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Introduction

This book is both timely and urgent. It mirrors the rapid change in the world in general and in education specifically. As early as 1965, Intel cofounder Gordon Moore (1965) noted that the capability of computer circuits had doubled every year since their invention; his prediction that this trend would continue and have broader applications has become known as Moore's Law. Buckminster Fuller, in his book *Critical Path* (1982), describes the "knowledge-doubling curve," explaining that new knowledge, which had doubled every century until 1900, is now estimated to double every 18 months. And the pace of growth is increasing.

At times, it can be difficult to comprehend that rate of change and the amount of new information. As schools grapple with this, many are still teaching content from the 20th century. Yet most students are growing up in a very different world. If Rip Van Winkle were to wake up in the middle of Times Square today, he would be awestruck by the multimedia messages and the pace of the world around him. If he were to wake up in a classroom, he might notice that the blackboard is now white, but otherwise feel relatively comfortable in the surroundings.

POISED FOR THE 21ST CENTURY

In education, most of the change has focused on teaching and learning. Some are calling for a corresponding change in educational assessment. This view of assessment as the driver of educational change is of great importance; combined with the traditional focus on teaching and learning,

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it produces is a strong and emerging imperative to alter our long-held conceptions of these three areas.

But we still have much to accomplish. Twenty-first century skills must build on the core literacy and numeracy that all students must master. No longer will measures of disconnected vocabulary or isolated facts suffice. Students will need to think critically and creatively, to communicate and collaborate effectively, and to work globally to be productive, accountable citizens and leaders of their world. A measure of those skills merely provides a number; assessment guides a response.

The challenge lies in reformulating curriculum, reformatting standards, developing instructional strategies to deliver them, and designing assessments that measure these skills while incorporating the psychometrician's goals of validity, reliability, and fairness. The challenge has been presented; the question is not whether, but how, we can meet it. Mike Schmoker (2011) urges teachers to focus on what to teach and how to teach it. I urge educators to add a third part to his formula: a focus on how to assess it.

This book is intended to spur change based on the best information available in an informed, purposeful, and strategic way. It considers the best ideas of Heidi Hayes Jacobs, Laurie Shepard, Linda Darling-Hammond, Cheryl Lemke, Craig Gerald, Margaret Heritage, John Hattie, Chris Dede, Donald Leu, Elena Silva, and many more. It is a book about teaching, learning, and assessing in the 21st century, locally and globally, with an eye on preparing students for world we cannot yet see.

Make assessment a vision worth working toward.

– Thomas Angelo

End of Stagnation

In the more than 25 years since the National Commission on Excellence in Education (1983) issued *A Nation at Risk*, the most significant change in education has been the reauthorization of the Elementary and Secondary Education Act in 2002. This bill, called No Child Left Behind, did not become the panacea it was predicted to be. The demand for accountability morphed into a system of sanctions and consequences for schools that could not meet the requirements of Annual Yearly Progress (AYP). Greater accountability was equated with standardized testing. School choice and reconstitution became catchphrases for change.

Presently, there are calls for another "Sputnik moment" by increasing investments in education and technology. International measures put the United States behind many other countries, including China, South Korea, Finland, Australia, and Canada. Whether you believe this is due to their better-trained teachers, more highly motivated students, or lower levels of poverty, it is a wake-up call for the United States.

In its report, *A Nation Accountable* (2008), the U.S. Department of Education continued the work of *A Nation at Risk*. Since then, graduation rates for high school and college have shown only small improvements, and international test score comparisons rank the United States as average (Organisation for Economic Co-operation and Development, 2009).

More than a decade into the 21st century, the call for school reform continues. Comprehensive reform models are numerous. In states, communities, and schools across the nation, there is ongoing exploration of policies and practices that are intended to reduce the gap between students of different backgrounds and to raise overall achievement. Research on those policies has shown mixed results, difficulty bringing effective programs to scale, and little conclusive evidence.

Changing for the Future

The path we are on is not the same one we walked 20, or 50, or 100 years ago. The world is different, and the following data explain why test scores haven't changed much in very many years. They also demonstrate the necessity for change.

