think would be fun.

To view commentary on this task, modeling tips for teachers, the scoring rubric and the Common Core standards it supports visit <http://www.smarterbalanced.org/wordpress/wp-content/uploads/2012/09/performance-tasks/fieldtrip.pdf>

you organize your strategy, how do you persevere to find a solution.”

Middle school students will see more and more of that with the Common Core, in tasks that require them to take a “stereoscopic” look at problems from different perspectives.

The four parts of the “Field Trip” task show how that would look and work.

“In the first question, students are digging into the data and responding to a single variable,” Cole notes. “By the last question [in which students are asked to make and justify a recommendation] they are dealing with multiple variables. In between it focuses on the major work of Grade 6, analyzing cost and looking at cost as a variable — things students would experience in the real world.”

“Students have to justify their answer, indicate what they were thinking, how they reached their conclusion,” Fitzhugh says. “That is very positive in this task. ... By middle and high school, students are resistant to communicating in math classes. They don’t want to talk. But with this you have to build a logical argument that supports your conclusion.”

“One of the key things for parents and students to realize about the Common Core is that there are multiple ways to think about something in math. A good question parents can always be asking children is ‘Can you show me another way to solve this problem?’ Are there other ways to think about it?”

— Shelbi Cole, director of mathematics,
Smarter Balanced Assessment Consortium

This will require a shift in classroom instruction, Fitzhugh notes, but that is a good thing.

“We are going to have to emphasize that the reasoning is as important as any answer,” he says. “We have to train them not to just come to a conclusion but to explain what they are basing that on.”

While reasoning is essential to developing a deeper understanding of math, it presents practical challenges for scoring tasks and assessments.

The written portion of the “Field Trip” task, for example, would need to be hand scored, Cole says, as would aspects of the task that would award partial credit for some answers.

“That would be a big change in Delaware, where we are now totally computer scored on state tests,” Fitzhugh says. “These types of opportunities are important, but the challenge is how do you score it?” Over the past twelve years, as No Child Left Behind increased the amount of testing required and the economic recession strained state budgets, many states removed test items requiring human scoring in order to reduce costs. By pooling their resources and expertise, states expect to be able to assess more complex skills while controlling costs.

Cole reports that rubrics are being developed to guide the scoring of written answers or those for which partial credit might be awarded.

And advances in technology are making it possible to electronically score short responses that combine English vocabulary with math symbols and numbers. “We really want to allow for multiple acceptable responses,” Cole says. “We will be able to award partial credit for a wide range of student responses.”

“It’s rigorous,” Fitzhugh says of the new approach. “We’re having students working to a purpose, not just taking numbers, writing out a calculation and moving on. These tasks require students to show what they can and cannot do.”

Fractions and Proportional Relationships

In K-12 mathematics, ratios and proportional relationships play a “pivotal” role for students. “Ratios and proportional relationships really bridge learning from elementary school to high school,” Umland says. “The domain helps students transition from arithmetic in elementary school to algebra, functions and modeling in high school.”

To explore the significance of ratios and proportional relationships in the Common Core, the team examined a Grade 7 task developed by the PARCC Assessment Consortium titled “Spicy Veggies” (see illustration on Page 33).

The task asks students to solve a set of problems involving a mixture of spices used to season grilled vegetables at a restaurant. Students are given the original recipe and the amount of each spice used and challenged to mix three additional batches of different sizes. The task is designed to be given and scored electronically, as students complete an interactive table on which some amounts of spices are listed for each batch. The technology enhancements are simple but are designed so that students cannot just guess the right answers.

“I like the structure of the problem in which students are asked to fill in the blanks,” Fitzhugh says. “I like it much better than a multiple choice question where you could stumble on the answer.”

“It’s certainly straightforward,” Cole adds. “It’s clear what you want students to focus on. It really builds nicely on work students have been doing with fractions in Grade 3 up to Grade 6, though coherence across grades is hard to see in a single task.”

“It’s good for teachers to understand that you can’t just shut out the Common Core standards from other grades,” Fitzhugh notes. “Seventh grade teachers might think that they can shut out things students mastered in sixth grade, but when this type of task comes up, they know they can’t.” In fact, the Common Core standards are carefully sequenced from grade to grade to build students’ understandings of core concepts over time.

For Umland, the strength of the task is that it brings different concepts and skills together for a single purpose, and it zeroes in on the math without asking students to read through a long word problem.

“When I first saw this task, I thought it really was a sixth grade task representing proportional relationships,” she says. “What makes this a seventh grade task is bringing together the expectations for fractions and this idea of proportional relationships.

Bringing these things together is what gives it complexity.”

Because the task asks students to solve for unknown quantities, it lays the groundwork for algebra studies to come. It also serves as a reminder to teachers and parents that familiar skills and concepts still are tested with the new Common Core.

“Parents and teachers need to realize that the mathematics in the Common Core is not brand new,” Umland says. “It’s not reinventing the wheel. What it’s doing is getting students to think about the way that the mathematical pieces fit together, being strategic, sequencing correctly and building to a higher level. Parents need to know we haven’t rewritten the standards from the ground up, but have built on the best parts of past standards.”

