NANCY SULLA

IT'S NOT WHAT YOU TEACH BUT HOW

7 Insights to Making the CCSS Work for You

An **Eye On Education** Book

ROUTLEDGE

It's Not What You Teach But How

How do we prepare students to become problem-finders, innovators, and entrepreneurs who can thrive in a global society? The Common Core charts a pathway to success, yet we know that checking off each standard one by one will not achieve the kind of results we want. This powerful book by bestselling author Nancy Sulla has the answers. She explains how teachers can bring students to deeper levels of learning by shifting from the *what* to the *how* of the CCSS. She offers seven insights that you can use to teach the standards in a more meaningful way, to bring all of your students to true understanding and application.

You'll uncover how to:

- **Incorporate ends-based teaching** to ensure that the instructional focus is on the ultimate goal of each standard and not just on the basic skills;
- **Encourage grappling with content** through structured techniques such as problem-based learning, questioning, and simulations;
- **Use cognitive progression**, by understanding how the brain learns, to produce real results;
- **Harness the power of language** in all disciplines, not just in English language arts;
- **Build executive function** in the brain rather than focusing on academic function alone;
- **Increase retention** by using learning and practice activities in different ways and by differentiating instruction; and
- **Become a true facilitator**, not just a responder to students' questions.

Throughout the book, you'll find a variety of practical examples from across the curriculum, as well as "Your Turn" opportunities to help you try the ideas in your own classroom.

The future may not be easily defined, but it can be shaped by teachers who are right now preparing the next generation of world citizens.

Nancy Sulla is the founder and President of IDE Corp. (Innovative Designs for Education), a consulting company specializing in instructional and organizational design. She is also the author of *Students Taking Charge: Inside the Learner-Active, Technology-Infused Classroom* (Routledge, 2011).

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To Mom and Dad

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About the Author

Nancy Sulla is the founder and President of IDE Corp. (Innovative Designs for Education), an educational consulting company specializing in instructional and organizational design. She holds a B.A. in Education from Fairleigh Dickinson University, an M.A. in computer science from Montclair State University, and an Ed.D. in Educational Administration from Fordham University. Her diverse background includes teaching at the elementary, middle, high school, and college levels; working as a computer programmer and systems analyst; and leading teachers as a district administrator prior to launching IDE Corp. Her consulting work focuses on helping educators design *Learner-Active, Technology-Infused Classrooms* ™ that engage all students in an academically rigorous, differentiated learning environment, in which they take responsibility for their own learning.

Introduction

"It was the best of times, it was the worst of times, it was the age of wisdom, it was the age of foolishness, it was the epoch of belief, it was the epoch of incredulity …." Perhaps Charles Dickens presented a foreshadowing for education and the introduction of the Common Core State Standards (CCSS) in his 1859 novel, *A Tale of Two Cities*. The "penning," or in this case "digital creating," of a set of standards that can be reviewed, printed out, and institutionalized, set the educational world in a tailspin. States started pumping out curriculum models for teachers to follow, school districts started aligning their classroom curriculum with the standards, and teachers started writing the numbers and letters of the standards in their plan books. The CCSS, however, were intended to be a pathway to success throughout life, not a checklist of content to master for the test. The CCSS hold great promise for the future of education as they seek to ensure that students are prepared for college, career, and life. When approached through that lens, they can represent the best of times: an age of wisdom and an epoch of belief that schools can actually chart a course for the future of a nation and, in fact, the world.

Advancing a Nation, the World

In 2009, the CCSS were born of a joint effort between the National Governors Association Center for Best Practices and the Council of Chief State School Officers. The purpose of the CCSS is to define a set of expectations as to what students should know and be able to do as a result of K–12 schooling, regardless of the school attended. The premise is that, if achieved, these standards will ensure that students will be well prepared for college, career, and life. They offer up a robust, and yet reasonable, set of expectations to guide curriculum developers, instructional designers, and teachers. Most importantly, they offer an important future focus: preparing students for life beyond the K–12 experience.

The introduction to the CCSS mathematics standards states: "The standards encourage students to solve real-world problems" (http://www.corestandards.org/Math/). The introduction to the CCSS English language arts standards states that the standards stress "critical thinking, problem-solving, and analytical skills that are required for success in college, career, and life" (http://www.corestandards.org/ELA-Literacy/). This new, powerful set of standards seeks to position the U.S. to be globally competitive. A significant part of that preparation is the ability to find and solve real-world, complex, open-ended problems. The standards also seek to ensure that students around the country experience a commonality of learning outcomes, strengthening a national mindset in a world in which people move easily and regularly from state to state.