SAT Scores

- In the 1920s, when the SAT was first widely given, 8,000 students took it (Lawrence, Rigol, Van Essen, & Jackson, 2002).
- In 1960, that number was 137,000, with an average verbal score of 534 and an average math score of 509 (Jacobsen, 2011).
- In 2011, 1.5 million students took the test, with an average verbal score of 497; the average math score was 514.

Population

- In 1900, 74,000 Asians immigrated to the United States; in 2000, the number was nearly 3 million (Gibson & Lennon, 1999).
- In 1990, Hispanic Mexican, Central American, and Caribbean immigrants numbered 70,000; in 2000 the number was 6 million (Gibson & Lennon, 1999).
- In 2010, 38% of the people under the age of 18 in the United States were of African, Asian, or Hispanic descent. (Lapkoff & Li, 2007)

Family and Income

- Single-parent families, which typically have a higher rate of poverty, have increased dramatically; 25% of white children and 60% of black children will grow up in a single-parent household.
- In 2010, the poverty rate for children rose to 25%, with rates higher for black and Hispanic children.

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- Poverty is associated with low birth weight, lower rates of school readiness, lower school success, and higher dropout rates. (National Center for Children in Poverty, 2012)

These statistics clearly indicate that the students we are educating today are not the same as those we were teaching a generation or two ago. There is no blame being placed in that statement: Simply, the world has changed and so must education. As Einstein said, “We can’t solve problems using the same kind of thinking we used when we created them.” Applied to education, we can’t educate today’s children using the same methods we used yesterday.

Policy

The divergence of viewpoints between educators and policy makers is another consideration. Educators focus on strategies that will change instruction such as curriculum, class size, instructional resources, and professional development. Policy makers, from Washington, D.C., to local boards of education, emphasize accountability, generally through large-scale testing. As government has increasingly inserted itself in education, numerical accountability has taken precedence over responsive assessment. Diane Ravitch (2002, p. 2), in “A Brief History of Testing and Accountability,” makes the comparisons shown in the following table.

<i>Policy Makers</i>	<i>Professional Educators</i>
Endorse the standards and testing approach	Reject standards and testing as the sole measure of learning
Want high-stakes tests to motivate schools and students	Recognize that intrinsic motivation does not come from external mandates
Support charters and vouchers	Are skeptical about the claims made for these schools
Reward teachers with merit pay for test score improvement	Recognize that other teacher factors need to be considered in teacher evaluation

As educational research has become more grounded in scientific methods, there are more data on what truly works in education. The works of Robert Marzano, John Hattie, Doug Reeves, Linda Darling-Hammond, and others illuminate this. More of their work will be included in later chapters, but for now, if we know what works in education, why are their voices the quietest in the mix of corporate and policy formulations? A review of the research on effective instructional strategies shows

numerous common threads: viable curriculum, high yield instruction, clear goals, higher-order questioning strategies, informative feedback, differentiated instruction, and engagement with content. Policy must support these best practices.

If we used the data available and followed research-based practices in our schools, assessment would look much different. Teachers and students would have multiple ways to measure competencies. A balance of formative, summative, and alternative assessments would be the norm. Tests would be taken over time as students showed readiness and mastery of content. Test scores would show growth rather than merely comparisons to others once a year. As students demonstrate mastery, they would move on to higher levels of thinking and performing. Those who need additional help would continue to develop the basics. The growth of the student would be the focus.

History has taught us a lot about what does and doesn't work. There's adequate evidence that any reform works best when both policy makers and educators are at the table solving the problems together. And there's enough expert knowledge, as well as emerging research and data, on what is effective and what isn't.

Reflection

- What do you think are the biggest changes in education over the last several decades?
- What are the biggest challenges facing education today?
- What is your vision of the future of education? What will it look like 20 or 50 years from now?
- What are three steps that can be taken today to make this happen?

FOUNDATIONS: BUILDING ON THE WORK OF OTHERS

The research base for defining, developing, and applying 21st century learning is promising. There was little research when Henry Ford developed assembly line production or when Bill Gates created a computer in his garage. These forward-thinking inventors turned to existing knowledge and critical information in tangential areas of thought, and combined these with their own critical thinking, problem solving, and creativity.