While simple on its surface, a task like “Spicy Veggies” can be easily adapted to provide greater challenges, both in understanding ratios and explaining concepts.

A set of fractions with different denominators would make the task more difficult, the team members

GRADE 7 | ASSESSMENT ITEM

This task from the PARCC Assessment Consortium calls upon students to analyze proportional relationships and use them to solve real-world and mathematical problems. It presents a recipe in an atypical way that requires students to demonstrate a deep understanding of proportionality to be successful. Instead of simply listing amounts for each ingredient, the recipe describes how the ingredients are related to the whole. Technology enhancements are simple, but they prevent guessing correct answers while allowing for fast, automated scoring. A second part of the task requires students to reason about how the quantities relate to a specified whole.

To view the second part of the task, learn more about the Common Core Standards it supports and see the scoring guide, visit http://ccsstoolbox.agilemind.com/parcc/middle_5.html

Spicy Veggies

WHAT STUDENTS SEE:

A restaurant makes a special seasoning for all its grilled vegetables. Here is how the ingredients are mixed:

$\frac{1}{2}$ of the mixture is salt

$\frac{1}{4}$ of the mixture is pepper

$\frac{1}{8}$ of the mixture is garlic powder

$\frac{1}{8}$ of the mixture is onion powder

When the ingredients are mixed in the same ratio as shown above, every batch of seasoning tastes the same.

Study the measurements for each batch in the table. Fill in the blanks so that every batch will taste the same.

	Batch 1	Batch 2	Batch 3
Salt (cups)	1		
Pepper (cups)		1	
Garlic powder (cups)	$\frac{1}{4}$		1
Onion powder (cups)			1

Please see the online task at the link above for Part B and for the scoring guide.

observe, and addition of a response question would get students to explain their reasoning and strategies.

“One of the key things for parents and students to realize about the Common Core is that there are multiple ways to think about something in math,” Cole says. “A good question parents can always be asking children is ‘Can you show me another way to solve this problem?’ Are there other ways to think about it?’ That will help students with the Common Core.”

Ratios, Rates, and Slope

If math is a story, then the chapter on proportional relationships is especially rich. Tasks within this chapter connect concepts across grade levels, require cumulative knowledge, and link abstract ideas with concrete challenges drawn from the real world.

“Parents need to know we haven’t rewritten the standards from the ground up, but have built on the best parts of past standards.”

— Kristin Umland, co-chair,
Illustrative Mathematics

Tasks that address proportional relationships should help students connect the numeric idea of rates with the graphical idea of slope. In this way, they will be able to see graphs as telling mathematical “stories” about the content they represent. To explore this connection, the team examined a Grade 8 task developed by Illustrative Mathematics titled “Bike Race” (see illustration on Page 35) that can be used by teachers to see what their students understand about functions, rates, and slope.

In the “Bike Race” task, students are presented with a non-linear graph showing the progress of two riders over a 4-mile race course. The vertical axis represents the distance in miles, and the horizontal axis shows the time elapsed in minutes; the graphs can be used to compare the progress of the two riders. If we look carefully at the graphs, we can see that one rider got off to a faster start but then stopped moving five minutes into the race. The other rider started more slowly, but accelerated to a faster pace and won the race. Students can use their imagination to embellish these facts if they like.

Like many standard problems that ask students to interpret graphs, this task asks students to determine which rider won the race. What elevates the task to another level, however, is a second question that asks students to imagine they are watching the race and announcing it over the radio. They are asked to write a short narrative of the race based on what

they can interpret from the information represented by the graph. “This task can give teachers a lot of information about what their students know,” Umland says. “With the second question, there isn’t one right story, although any story needs to be consistent with the information presented in the graph. It brings functions, rates, and slope all together in a single task. This really is a transitional task between eighth grade and high school.”

For Fitzhugh, the strength of the task is that it requires students to know how a graph represents information and forces students to look closely at a situation where the speed is not constant. “Students have a hard time taking data from a table, putting it on a graph and using it to predict things,” he says. “For comparing linear and non-linear graphs, this graph is perfect. I like it all the way. You want students to notice what is going on in the graph and why it’s not a straight line. It all fits in.”

By asking students to write a narrative of the race, the task not only connects to English Language Arts but also challenges students to craft a plausible interpretation of what the graphs show.

Umland explained that a common misconception students have when looking at a graph like this is that it represents an aerial view of the race, showing two people racing side by side, crossing paths and then ending up 10 feet apart. “This task is moving students toward abstraction by asking ‘what does the graph mean?’ It requires that they understand that a point on the graph represents a distance at a particular time and the slope of a line in this context represents the speed of a bike rider.”

Explaining the reasoning behind answers is central to the Common Core approach, because it reflects the assignments people are given every day in jobs and careers.

“The reason most people study math is to apply it to real problems in the real world,” Umland says. “The Common Core expects students to understand the usefulness of mathematics and prepares them to solve problems.”