At this time in our nation's history, we find ourselves part of a global economy, environment, and civilization with countries inextricably linked to one another. (This was not the case in 1635 when the first U.S. public school was established.) Preparing students for their future, and in fact, charting a course for the future, requires much different thinking today than that of 400 years ago. The CCSS offer a blueprint for re-culturing schools to serve a global society; however, schools must keep their eye on the future and not merely on a set of printed standards. *It's Not What You Teach But How* moves beyond curricular content to re-thinking the very practices found inside classrooms, with the goal of designing classrooms that better prepare students to succeed, thrive in, and chart the course of our global society.

Two Words

The CCSS can be summed up in two words: *understanding* and *application*. They challenge students and their teachers to push beyond short-term content acquisition and rote mastery of procedures to levels of thinking that result in continual learning and real-world problem solving. They are purposefully designed to prepare students to succeed in life beyond the K–12 experience.

The first word of many of the math content standards is "understand." For example, a kindergarten math standard states:

> Understand that the last number name said tells the number of objects counted.

It's not enough for a child to walk upstairs counting, "one, two, three, four …." When the child stops with "fourteen" at the top, he must understand that that number represents the quantity, or total number, of stairs he just climbed; he must have a concept of fourteen.

A fourth-grade math standard states:

> Understand a fraction a/b as a multiple of 1/b.

The student must understand that three-fourths is the value one-fourth taken 3 times, thus a multiple of one-fourth. Coloring in fraction parts and computing with fractions does not equate to understanding the concept of fractions. Understanding requires significant engagement with concrete examples and real-world situations in which the student experiences personal "aha" moments.

A high-school statistics and probability standard states:

> Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

It is not enough to know the various statistical calculations or to follow the process laid out by the teacher or textbook; students must understand the purpose and power of statistics. They must engage with statistical problems that make sense to them so that they see the connections, make inferences, and test hypotheses.

A fourth-grade writing standard states:

> Use concrete words and phrases and sensory details to convey experiences and events precisely.

Students must possess an understanding of concrete words and phrases and sensory details in order to use them. However, the standard focuses on the end-goal of enhanced communication, which requires the application of an understanding of concrete words and phrases and sensory details.

A high-school informational text standard states:

> Delineate and evaluate the argument and specific claims in a text, assessing whether the reasoning is valid and the evidence is relevant and sufficient; identify false statements and fallacious reasoning.

Here, students must understand the concept and skill of reasoning in order to evaluate it; they must understand the concepts of evidence, relevance, and sufficiency in order to achieve the standard. Armed with a deep understanding of those concepts and skills, students can tackle any number of situations requiring argument evaluation.

While it used to be that teachers could feel accomplished by teaching the lesson and having students practice, today, building understanding and application requires significant student engagement with content and active participation in the learning process.

Mere memorization may last a lifetime yet have little bearing on future problem finding. Many years after high-school graduation, adults may harken back to using mnemonic devices to remember that the formula for tangent in trigonometry is opposite over adjacent; but without understanding, that knowledge cannot serve them throughout their lives. The power of K–12 content to shape the future of students' lives and the world depends upon students' ability to understand it.

From Understanding to Application

Understanding leads to successful application, and the CCSS frequently present content through its application. A second-grade speaking and listening standard challenges students to:

> Build on others' talk in conversations by linking their comments to the remarks of others.

Students must demonstrate an understanding of what their peers are saying in order to apply their knowledge of responding with their own, related comments. Absent of an understanding of the process of listening and comprehending someone's comments, and then linking one's own ideas to them, the student will not be able to effectively engage in conversation.

A fifth-grade literature standard challenges students to:

> Determine a theme of a story … from details in the text ….

Here, students must first understand what a detail is and then understand the details themselves in order to determine a theme. Absent of that understanding, the student will fall short of the standard's expectation. Following a teacher's demonstration or process alone will not produce the necessary level of understanding. That's not to say teachers' demonstrations and lessons are not necessary; they are. However, in addition to direct instruction, students must engage with content to build a level of understanding that will arm them with the skills they need to apply the standards in a variety of situations.

A high-school writing standard challenges students to:

> Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Students must apply an understanding of task, purpose, and audience in developing their writing, and also apply an understanding of development, organization, and style of writing.

In 2006, school technology director Karl Fisch produced his first musically enhanced, digital slideshow on the influence technology was having around the globe that would have an impact on teachers in his school; the video was titled *Shift Happens*, later renamed *Did You Know*. His statistics stunned viewers into a new world view: "India has more honors kids than the US has kids …. Today's learner will have 10 to 14 jobs before the age of 38." The videos went viral and became poignant

presentations shown at school professional development days, emailed to colleagues, and discussed at faculty room tables. Most compelling was the statement that, “We are currently preparing students for jobs that don’t yet exist, using technologies that haven’t yet been invented, in order to solve problems we don’t even know are problems yet.” The CCSS seek to prepare students to succeed and thrive in that reality.