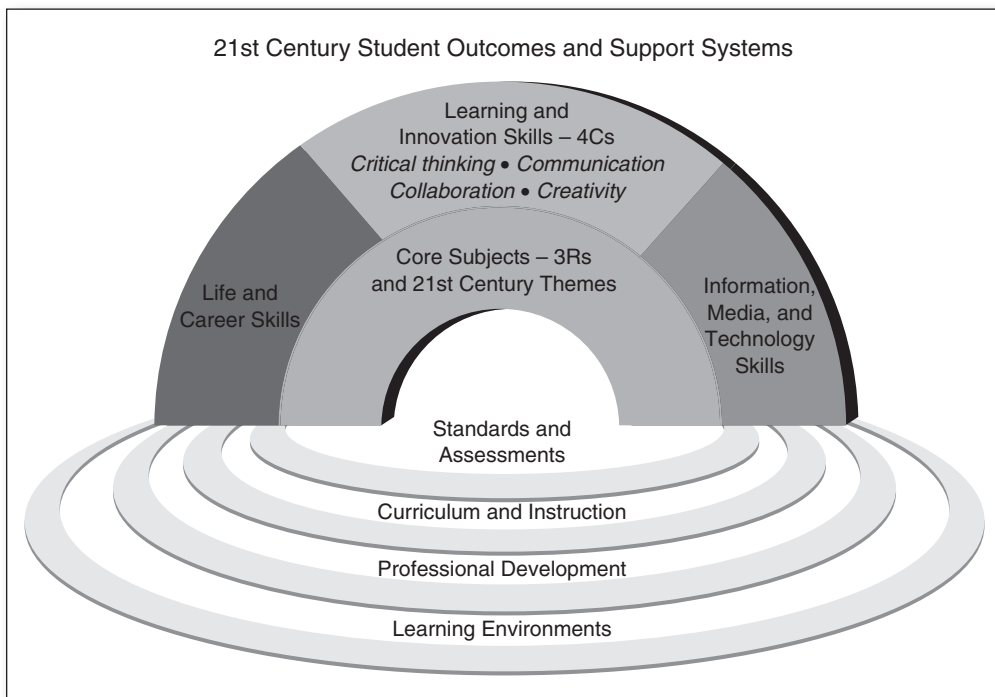
Current Initiatives

In an investigation of key research on defining 21st century skills, a few initiatives stand out.

Partnership for 21st Century Skills

The Partnership for 21st Century Skills (p21.org) has emerged as a major advocate for 21st century skills. This coalition of public, private, nonprofit, and educational groups has created a framework that defines expectations, content, strategies, and outcomes. The four main components of the model are (1) core subjects, (2) learning and innovation skills, (3) information, media and technology skills, and (4) life and career skills. Each of these is then refined as explained in Figure 1.1.

Figure 1.1 Partnership for 21st Century Skills



- Core subjects include English, reading, and language arts; world languages; arts; mathematics; economics; science; geography; history; and government and civics.
- Learning and innovation skills are those possessed by students who are prepared for the 21st century and include creativity and innovation, critical thinking and problem solving, and communication and collaboration.
- Information, media, and technology skills are needed to manage the abundance of information and also contribute to the building of it. These include information literacy; media literacy; and information, communications, and technology (ICT) literacy.

- Life and career skills are those abilities necessary to navigate complex life and work environments. These include flexibility and adaptability, initiative and self-direction, social and cross-cultural skills, productivity and accountability, and leadership and responsibility.

Assessment and Teaching of 21st Century Skills

The Assessment and Teaching of 21st Century Skills project (atc21s.org) has its headquarters at the University of Melbourne in Australia, where an international group has been working at defining essential 21st century skills and developing ways to measure them. Founding countries include Australia, Finland, Portugal, Singapore, the United Kingdom, and the United States. Their core belief is that alignment of goals with learning and assessment is essential to policy and practice. They emphasize the importance of balanced assessment systems that incorporate 21st century goals.