Along with instructional changes teachers must incorporate, there will need to be adjustment by



Shelbi Cole

Shelbi Cole is the director of mathematics for the Smarter Balanced Assessment Consortium and responsible for overseeing item writing, item quality, item alignment, item sensitivity, and bias and data reviews. Previously, she served as mathematics education consultant for the Connecticut State Department of Education.

students and parents — and parental support as well.

“A lot of parents had the experience that school math was getting the right answer to a routine problem and being computationally efficient,” Umland says. “Right answers and computational efficiency are important, but with the Common Core we expect more than that.

“Sometimes parents want to take away the heavy lifting

we are asking students to do,” she adds. “They don’t want to see students frustrated and struggling and they think something is wrong if they are. The point is for students to be able to persevere through the confusion and come out the other side with understanding.”

This may be, after all, the most fundamental indicator of readiness for college, careers and adult life.

GRADE 8 | CLASSROOM TASK

This Grade 8 classroom task from Illustrative Mathematics focuses on ratios. It illustrates how the Common Core were written to carefully develop deeper understandings over time concerning the building blocks of mathematics and to require students to clearly communicate their mathematical reasoning and interpretations. This item could be used summatively with some adjustments but is especially strong as a classroom task due to the rich classroom conversations it can be used to evoke.

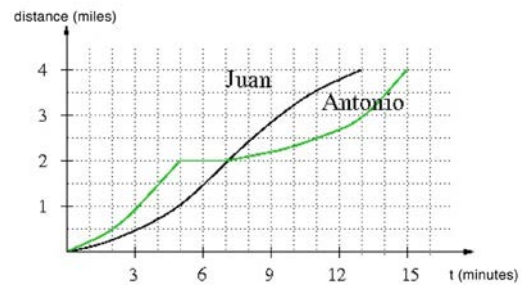
To read commentary about this task, see the Common Core Standards it supports and read a sample answer for its narrative response question, visit <http://illustrativemathematics.org/illustrations/633>

Bike Race

WHAT STUDENTS SEE:

Antonio and Juan are in a 4-mile bike race. The graph shows the distance of each racer (in miles) as a function of time (in minutes).

- a. Who wins the race? How do you know?
- b. Imagine you were watching the race and had to announce it over the radio. Write a little story describing the race.



Commentary for Teachers

In this task students tell a story from a graph. The story unfolds as students interpret slopes, intersection points and selected coordinate points. The task can be used to generate a classroom discussion, small group discussion or even as an assessment item.

Sample Solutions

- a. Juan wins the race. He will have finished the race in 13 minutes while Antonio takes 15 minutes to ride the same distance.
- b. Sample Narrative Response:

Juan and Antonio are off for a 4-mile bike race. Antonio has the early lead. He is picking up speed, pulling away from Juan who seems to have some trouble finding his stride.

Antonio looks like the clear favorite 4 minutes into the race. But wait, he is in trouble now – oh now, he ran off the road and fell off his bike. He seems a bit dazed sitting at the side of the road. Okay, he is getting up

and checking that all limbs are still working. He lost two minutes getting up and dragging his bike out of the ditch, but now he is back on the bike.

Juan had a slow start but he was picking up speed and now is virtually flying by Antonio, just as he is getting back on this bike. Can Juan keep up his newfound speed or will Antonio catch up again? Juan passed Antonio 7 minutes into the race and with 2 miles to go. He is pulling ahead now of Antonio who looks like he is hurting a little bit after his fall and has trouble finding his old speed.

Oh no, Juan is loosing steam and slowing down. Is his advantage big enough to get him over the finish line ahead of Antonio? Yes! He has won the race in 13 minutes and is collapsing into the grass trying to catch his breath after his epic win. Where is Antonio? Ah, here he is coming now, he is speeding up, going really fast as he crosses the finish line at the 15-minute mark, but too late to make a difference in the race.

Bike Race is licensed by Illustrative Mathematics under a Creative Commons Attribution-NonCommercial-ShareAlike 3.0 Unported License

In high school, consolidation and greater focus on mathematical reasoning and applications

High school is a time for students to consolidate the mathematics they have learned in elementary and middle school and to take on new and more sophisticated challenges. With the Common Core Math Standards, students will focus more on mathematical reasoning and applications than they have in the past. Like a woodworker using different tools for different purposes, they will need to determine which mathematical tools and strategies can be used to efficiently solve different kinds of problems in both mathematical and real-world contexts. They will be asked in more rigorous ways than ever to demonstrate that they can not only follow procedures but can determine their own path to a solution and clearly communicate their reasoning. In this chapter, a team of high school math experts discuss three high school tasks that reflect the focus, coherence, and rigor of the Common Core. The participants were:

- Dev P. Sinha, associate professor of mathematics at the University of Oregon and a content leader for Illustrative Mathematics.
- Darren Burris, a high school math teacher and coach at Boston Collegiate Charter School.
- Kristin Umland, co-chair of Illustrative Mathematics, a non-profit initiative seeking to provide high-quality mathematics tasks to support the implementation of the Common Core.