The End of Teacher-Proofed Curriculum

Some fear that more rigorous standards and standardized tests just cause educators to "teach to the test." Textbook publishers pump out new curricular programs (an expansion on the outdated "textbook") that claim to address these new standards and tests. Teachers implement state-designed curriculum modules page by page, hoping to yield success. None of those approaches will work. What is needed is a workforce of teachers who are empowered with content knowledge and instructional strategies that, in turn, empower students to take charge of their own learning and chart a course for their future.

As is the case with students, teachers must own a deep level of understanding of the content and expectations of the CCSS. Understanding the CCSS requires engagement with the standards and processing of the anticipated performance outcomes. The standards cannot be "delivered." Teachers must create student-centered, problem-based instructional environments that foster the level of achievement defined by the CCSS. No one can hand teachers a set of lessons that will produce success. The CCSS require deliberate and purposeful facilitation of learning. There is no "teacher proofing" of these standards. Teachers must be prepared and empowered to lead students to higher levels of thinking and content acquisition.

The Essence of the Standards Transcend All Subject Areas

The CCSS directly address only English language arts (ELA) and math, with ELA standards for history, social studies, science, and technical subjects. The essence of these standards, however, is less about specific content and more about a higher-order level of thinking in approaching content. The standards represent conceptual shifts in the outcomes of schooling, with a much greater focus on the ability to solve real-world problems than ever before. Additionally, they marry content standards with characteristics of those who are ready for college, career, and life—characteristics that transcend the disciplines. The Next Generation Science Standards (NGSS) follow suit, focusing on a higher-order, problem-solving approach to science. They, too, include crosscutting concepts that transcend the disciplines.

No matter what the subject area, you can view your course content through the lens of higher-order, real-world problem solving. As you read this book, consider the shifts in the CCSS and apply them to any content area. Additionally, literacy and numeracy are key foundations for the study of any content. Social studies students must be able to read well, comprehend, and apply higher-order thinking to master the key concepts of this subject area and be positioned to solve related real-world problems. Students of the arts must be able to read directions and critiques, write about process and reflections, and apply mathematical concepts to the field. Physical education students must be able to master cause-and-effect relationships, inference, and sequences; they would benefit from the ability to read and generate charts and graphs. No matter the subject, the CCSS apply. Throughout the book, I will include references to various disciplines outside of ELA and math. I encourage you, the reader, to view the book as a template through which you can consider any content area.

Seven Insights

This book will focus on the *how* of teaching, taking into account the *what* of the CCSS. Focusing on what the standards say can cause you to miss some key elements in achieving them. Each chapter of the book will offer you an insight to explore and strategies to implement:

1. CCSS Achievement Requires Ends-Based Teaching. The CCSS are written as a set of "ends," the result of the teaching/learning relationship. This chapter will provide strategies for designing classrooms that focus on the ends rather than merely on the means, which could result in missing the ends altogether.
2. Understanding Requires Grappling. Teach in ways that produce not just knowledge acquisition, but deep understanding that leads to application. Building understanding requires the learner to "grapple" with content in a structured environment that provides motivation, probing of thinking, and leveled support. This chapter will offer strategies for building understanding through grappling.
3. Cognitive Progression Is a Lever for Achievement. While that sounds like a mouthful, it means that if you understand how the brain learns, you can leverage that knowledge to produce results. You've most likely experienced situations in which you were so overwhelmed by the content you could barely learn anything, and situations in which you were bored because you already possessed the knowledge being presented. This chapter will provide strategies for how to use cognitive science to produce results.
4. The Power of Language Transcends the Disciplines. Language has the power to change lives and the world. Every subject area can be viewed as a language and taught as such. For example, math is the language used to describe the natural world. This chapter will offer strategies for focusing on the power of language across the disciplines.
5. Executive Function Is Foundational for All Learning. Without executive function, you cannot achieve the level of mastery required by the CCSS. Children growing up under stressful conditions do not always build adequate executive function to succeed in their academic studies. This chapter will promote a deeper understanding of executive function and offer strategies for building a learning environment that focuses on both academics and executive function.
6. Purposeful Instruction Yields Retention. The CCSS do not address how to acquire new knowledge nor how to motivate students to learn a given skill, concept, or piece of information. That's what this book is about. This chapter introduces the learning hourglass of three stages of learning—motivation, acquisition, and retention—and proposes a difference between learning and practice activities. This chapter will offer strategies for teaching a student, as opposed to a lesson, and, thus, for differentiating instruction toward learning retention.
7. CCSS Achievement Relies on Teacher Facilitation. Facilitation toward application is more

than responding to students' needs and questions. This chapter will offer strategies for practicing powerful facilitation to achieve the level of understanding and application required by the CCSS.

Each insight focuses on helping students master the skills, concepts, and habits they will need to thrive beyond their K–12 experience: in college, career, and life. The objective of *It's Not What You Teach But How* is to maximize the interconnectedness of the CCSS, the actions teachers take, and the resultant student learning—and, in the process, to design classrooms for a new age in the history of education.