In this theoretical model, 21st century skills are organized into four groups, each comprising three to four competencies:

- Thinking includes creativity, critical thinking, problem solving, and metacognition.
- Working involves communication and collaboration.
- Information and technology literacies are the tools for working.
- Citizenship, life skills, and personal responsibility are necessary for living in the world. (Binkley et al., 2010)

Center for Public Education

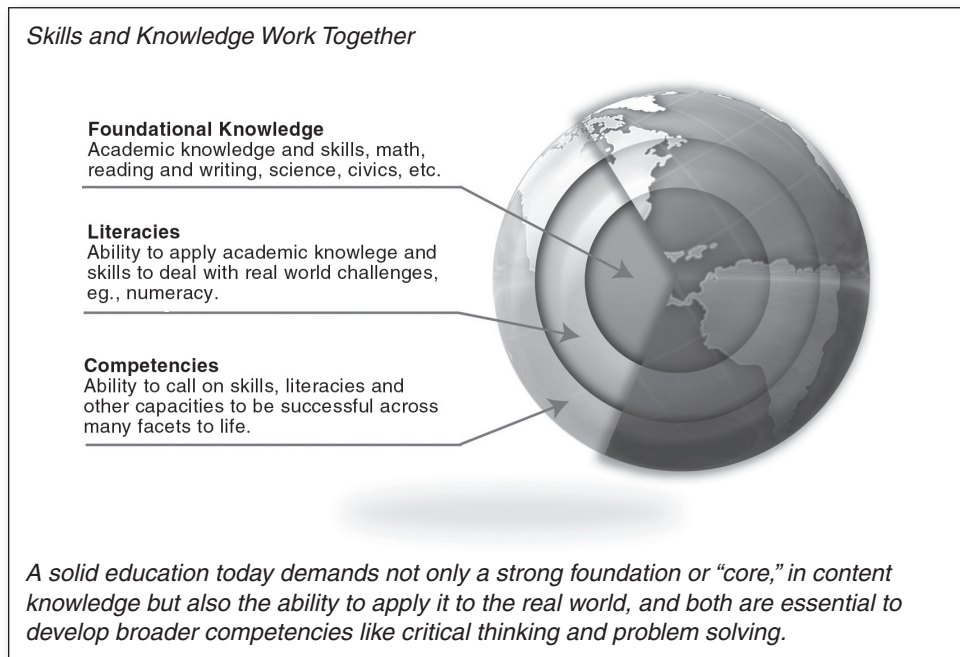
Craig Jerald, in a report for the Center for Public Education (CPE), uses workplace data to support the imperative to transform education. Reports from 431 employers showed that “while employers still view basic skills like reading comprehension to be fundamental to success on the job, some broader competencies such as the ability to communicate, collaborate, think critically, and solve problems are considered even more valuable” (2009, p. 47).

The CPE’s conception and organization of 21st century education is shown in Figure 1.2. The sphere is composed of layers, with foundational skills at the center. Each layer builds on the preceding one. Then the literacies are applied to these skills. Finally competencies for success are described.

Organisation for Economic Co-operation and Development

In a 2009 paper, the Organisation for Economic Co-operation and Development (OECD) described skills and competencies that young

Figure 1.2 Center for Public Education



Source: Jerald (2009). Used with permission.