Reasoning About Buying a Car

With the new Common Core Standards, mathematics ideas build over time and tell a coherent story for students. And in that story, high school “is where some of the biggest action takes place,” according to Kristin Umland, co-chair of Illustrative Mathematics. “That is where a lot of the early work pays off.”

To explore the cumulative story of mathematics — what is called “coherence” in the Common Core — the team examined a high school sample task developed by the Smarter Balanced Assessment Consortium called “Buying a Car” (see illustration on Page 37).

In this task, a buyer is shopping for a used car and students are challenged to determine which of two cars is the better deal based on purchase price, gas mileage and costs, estimated repair expenses, and the buyer’s intent to own the car for four years.

While the individual concepts and procedures are things students should have mastered by the end of eighth grade, the complexity of the problem, the reasoning it demands, and its use of a real-world scenario make it the kind of task that can help assess high school students’ progress toward college or career readiness.

“The first thing I like about this task is that it’s something students could encounter in their lives and want to have a solid answer to,” says Darren Burris, a high school math teacher at a charter school in Massachusetts. “It’s a task worth solving. The point isn’t solely to do a series of operations but to determine a better outcome for the consumer.”

And nothing within the problem tells students how to solve it. Even more important, Burris notes, is that “they have to explain their calculations. They have to

justify what they did. They have to apply math in a rigorous way ... to determine something they could encounter in the real world.”

“Motivation is important,” notes Dev P. Sinha, an associate professor of mathematics. It also is a task that has what Sinha likes to call mathematical “juiciness” — challenges “that involve more demands on reasoning, more real-world applications, more modeling,” as these are the types of skills needed throughout life.

For Umland, “This task illustrates the idea of coherence. In a task like this students draw on pieces of mathematics that they understand in isolation, but the new challenge is for them to show how those pieces fit together.”

As a diagnostic tool, the task is constructed in a way that gives teachers a lot of information about students’ mathematical skills and understanding. “You don’t want students to be able to solve it by guess-and-check,” Sinha says. “In this case, [they could] absolutely not. They could guess one way or the other, but not have the reasoning for it. They really have to set up and organize the problem.”

For Burris, the task also dovetails nicely with the new Common Core Standards for Mathematical Practice, which, when integrated with the Content Standards,



Dev P. Sinha

Dev Sinha is an associate professor of mathematics at the University of Oregon and a content leader for Illustrative Mathematics. His training and research are in algebraic topology. His scholarship is internationally recognized and has been supported by the National Science Foundation.

help students develop the habits of mind they need to be successful, such as persevering to solve problems, attending to precision and constructing mathematical arguments.

“The beautiful thing about this task for teachers, parents and the Common Core itself is that it requires students to bring important skills to the forefront to deepen and develop content knowledge,” he says. “They have to organize information, plan and integrate many pieces of information. ...It creates an authentic context where students are required to persevere through a series of steps to solve a problem.”

Coherence also means setting students up for future success. “You can see that this particular task does not require algebra,” notes Sinha. “However, it is a great task for determining readiness for that next level of mathematics. For example, after this task the

teacher could ask, ‘What if Tony is unsure how many years he wants to own the car? Determine for how many years Car A would cost the least and which Car B would.’ Doing that kind of task would really show college readiness.”

Some people question whether all students need to achieve the level of mathematical skill required by the Common Core. “But the types of algebraic skills that the Common Core asks all students to master are very much a part of everyday life,” noted Burris. “The person who has these skills as part of their personal toolkit is better equipped to make wise choices in life.”

Seeing Structure in a Quadratic Equation

For most students, algebra is a major part of their high school math experience. Mastery of its principles

HIGH SCHOOL | ASSESSMENT TASK

This realistic problem-solving task, developed by the Smarter Balanced Assessment Consortium, requires students to thoroughly read information, determine how to solve a multi-step problem, solve it accurately and explain their mathematical reasoning clearly.

Buying a Car

WHAT STUDENTS SEE:

Tony is buying a used car. He will choose between two cars. The table below shows information about each car.

Car	Cost	Miles Per Gallon (MPG)	Estimated Immediate Repairs
Car A	\$3200	18	\$700
Car B	\$4700	24	\$300

Tony wants to compare the total costs of buying and using these cars.

- Tony estimates he will drive at least 200 miles per month.
- The average cost of gasoline per gallon in his area is \$3.70.
- Tony plans on owning the car for 4 years.

Calculate and explain which car will cost Tony the least to buy and use.

Sample Top-Score Response:

For Car A it will cost $\$3200 + 700 + (200 \text{ miles/month} \times 48 \text{ months} \times \$3.70/\text{gallon} \times 1 \text{ gallon}/18 \text{ miles}) = \5873.33

For Car B it will cost $\$4700 + 300 + (200 \text{ miles/month} \times 48 \text{ months} \times \$3.70/\text{gallon} \times 1 \text{ gallon}/24 \text{ miles}) = \6480

Tony will spend less money if he buys Car A.