The final chapter offers a look at a comprehensive classroom model that can be used to address the *how* of teaching, outlined in my first book, *Students Taking Charge: Inside the Learner-Active, Technology-Infused Classroom*. This chapter will describe how this model addresses the levels of achievement demanded by the CCSS.

Along the way, you'll find "Your Turn" opportunities to grapple with the content of this book and design materials to use in classrooms. The future may not be easily defined, but it can be shaped by masterful teachers who are right now preparing the next generation of world citizens.

Chapter 1
Problem-Finders, Innovators, and Entrepreneurs

The future is not Google-able.

—*William Gibson*

Our lives are changing at an unprecedented pace. Transformational shifts in our economic, environmental, geopolitical, societal and technological systems offer unparalleled opportunities, but the interconnections among them also imply enhanced systemic risks. Stakeholders from across business, government and civil society face an evolving imperative in understanding and managing emerging global risks which, by definition, respect no national boundaries.

(World Economic Forum, 2014, p. 7)

Thomas Friedman (2007) asserted that the world is flat. Technology has created one global society, melding individuals and companies in different countries, allowing employees of one company to work from anywhere in the world, and fostering communication and collaboration among peoples around the world. This flattening offers the "empowerment of individuals to act globally" (Friedman, 2007, p. 11). Even work challenges and government policies that seem to be local may have global impact. We no longer depend solely on our own community or country; we are all intertwined; we are a global society. More than sharing information, we solve problems with people around the world, whether a problem is addressing a supply-and-demand issue for goods, collaborating on space exploration or environmental issues, utilizing available personnel for help-desk issues, or averting war. Likewise, we create problems for one another around the world based on actions we take in our own countries that affect the economy, environment, and humanity.

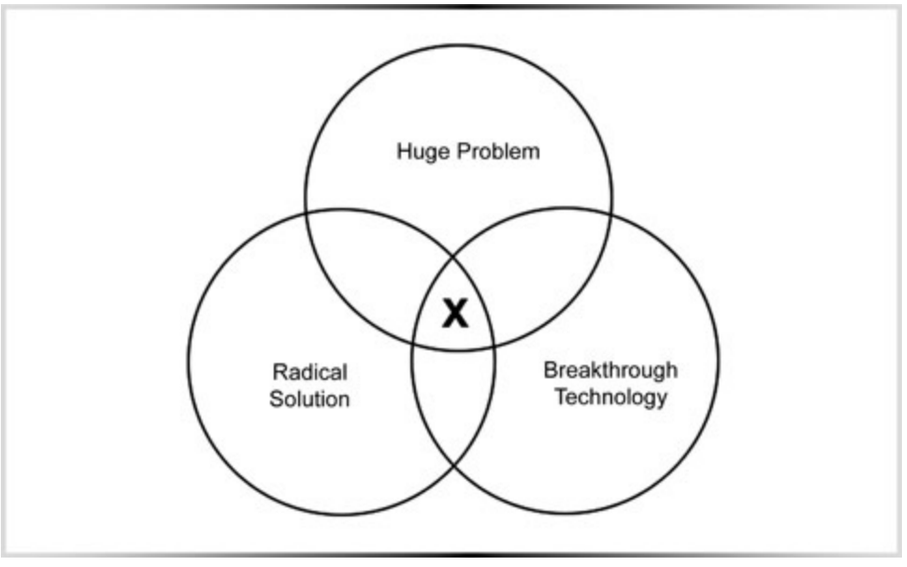

Figure 1.1 Solve for X (www.solveforx.com) Key Graphic

In February of 2012, *Google* held an experimental event over three days during which "forty-six scientists, entrepreneurs and innovators from around the world came together to discuss and debate radical solutions using breakthrough technologies to some really big problems" (www.solveforx.com/about/team). As a result, *Google* launched a website called "Solve for X" (www.solveforx.com): "A place to hear about and discuss radical technology ideas for solving global problems." A key site graphic (see Figure 1.1) defines "moonshot thinking" through three intersecting circles marked "huge problem," "radical solution," and "breakthrough technology," with the intersection being marked "x." The site offers videos of "Solve for X" talks, opportunities for the public to digitally discuss issues, and the ability to create circles of people interested in the same problems for the purpose of collaboration.

One "Solve for X" video describes thirty-something Leslie Dewan's innovation for producing energy from nuclear waste. At the time of her "moonshot thinking," the world had amassed 270,000 metric tons of high-level nuclear waste—a number that was continuing to build at 9,000 metric tons per year. She and colleague Mark Massie designed the "Waste-Annihilating Molten Salt Reactor," which would convert nuclear waste into electricity. Given 270,000 metric tons of nuclear waste, they predict the reactor could produce enough electricity to power the world for seventy-two years.