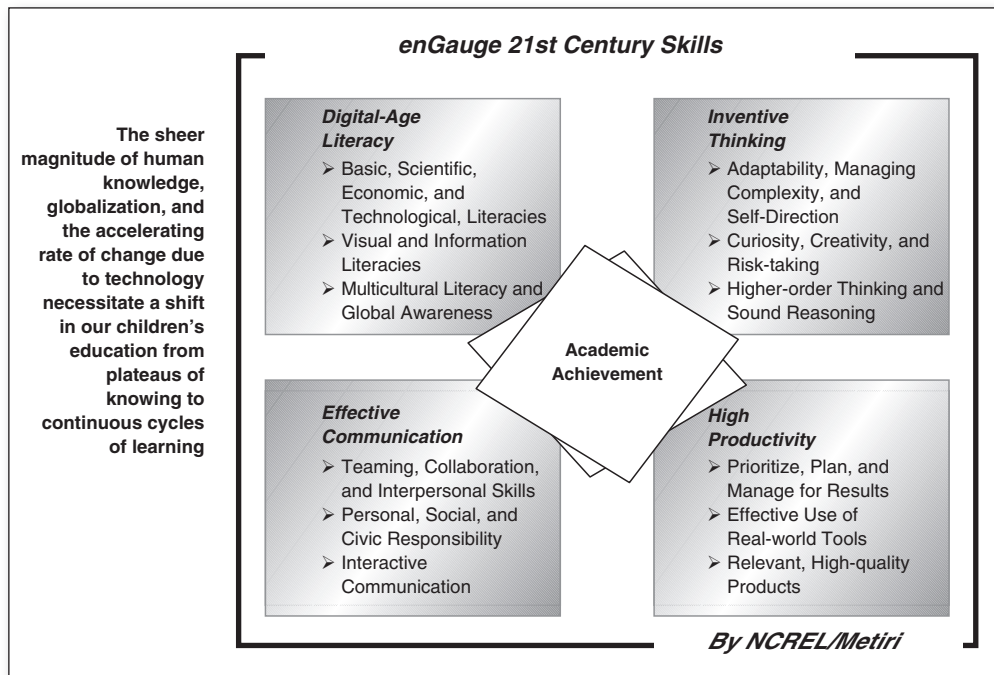
people require in order to benefit from and contribute to a rapidly changing world. The OECD distinguishes these by defining *skills* as the ability to perform tasks and solve problems. Skills include critical thinking, responsibility, decision making, and flexibility. They define *competencies* as the ability to apply skills and knowledge in a specific context such as school or work. The OECD framework for 21st century skills and competencies has three dimensions:

- **Information:** This dimension includes accessing, selecting, evaluating, organizing, and using information in digital environments. Use of the information involves understanding the relationships between the elements and generation of new ideas. The competencies necessary to effectively use information include research and problem-solving skills.
- **Communication:** This dimension includes the ability to exchange, critique, and present information, and also the ability to use tools and technologies in a reflective and interactive way. The requisite skills are based on sharing and transmitting information to others.
- **Ethics and Social Impact:** This dimension involves a consideration of the social, economic, and cultural implications of technologies, and an awareness of the impact of one’s actions on others and the larger society. Skills and competencies required for this are global understanding and personal responsibility.

Metiri/NCREL

A report by the Metiri Group in partnership with the North Central Regional Educational Laboratory (Lemke, Coughlin, Thgadani, & Martin, 2003) explains that 21st century skills are built on basic literacies of language and numeracy, which are then applied to thinking, communicating, producing, and using technology. The report refers to principles and recommendations from many sources and concludes that “educational decision makers must acknowledge that the academics of yesterday are not sufficient for today. To adequately prepare students, they must learn content within the context of 21st century skills” (p. 4). Figure 1.3 graphically illustrates their ideas.

Figure 1.3 enGauge 21st Century Skills



Source: Metiri Group (2003).

- Digital-age literacy comprises three areas: basic (linguistic and mathematical), scientific, economic, and technological literacies; visual and information literacies; and multicultural and global literacies.
- Inventive thinking includes adaptability, self-direction, curiosity, creativity, risk taking, higher-order thinking, and sound reasoning.
- Effective communication emphasizes collaboration, interpersonal skills, personal responsibility, social and civic responsibility, and interactive communications.

- High productivity means prioritizing and planning, use of real-world tools, and the ability to produce relevant high quality products.

Knowledge Works Foundation

The *2020 Forecast* from the KnowledgeWorks Foundation (2008) presents a multidimensional vision of the future in the realms of knowledge, the economy, changes in society, resilient systems, amplified organizations, and the individual. They consider the major forces that will reconfigure learning to include

- Knowledge: information proliferation and data management through visualization;
- Economy: a maker economy in which anyone can design knowledge and promulgate it;
- Society: new civic discourse where all constituents and parties can contribute;
- Systems: flexible systems that change with needs and demands; and
- Self: extended human capacities through technologies and advances in neuroscience.

They believe that the forces of globalism, networking, collaborative media, portable learning, and transliteracies will remake learning. In plain language, these forces will enable people to work together at any time and any place.

Earlier Roots

The designation of certain abilities as 21st century skills may be new, but the essential ideas of this movement have roots that go back many decades.