For full credit (2 points)

The response demonstrates a full and complete understanding of solving problems of this type. The response contains the following evidence:

- The student determines Car A will cost the least.

AND

- The student provides sufficient reasoning to support this conclusion.

For partial credit (1 point)

The response demonstrates a partial understanding of solving problems of this type. The response contains the following evidence:

- The student determines Car A will cost the least; however, the student does not provide sufficient reasoning to support this conclusion.

OR

- The student selects Car B but provides reasoning to support this answer that contains a minor conceptual or computation error.

For more information about this task, visit <http://www.smarterbalanced.org/wordpress/wp-content/uploads/2012/09/math-rubrics/43052Rubric.pdf>

and concepts is essential for moving on to higher mathematics as well as for college and careers. Many people have experienced algebra as a mysterious subject where you manipulate symbols according to a set of arbitrary rules,¹ but this is not an accurate description of what algebra is about. As the natural extension of arithmetic, algebra is the language needed to represent relationships between quantities. One simply cannot describe the mathematical facets of the world without algebra; both physical and social scientists use algebra as a fundamental tool for their work.

With the Common Core, students will still learn many of the terms and procedures that have been used for generations, but they will be challenged as well to think more deeply about algebraic concepts. Most significantly they will develop an understanding of algebra that will enable them to find solutions to novel problems in flexible ways.

To explore how algebra instruction and assessment might look with the Common Core, the team examined a sample assessment task developed by the PARCC Assessment Consortium called “Seeing Structure in a Quadratic Equation” (see illustration below).

Solving quadratic equations has long been a familiar activity in high school Algebra. But the PARCC task does not present the question in the traditional way and rewards alternative ways of solving it.

“This is a very interesting task because it has two very distinct solution pathways, both of which would reflect college readiness,” says Sinha, who has been teaching at the University of Oregon for 12 years. “One is to just expand and move everything to one

side and then use standard methods. The other is to recognize the structure, which allows for a more efficient solution. That is a fairly demanding set of algebra skills and as college faculty we would like to see that kind of fluency.

“The interesting thing about the task,” he adds, “is that it supports a different kind of solution path in which you are asked to recognize the relationship between the quantities in front of you and make the change in variables” to solve it.

“Students will be rewarded for seeing the structure,” Burris says. “By seeing particular structures in an equation, or a particular form or the way the problem is constructed, a student who can see the structure will benefit from doing so because they will be able to solve the problem more efficiently.

“Teachers have been teaching quadratics forever, but this type of questioning points toward developing a different capacity in students instead of crunching out this algebraic manipulation,” he adds. “It’s definitely a signal to teachers to increase the level of critical thinking when teaching an equation like this.”

The ability to see structure is a 21st century math skill that will help students in the increasing number of careers in which engineering and technology skills are important. In the workplace today, the demand is not for workers to perform repetitive factory jobs, but workers who can see the big picture, troubleshoot problems as they arise, and find more efficient approaches. This nimbleness of mind is key to future success, whether students pursue college-level math or not.

It is so important, in fact, that “Looking for and

¹ http://iincs.ed.gov/publications/pdf/algebra_paper_2010V.pdf

HIGH SCHOOL | ASSESSMENT TASK

In this task, developed by the PARCC Assessment Consortium, the given equation is quadratic equation with two solutions. The Task does not clue the student that the equation is quadratic or that it has two solutions; students must recognize the nature of the equation from its structure. Students taking a brute-force approach to this task will need considerable symbolic fluency to obtain the solutions. In this sense, the task rewards looking for and making use of structure.

For more information about this task, visit http://www.parcconline.org/sites/parcc/files/PARCC%20Math%20Sample%20Problems_HS-QuadEquation_0.pdf

Seeing Structure in a Quadratic Equation

WHAT STUDENTS SEE:

Solve the following equation:

$$(3x - 2)^2 = 6x - 4$$

When you are finished, enter the solution(s) below.

Solution 1:

Click to enter another solution, or click



“Making Use of Structure” is one of the new Standards for Mathematical Practice designed to build the habits of mind needed for success by American students in an international economy.

“I think it’s really wonderful to have prototype items like this available now for teachers and have teachers realize ‘Oh, it’s worth our time to promote this kind of reflection ... where you see the relationship of the quantities,” Sinha says. “It’s a signal to teachers of what is worth developing in students.”

For Burris, the form of the task also makes it a more rigorous measure of students’ understanding of the math involved.

In traditional instructional materials “teachers don’t often see a quadratic written in this form,” he notes. “This is a very nontraditional presentation, but if students can see the structure, they are rewarded because they can do the maneuvering necessary to get the answer.”²

The task also requires students to demonstrate understanding because they have to come up with their own answer, rather than “backwards-solving” from multiple-choice options.