Leslie and Mark were Ph.D. students at M.I.T. when they decided to take the next step beyond academia and design a nuclear reactor. They considered that the nuclear waste from a typical nuclear reactor still contained significant energy and determined that they should find a way to extract the remaining energy: problem-finders who went beyond the typical question of simply how to *store* nuclear waste to how to eliminate it. They won the U.S. Department of Energy's top award in the Future Energy innovation contest: innovators who developed a unique solution to a global problem. They decided to build these reactors: entrepreneurs who started a company called Transatomic.

In another Solve for X video, Aldo Steinfeld shares his "aha" moment flying from Germany to California in which he realized that, based on the amount of fuel consumed by the jet and the number of passengers on the plane, his carbon footprint for that flight was 1.4 tons of CO_2. A problem-finder sets the stage for innovation. Given there were then no alternative fuels for aircraft, his "moonshot thinking" became how to produce airplane fuel from water, CO_2, and solar energy. An innovator generates new ideas and fuels the drive for entrepreneurship. As an entrepreneur, Aldo heads the Solar Technology Laboratory at the Paul Scherrer Institute in Zurich, where this idea can come to fruition.

A third Solve for X video shows Dr. Keith Black sharing his "moon-shot thinking" for identifying beta amyloid plaques building up in the brain—the building blocks of Alzheimer's—through an eye examination. His radical solution would allow people to take significant steps early on to slow the advancement of the disease. Dr. Black knew that pharmaceuticals existed to treat the brain for the plaque buildup. As a problem-finder, he recognized the need to identify the existence of these plaques well in advance of the appearance of the disease's symptoms, at which point a significant loss of brain cells would have already occurred. As an innovator, he designed a retinal imaging test to accomplish just that. As an entrepreneur, he co-founded NeuroVision Imaging, LLC to develop the capability to perform the test.

Problem-Finders

In a world in which we have to solve problems we don't even know are problems yet, problem finding is an important next step beyond the solving of known problems. Problem-finders:

> … sort through vast amounts of information and inputs, often from multiple disciplines; experiment with a variety of different approaches; are willing to switch directions in the course of a project; and often take longer than their counterparts to complete their work.
>
> (Pink, 2012, p. 127)

Perhaps the first reference to problem-finders was made in 1881 by the French philosopher Paul Souriau, as cited by Sawyer (2006, p. 72): "There is something mechanical, as it were, in the art of finding solutions. The truly original mind is that which finds problems." While Souriau drew attention to the power of problem finding, it appears the term "problem-finder" was first introduced in a study of creativity by Getzels and Csikszentmihalyi (1976). They identified two stages of problem finding: problem formulation and problem solution. They noted, too, that problem finding is not a skill relegated to a talented, creative few; the creativity required for problem finding is more a matter of connecting with purpose than of possessing any particular skillset.

Children can be taught to be problem-finders. More recently, Ewan McIntosh gave a Ted Talk in which he proposed that schools place an emphasis on problem finding, beyond the current focus on problem solving. Teachers who offer students a field of content in which to find and solve problems are developing problem-finders. A global society that must be prepared to solve problems it doesn't even know are problems yet needs problem-finders. Schools must produce problem-finders.

Innovators

In a society that has moved from an agrarian economic model to an industrial model to an information model, we need "a new engine of economic growth for the twenty-first century …. And there is general agreement as to what that new economy must be based on. One word: innovators" (Wagner, 2012, p. 2). According to www.oxforddictionaries.com, an innovator is "a person who introduces new methods, ideas, or products." Innovators associate, question, observe, experiment, and network (Wagner, 2012).

Stanford University is home to the ground-breaking d.school (the Hasso Plattner Institute of Design) in which students apply "design thinking" and focus on "how to ease people's lives." As a result of their work, students have "developed original ways to tackle infant mortality, unreliable electricity and malnutrition in the third world" (Perlroth, 2013, p. 1); d.school is developing innovators. Teachers who engage students in devising solutions for open-ended, authentic problems are developing innovators. The future of a country's economy and success as a world leader depends upon the work of innovators. Schools must produce innovators.

Entrepreneurs

Innovators who turn ideas into action are entrepreneurs. The word “entrepreneur” derives from the early 19th century French term *entreprendre*, to undertake. Yong Zhao (2012) asserts that we need to broaden the use of the term entrepreneur as it applies to today’s society. In the traditional sense, entrepreneurs create jobs for themselves by starting businesses or supplying goods or services. Not all entrepreneurs need own their own business, however; they need only turn their ideas into action. Social entrepreneurs seek to make a difference through the promotion of social values: making a difference in the world that does not necessarily translate into personal profit. Entrepreneur-ship follows innovation: where innovation is the having of new ideas, entrepreneurship is the enacting of those ideas. Both rely on problem finding and innovation. Teachers who provide students with opportunities to engage with real audiences and turn their ideas into action are developing entrepreneurs. A civilization that intends to progress over time, and not vanish, requires entrepreneurs. Schools must produce entrepreneurs.