“If I give students a multiple-choice exam, students who understand the math concepts will backwards-solve because that is the most appropriate, most efficient strategy,” Burris notes. “Here students don’t have the benefit of knowing that the answer lies in one of the multiple-choice options. They have to work to find the answer.”

That exemplifies the Common Core emphasis on fluency when developing students’ mathematical knowledge.

“We want students who know different approaches to solving problems that are appropriate in different situations,” Umland says. “We want them to be able to do the algebra, but we also want them to be strategic about it. Students should say, ‘I have more than one trick in my bag. Which one is going to pay off for me here?’”

“Fluency means more than just getting the right answer,” she says. “It’s being able to reason your way to the right answer.”

Functions and Modeling

In the real world, mathematics is a powerful tool for making sense of scientific findings, economic trends, and consumer decisions. As algebra gives people the ability to represent and analyze quantities that they encounter in life, functions provide a way to describe the

relationships of different but related quantities and to represent and interpret those relationships visually through graphs.

In the workplace today, the demand is not for workers to perform repetitive factory jobs, but workers who can see the big picture, troubleshoot problems as they arise, and find more efficient approaches.

This is a life skill addressed by the Standards for Mathematical Practice that call for students to model and analyze real-world situations with mathematics. It also can be seen in the task developed by Illustrative

² For further explanation, see http://parcconline.org/sites/parcc/files/PARCC%20Math%20Sample%20Problems_HS-QuadEquation_0.pdf

Mathematics titled “Influenza Epidemic” (see illustration on Page 41).

In this task, students are presented with a graph illustrating the spread of a flu epidemic through a city over the course of 16 weeks. The vertical axis shows the number of people affected, and one can see that the epidemic spread rapidly for the first four weeks before beginning to taper off. In a series of four questions, students are asked to interpret and explain the meaning of both symbols and the graph at various points and relate it to the epidemic.

“Part of the story of coherence of the Common Core standards is recognizing that for certain topics we are able to work with math objects in multiple ways,” Sinha says. “This task shows that a function can be a relationship described in words, a graph or an equation. It’s very explicit about relating the different ways we can interact with a function.”

To Umland, the task demonstrates a key point students need to know about modeling with mathematics.

“They have to organize information, plan and integrate many pieces of information. ...It creates an authentic context where students are required to persevere through a series of steps to solve a problem.”

— *Darren Burris,
math teacher and coach,
Boston Collegiate Charter School*

“Sometimes we use the context to understand the math, and sometimes we use the math to understand the context,” she says. “In this item, students may not have seen a graph showing an epidemic of influenza, but they are using the math to make sense of and understand what is happening during the epidemic.”

In this way, the Common Core seeks to make students lifelong learners who will see math as a useful and powerful tool.

“We want students to go out in the world and take the mathematics they know and say ‘I can use this to understand things I don’t understand yet,’” Umland says.

Once they do that, they will be better prepared to handle challenges in careers, college or even personal life.

“Organizing your thoughts and engaging the world in this way will help you when you are first faced with an



adjustable-rate mortgage,” Sinha notes. “... With an integrated, sustained effort you can say ‘I can reason about that. I can pick that apart and understand it.’”

Being able to use functions to show the relationship between quantities is increasingly important in a wide variety of disciplines.

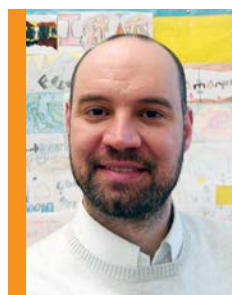
“People use functions to describe phenomena in many disciplines: sociology, psychology, economics, chemistry, physics, biology and many others” Umland says. “So for a wide range of future career areas, as well as lifelong learning in areas of interest and informed citizenship, students will need to be able to accurately interpret graphs of functions.

“This is precisely the kind of thing colleges feel their students can’t do,” she adds. “The hope with the Common Core is that over time students will be coming to college ready to do this kind of work.”

“As college professors, every one of us on campus will be jumping up and down if students are better prepared for that work,” Sinha notes.

This may take time, but the Common Core effort may be aided by students’ growing facility with new technology applications.

“Thirty to 40 years ago only a very small subset of students would have the ability to generate the graph shown in this item.,” Burris notes. “My students are creating graphs like that all the time. Representations



Darren Burris

Darren Burris is a secondary math teacher, instructional coach and department chair at the Boston Collegiate Charter School. At the state level, he is currently a PARCC educator leader fellow for Massachusetts, as well as a member of the Massachusetts’ model curriculum development project.

of data showing the relationships of quantities and the ability to interpret them is rampant. They're using online graphers for tracking everything from entertainment trends to popular Tweets."

"These all illuminate different aspects of college readiness," Sinha says. "Applying knowledge fluently

in context or in abstract settings, being structured, persevering, using math to make sense of the world.

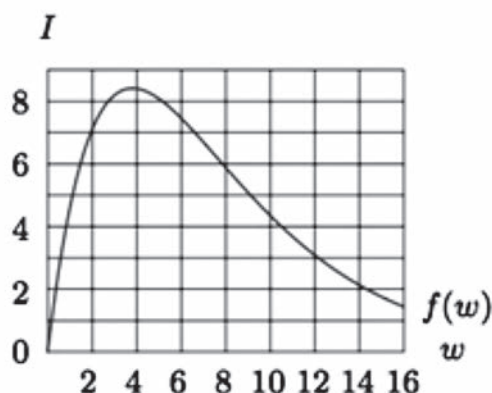
"... Students will be better prepared for postsecondary education and life because we are asking them to do these things."

HIGH SCHOOL | CLASSROOM TASK

This task from *Illustrative Mathematics* addresses functions and modeling and builds upon elementary and middle school students' work on number lines and graphing.

Influenza Epidemic

WHAT STUDENTS SEE:



An epidemic of influenza spreads through a city. The figure below is the graph of

$I=f(w)$, where I is the number of individuals (in thousands) infected and w is the weeks after the epidemic begins.

- Estimate $f(2)$ and explain its meaning in terms of the epidemic.
- Approximately how many people were infected at the height of the epidemic? When did that occur? Write your answer in the form $f(a)=b$.
- For approximately which w is $f(w)=4.5$; explain what the estimates mean in terms of the epidemic.
- An equation for the function used to plot the image above is $f(w)=6w(1.3) - w$. Use the graph to estimate the solution of the inequality $6w(1.3) - w \geq 6$. Explain what the solution means in terms of the epidemic.

(Task from *Functions Modeling Change: A Preparation for Calculus*, Connally et al., Wiley 2010.)

Commentary for Teachers

The purpose of this task is to probe students' ability to correlate symbolic statements about a function using function notation with a graph of the function, and to interpret their answers in terms of the quantities between which the function describes a relationship. It can be used in assessment, or in instruction to bring out some common frailties of student understanding, for example, not really understanding what it means for a point to lie on the graph of a function, and, in part (d), not being comfortable with interchanging a function value expressed in function notation and an expression for the function.

Solution: Influenza epidemic

- To evaluate $f(2)$, we determine which value of I corresponds to $w=2$. Looking at the graph, we see that $I \approx 7$ when $w=2$. This means that approximately 7000 people were infected two weeks after the epidemic began.
- The height of the epidemic occurred when the largest number of people were infected. To find this, we look on the graph to find the largest value of I , which seems to be approximately 8.5, or 8500 people. This seems to have occurred when $w=4$, or four weeks after the epidemic began. We can say that the height of the epidemic corresponds to the evaluation $f(4)=8.5$.
- To find a solution to $f(w)=4.5$, we must find the value of w for which $I=4.5$, or 4500 people were infected. We see from the graph that there are actually two values of w at which $I=4.5$, namely $w \approx 1$ and $w \approx 10$. This means that 4500 people were infected after the first week when the epidemic was on the rise, and that after the tenth week, when the epidemic was slowing, 4500 people remained infected.
- We are looking for all the values of w for which $f(w) \geq 6$. Looking at the graph, this seems to happen for all values of $w \geq 1.5$ and $w \leq 8$. This means that more than 6000 people were infected starting in the middle of the second week and lasting until the end of the eighth week, after which time the number of infected people fell below 6000.

What parents can do to be effective ‘partners in change’ with the Common Core

The new Common Core State Standards will bring changes to classrooms all over the country. Their effect also will be felt in family rooms all over the country, as students and their families adjust to an approach designed to help students be more successful in college, in the workplace and in life. Parents and guardians have a crucial role to play as “partners in change” with the teachers and school leaders implementing this new approach.

So what do parents need to know to be effective partners — and help their children adjust and succeed?

The first thing to realize is that while the Common Core standards are new, they are not reinventing the wheel. The basics will still be taught in mathematics and English Language Arts. Students will still have to master number facts and great literature will still be read.

The key difference is that the work students do will be more challenging. Students will read more advanced works at earlier grades. They will read more non-fiction “informational” text. They will be asked to explain their reasoning with evidence in both language arts and mathematics.

Because the bar is being raised — and students are being given greater challenges — assessment scores will almost certainly be lower initially than scores students recorded on state tests in the past. Families should not be alarmed at this in the first year. One of the goals of the Common Core is to establish a uniform, nationwide “base line” measurement for student performance and achievement.

Lower scores in the first year also do not automatically mean that local teachers have been doing a poor job. More likely, lower scores may reflect that instruction was being targeted to a lower set of standards in previous years.

The new scores on the Common Core aligned assessments will give families a clearer picture of how their children and schools are doing and how they compare with other students and schools across the country. Their children also will not be put at a disadvantage if a family has to move to another state, as the expectations will now be the same, in most cases.

For students, the greater challenges that come with the Common Core will bring greater benefits down the road. Most significantly, students who master the skills stressed by the Common Core will be better equipped to do college level work or get a 21st century job upon graduation from high school.

In college, they will be more able to closely read and analyze the complex texts they will encounter and use math concepts and strategies to develop solutions

to more challenging problems across a wide range of fields.