Tomorrow's Moonshot Thinkers

Clearly, if we fail to identify and solve the world's biggest problems, nothing else will really matter. It is likely that most of those "moonshot thinkers" who will, in fact, identify and offer viable solutions to global problems are sitting in classrooms today; perhaps some are sitting in classrooms in your school. If these problem-finders, innovators, and entrepreneurs seem like they will only emerge from among the gifted and talented students, look again. A sixth-grade student read a book on airplane engines and wrote to the Pentagon, suggesting ideas for making its fighter planes more efficient and effective; the Pentagon wrote back. Students living in a town where a new bridge is under construction learned that a plan for connecting a pedestrian/bike path had not yet been devised. They set to work researching and offering innovative ideas, which they presented to the bridge project leaders. These are just two examples of many classroom projects in which students were charged with making a difference.

In order for schools to meet the needs of a global society, they must prepare students to be problem-finders, innovators, and entrepreneurs. None of these skills should be viewed as innate; they all can be taught, to all students, at varying levels. Today's students are ready to make the leap from passive recipients of information to active participants in a classroom that will prepare them for their future. The world needs problem-finders, innovators, and entrepreneurs.

What Today's Employers Want

When it comes to the needs of employers, if a picture says a thousand words, then the word cloud in Figure 1.2 says it all. As part of a regional research initiative, *WorkForce Now* (Regional Economic Research Institute, 2013), three major employers in Southwest Florida (Arthrex, Chico's, and Lee Memorial Health System) were asked to provide information on their critical employment gaps—positions that are difficult to fill for lack of qualified employees. They shared the job descriptions and requirements of these positions. Feeding these job descriptions and requirements into www.wordle.net—an online tool that calculates the frequency of words and displays them in a font size relative to their frequency—produced this image.

Note that the greatest needs of these employers are for those who communicate well, possess a customer service orientation, solve problems, act well as team players, and utilize technology. An online survey of 318 employers concurs, indicating that 93% value critical thinking, communication, and complex problem-solving skills over a candidate's undergraduate degree (Hart Research Associates, 2013). "More than three in four employees say they want colleges to place more emphasis on helping students develop five key learning outcomes, including: critical thinking, complex problem solving, written and oral communication, and applied knowledge in real-world settings" (p. 1). Additionally, the survey revealed that an employee's ability to contribute to the innovation of a company is a high priority for employers. Whereas schools have been criticized for failing to produce a skilled and knowledgeable workforce for today's society (Carnevale, 2013), the CCSS now address all of these skills.

Figure 1.2 Wordle Created From Employer Needs

Educating Problem-Finders, Innovators, and Entrepreneurs

Much of the information schools have spent years having students memorize is now all available on the Internet: "Google-able," if you will. However, while facts, data, and other information are available, what are not are the solutions to complex, real-world problems and, more importantly, the finding of problems. As the novelist William Gibson said, "The future is not Google-able" (comment made at A Clean Well-Lighted Place for Books, Feb. 5, 2004).

In an online *Forbes* magazine article entitled, "Educate for problem-solving, not factories" (Townsend, 2012), the author asserts that educators "must consider the power of new learning models to unlock the potential of youth … create value by teaching people to make a living as problem-solvers and purposeful entrepreneurs" (par. 18). While computers can automate many rote-skill jobs—such as tollbooth collectors, bank tellers, grocery clerks, etc.—complex problem finding and problem solving is still largely a human process.

Yong Zhao, in his 2012 book *World Class Learners: Educating Creative and Entrepreneurial Students,* drives home the need to educate students to innovate and, from their ideas, take action. Zhao shares bold ideas by those who are studying this entrepreneurial phenomena: "Entrepreneurs are believed to have more power to solve the complex problems facing human beings and bring prosperity to humanity than governments and international organizations" (Zhao, 2012, p. 4). Serving society means helping students foster entrepreneurial thinking, the kind of thinking exhibited by global problem-solvers.

In 2005, Dale Dougherty first published *Make* magazine for those who like to, simply put, make things. He called his subscribers "makers," and the result was the creation of a subculture of entrepreneurial, technology-driven, do-it-yourselfers who problem-find, innovate, share ideas, collaborate, and attend Maker Faires. This publication essentially launched the Maker Movement. In 2011, Dale was honored by the White House as a "Champion of Change" for tapping into the innate desire of people to take control over their lives and the tools they use, empowering people through a like-minded community to invent.

The Maker Movement fosters problem-finders, innovators, and entrepreneurs. That same innate desire to take control of one's life exists in students today. Classrooms that encourage students to take control of their own learning and provide the structure and scaffolding to do so can produce the level of achievement required by the CCSS and the qualities to play a significant role in their future and the future of the world.