In the workplace, they will have better math skills for problem-solving, and greater ability to read the non-literary “informational” texts found in most jobs.

Perhaps most significantly, they will have greater perseverance and other “habits of mind” for working through problems and challenges, even when they are difficult or frustrating.

Support Good Habits

So where should parents start to be successful “partners in change”?

Encouraging students to develop the right “habits of mind” would be a good place to begin.

Habits of mind are personal traits, strategies and approaches that help students become better and more successful learners.

They are traits like perseverance when faced with obstacles or difficult tasks — a quality every parent can help develop in children.

With the new Common Core, “The very first Standard for Mathematical Practice is about persevering,” notes Kristin Umland, co-chair of Illustrative Mathematics, a nonprofit initiative to provide quality mathematics tasks that illustrate the Common Core. “Often we find that when things aren’t going well, a lot of kids give up. ... The message to students needs to be that they can solve a problem if they make sense of it and stick to it.”

Another habit of mind parents can support is getting students to “show what they know” with evidence and reasoning. In mathematics the Common Core standards ask students to explain their reasoning and and the approach they used when solving problems of all kinds. In English Language Arts, students must use evidence found in texts to summarize or analyze key points, whether they are speaking or writing.

In this context, “how do you know that?” may be the most important question parents can ask their students to support Common Core learning.

“The more that parents ask follow-up questions the better,” says Gail E. Militello, instructional specialist for K-2 ELA and reading for the Williamsville Central School District in East Amherst, NY. “Why do you think that? How do you know that? Making those questions part of parent-child conversations is so important.”

Such questions will help students build reasoning, observation and analysis skills — and apply to both printed and other types of materials.

“If you’re watching a news report on TV, have a conversation,” Militello says. “What is happening? Why is it happening? What evidence did they present?”

“A good question you can always ask children is ‘Is there another way to think about it?’” notes Shelbi Cole, director of mathematics for the Smarter Balanced Assessment Consortium, which is developing assessment tasks for 23 states. “Figuring out if there are multiple ways to think about a problem in mathematics benefits the parents as much as the children.”

From a child’s earliest years, parents can help develop strong habits of mind by asking questions.

When looking at a photo or picture book, for example, parents can ask “What do you see? What is happening? What might happen next?”

When shopping, they can encourage children to practice mental math for addition or subtraction, show how a food budget works or compare sizes and prices to see which product is a better deal.

When watching television or a movie, they can ask “Why did that character do that? What happened as a result? What does that tell you?”

“Parents should tap into their child’s interests,” Militello says, whether it’s sports, or music, or the space program. They can encourage online or print reading and help them “be more critical thinkers, not just taking things at face value.”

“We’re not just teaching content, but habits of mind,” says Karl-Henry Romain, a math specialist for the Little Rock, AR, School District. “I love the Common Core because of that. Now we teach critical thinking, problem solving ... what it takes to be successful in the 21st century.”

KEY SUPPORT RESOURCES



Families Can Help Build Strong ‘Habits of Mind’

Habits of mind are not the instructional content standards on which students will be tested each year. Instead, they are personal traits, strategies and approaches that every student needs to be successful as a learner. They are expressed in the Common Core as Standards for Mathematical Practice and English Language Arts Capacities. Full descriptions can be found online at <http://www.corestandards.org/Math/Practice> and at <http://www.corestandards.org>.

Habits of Mind for English Language Arts

With the English Language Arts Capacities successful students:

1. Demonstrate independence (as learners).
2. Build strong content knowledge.
3. Respond to the varying demands of audience, task, purpose and discipline.
4. Comprehend as well as critique.
5. Value evidence.
6. Use technology and digital media strategically and capably.
7. Come to understand other perspectives and cultures.

Habits of Mind for Mathematics

With the Mathematical Practices Standards successful students:

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Resources for Parents

Council of Great City Schools <http://www.cgcs.org/Domain/36> Grade-by-grade “Parent Roadmaps to the Common Core.”

National PTA <http://pta.org/parents/content.cfm?ItemNumber=2583>. Grade-by-grade “Parents’ Guides to Student Success.”

Engage NY <http://www.engageny.org/parent-and-family-resources>. “Common Core Parent Toolkit.”



Driving Advances in K-12 Assessment

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A screenshot of the K-12 Center at ETS website. The header includes the logo and the title "Driving Advances in K-12 Assessment" with a search bar. The navigation menu has links for Home, About Us, Publications, Events, News, and Contact. The "Publications" dropdown menu is open, showing options like "All Publications", "The Assessment Consortia", "Measurement Challenges", "For K-12 Educators and Policy Makers", "For the Research Community", "Specialized Publications", and "Alternate Assessment Consortia". A callout box points to "The Assessment Consortia" with the text "Learn more about the six assessment consortia". Below the menu, there are two article teasers: "2nd English Proficiency Assessment Consortium Launched" and "Discussion with Assessment Consortia Leaders: Prototype Items and Tasks". A "Join Our Email List" section is also visible on the left side of the page.



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