New Territory: Procedural Automaticity vs. "Novelity"

Schools serve society by *what* they teach; they form society by *how* they teach (Sulla, 2011). In order for schools to address this changing world and develop problem-finders, innovators, and entrepreneurs, schools must rethink not only *what* they teach, but *how* they teach. Critical thinking, communication, and problem solving are more about how students engage in learning than what content is being presented. The CCSS address skills and concepts typically taught in school, but they present significant shifts in the teaching-learning process. One shift is from memorization and acquisition through procedural automaticity to understanding and application.

When a teacher presents the process through which to solve a math problem, carry out a science experiment, identify the plot line of a novel, mix paint colors, serve a volleyball, interpret a population pyramid, convert music to a different scale, and so forth, students are engaging in procedural learning. They can watch the process, take notes on it, study it, enact it, and practice it. The goal is procedural automaticity. (Note, this is not the same as automaticity of math facts, requiring memorization, which is critical to success in mathematics.) Procedural automaticity is the memorization of a set of steps leading to the ability to implement a procedure automatically to produce a result, regardless of level of understanding.

To date, much of schooling has ended in procedural automaticity. One can build procedural automaticity for myriad skills: identifying the main idea, calculating the surface area, citing evidence, playing the notes of a scale, balancing chemical equations, decoding a word, conjugating a verb, shooting a basket, and so forth. A teacher presents information and models it, then has the students practice with guidance, then has them practice on their own; and, over time, they build procedural automaticity. Typical standardized tests in schools have assessed procedural automaticity. Students are presented with much the same situations they've encountered in their studies: compute these numbers, identify the main idea, calculate the area, balance the chemical equation, and so forth.

While this process may produce results on a test that offers the same types of questions as were practiced, it does not ensure understanding. It also does not ensure long-term retention, which results in teachers being faced with students who fail to remember content that was clearly addressed in prior years. With the CCSS designed to build upon learning of the prior years, educators can no longer afford to rely on procedural automaticity. Procedural automaticity is appropriate for a factory-based society, but not for a society seeking to become or remain a thought leader and innovator.

The shift in the CCSS and new standardized tests is away from rewarding mere procedural automaticity toward ensuring that students understand and can apply knowledge. What counts is what I refer to as "novelity"—the ability to respond appropriately and successfully to novel situations. Without understanding, you cannot solve problems for which there are not known solutions. Procedural automaticity won't get you there. As standardized tests are evolving, fewer questions address procedural automaticity, and more are assessing novelity. This does not mean procedural automaticity is not needed: it is a necessary but not sufficient component of preparing students for their future. Procedural automaticity can be a means to the greater end of novelity.

When I was first learning to drive, a friend of mine owned a car with a manual transmission. I wanted to learn how to drive a stick shift, and he agreed to teach me. He didn't take the usual approach, which would be to model the process of shifting and then put me behind the wheel, coaching me through it. Instead, he sat down with paper and pen and drew the drive-shaft of a car. He drew and discussed with me what would happen when I depressed the clutch, changed a gear, and so forth. I engaged with the image and my mentor by asking questions and posing "what if" situations. I was able to visualize it and understand how the shifting process worked. Once I took the wheel, I hardly needed coaching because I possessed understanding. When faced with a challenge, such as a hill, I was able to figure out what steps to take, because I understood how the gears worked and could apply that understanding; I had achieved a level of "novelity." Following a procedure only works until the situation changes and one is required to think through an alternate route. Understanding yields success in many situations.

This shift to novelity requires developing a mindset of preparing students for next Tuesday's test, but not just for next Tuesday's test. Let's begin by thinking about the future for which we are preparing our students and consider how we can accomplish that in classrooms across the country, across the world.

To prepare students for an unknown future, schools must arm them with skills that transcend time and an understanding of content that can be applied to new situations as they arise. The CCSS provide a strong guide for those who wish to teach for novelity.

The Intent of the CCSS: Beyond Content

Understanding and application of content form an important foundation for life; however, subject-area content alone is not sufficient for ultimate success in college, career, and life. The ELA standards offer seven characteristics of students who are "College and Career Ready in Reading, Writing, Speaking, Listening, and Language." These characteristics are not specifically connected to any particular content; teachers across the content areas must offer active practice in them while pursuing content goals. This speaks of a classroom environment in which students are engaged in grappling with content, individually and collaboratively; questioning and sharing; taking responsibility for their own learning; selecting appropriate resources for learning; and relying on the teacher as a guide and a key resource in the learning process. The development of these seven characteristics will depend largely on *how* you teach. Consider for each of these characteristics the possibilities for achieving it through *how* one teaches (see Table 1.1).

Table 1.1 CCSS ELA College and Career Readiness Characteristics

CCSS College and Career Readiness Characteristics	Fostered by a Learning Environment in Which Students Are ...
Demonstrate independence	... taught and encouraged to self-assess, set goals, select resources, and take responsibility for their own learning
Build strong content knowledge	... regularly engaging with content and applying it to new situations, both independently and collaboratively, with and without the teacher's overt guidance
Respond to the varying demands of audience, task, purpose, and discipline	... offered ample opportunities to present to varied audiences, both verbally and in writing, around a variety of issues across the disciplines
Comprehend as well as critique	... asked to critique opinions, solutions, ideas, and works created by others and themselves
Value evidence	... encouraged to provide and demand evidence to back up claims
Use technology and digital media strategically and capably	... offered ample opportunities to utilize technology and digital media in the course of their studies, not as an end unto itself, but as a means to the greater end presented by the subject-area content
Come to understand other perspectives and cultures	... encouraged to see situations from the perspectives of others, including those around the world

A teacher can present the concept of evidence to students and demonstrate the skill of locating evidence for a claim. Students can take notes and follow up with practice. If students fail to assimilate the valuing of evidence into their lives, however, they will be ill prepared to handle yet-unknown situations they might meet in their future. To prepare students for their future, teachers will need to regularly respond to students' assertions with the question, "What evidence can you show me?" and encourage students to challenge others, including the teacher, for evidence of their claims. This

intentional practice would extend well beyond the lesson on evidence, with students being challenged to provide and require evidence of claims in all situations. The *how* of teaching, in this case, produces students who value evidence, and that skill will serve them well in their future.

Table 1.2 CCSS Math Practice Standards

CCSS Mathematical Practice Standards	Fostered by a Learning Environment in Which Students Are …
Make sense of problems and persevere in solving them	… provided with problem solving on a regular basis, encouraged to work through to success, and acknowledged and celebrated for doing so
Reason abstractly and quantitatively	… often asked to deconstruct a problem and draw logical conclusions
Construct viable arguments and critique the reasoning of others	… often asked to present an argument related to content and evaluate the reasoning of their peers and others
Model with mathematics	… provided with manipulatives, strategies, and computer applications to model real-world situations through mathematics
Use appropriate tools strategically	… expected to use the tools of mathematics to present, deconstruct, and create information
Attend to precision	… expected to be precise in their thinking and communication
Look for and make use of structure	… provided with regular opportunities to examine structure within the content area
Look for and express regularity in repeated reasoning	… often asked to take their reasoning to the next level and explore the value of repeated reasoning

Responding to the varying demands of audience, task, purpose, and discipline is not a unit of study; it is a skill that is developed through repeated opportunities to speak and write on myriad topics for real audiences. Success in the college and career readiness standards emerges from the *how* of teaching more than the *what*.

The mathematics standards introduce eight standards for mathematical practice that outline the habits required for achievement, provided in Table 1.2.

As with the college and career readiness characteristics, these habits reach beyond specific content mastery; they are evident across the content areas and in many life situations. While they may be explained, they are not achieved through lessons in the classroom; they are achieved through the culture of the classroom, the *how* of teaching. Attention to precision is not a unit of study, it is an expectation modeled and held in high regard by teachers all throughout the year, regardless of assignment or activity.

Perseverance is not a content lesson, it is a habit built through an intentional classroom culture that places an emphasis on it, with the teacher encouraging students to stick with a problem or process and seeing it through to completion in spite of the challenges. That's the *how* of teaching.

Teaching with the *how* in mind means building a classroom culture that cultivates these seven characteristics and eight habits. As students build these characteristics and habits, they will excel in their content-related studies. A classroom of independent learners who persevere in problem solving and attend to precision can make any teacher's work easier.

Standards-Based Teaching

While the CCSS do not define *how* to teach, their very nature offers a guide for teaching techniques. Students build understanding and application through problem solving and deliberate and purposeful engagement with content; through personal investment and responsibility for their own learning; through the relentless pursuit of ideas and questions that are of interest to them; and through access to a variety of resources, including the teacher. These are the characteristics of problem-finders, innovators, and entrepreneurs. Standards-based teaching isn't simply about providing lessons on specific standards. It's about developing a classroom environment through which students will come to learn, achieving a high level of understanding necessary for the application of knowledge.

The insights presented in the subsequent chapters of this book will provide strategies for deconstructing the standards and building a deeper understanding of them. Just as students need to gain an understanding of the content of the standards in order to apply them throughout life, educators need to gain an understanding of the standards themselves in order to apply them in their work. Most districts have aligned their curriculum to the CCSS, meaning they've ensured that the skills and concepts are represented; however, ensuring that students attain the level of mastery outlined in the CCSS requires realigning the teaching-learning process.

Positioning students to be problem-finders, innovators, and entrepreneurs in order to thrive in their future requires creating learning environments through which students gain more than a cursory knowledge of content. Teaching today requires keeping an eye on the future and intentionally designing learning experiences aimed at producing specific results, with the end-goal being understanding; understanding is developed through grappling.