Habits of Mind

The habits of mind were synthesized from the work of others by Art Costa and Bena Kallick in the 1980s (Costa & Kallick, 2000). They are not intellectual tools but instead are dispositions that people use when they are faced with new and challenging problems. They are not measures of intelligence but rather behaviors that people choose in response to real-life questions and challenges. Costa and Kallick cite the research of Ames, Ennis, Glatthorn, Goleman, Sternberg, and others in explaining these essential qualities. Figure 1.4 summarizes and explains them.

Figure 1.4 Habits of Mind

Persisting: <i>Stick to it.</i>	Managing impulsivity: <i>Take your time.</i>	Listening with understanding and empathy: <i>Try to understand others.</i>	Thinking flexibly: <i>Look at it another way.</i>
Using Metacognition: <i>Think about your thinking.</i>	Striving for accuracy and precision: <i>Check it again.</i>	Questioning and problem posing: <i>Ask "How do you know?"</i>	Applying past to new situations. <i>Use what you learn.</i>
Thinking and communicating with clarity and precision: <i>Be clear.</i>	Gathering data through all senses: <i>Use your natural pathways.</i>	Creating, imagining, and innovating: <i>Try a unique and different way.</i>	Responding with wonderment and awe: <i>Have fun figuring it out.</i>
Taking responsible risks: <i>Try something new Venture out.</i>	Finding humor: <i>Laugh a little.</i>	Thinking interdependently: <i>Work together for better results.</i>	Remaining open to continuous learning: <i>Learn from experiences.</i>

Source: Adapted from Costa and Kallick (2000).

In practice, teachers can incorporate the habits in multiple ways. Students can read biographies of well-known people and identify the habits they used to achieve success. Applying the past to the present is an integral part of an introduction to a new topic. Managing impulsivity can be incorporated into classroom management. And, of course, humor can quickly diffuse the tension and stress in any classroom.

Triarchic Intelligence

As early as the 1970s, Robert J. Sternberg was redefining intelligence and emphasizing elements of today's 21st century skills. He defined intelligence as "mental activity directed toward purposive adaptation to, and selection and shaping of, real-world environments relevant to one's life" (1985, p. 45). This definition incorporates not only core knowledge but also how an individual applies that knowledge throughout his or her life. Sternberg's concept of intelligence has three aspects:

1. *Analytic or componential intelligence* comprises the macro components of intelligence used in problem solving and decision making.
2. *Experiential intelligence* relates to how well a task is performed in relation to our prior experience with it.
3. *Practical or contextual intelligence* uses three processes: adaptation, shaping, and selection to create a fit between the individual and their environment.

Bloom's Taxonomy

Going back even further, Benjamin Bloom introduced his taxonomy in the 1950s (Bloom, 1956). This hierarchy of skills illuminates the spectrum of thinking from early acquisition of knowledge through synthesis and creative applications. The classification is a tiered model of thinking and learning that builds on prior learning. The original taxonomy was revised in the 1990s, primarily to reflect a change from thinking of the skills as nouns to thinking of them as action verbs and to place more emphasis on creativity. Figure 1.5 relates Bloom's taxonomy to teaching, learning, and assessing in the 21st century.

Most educators focus on the cognitive aspect of Bloom's work, but he also developed taxonomies in the affective and psychomotor domains. The affective domain incorporates the 21st century skills of communication and collaboration. Working independently, accepting responsibility, planning, and problem solving are also included in this domain.

In the psychomotor domain, physical movement and coordination are the focal points. Actions for success are part of this domain. Following directions and applying and practicing skills as one works toward competence at such tasks as assembling a robot or baking a cake are important 21st century applications.

The domains cannot be separated from each other in everyday practice in schools or in the workplace. For example, how one perceives his coworkers on a project will affect his contribution to the project. How one feels about her stature, build, or strength will influence her participation in physical education. And how one feels about his academic achievement will guide his educational choices.

Critical Thinking: Edward Glaser

The foundations of 21st century skills can be traced back even further in history. In 1941, Edward Glaser explained that the ability to think critically involves three things:

1. An attitude of being disposed to consider in a thoughtful way the problems that comes within the range of one's experiences
2. Knowledge of the methods of logical inquiry and reasoning
3. Skills in applying those methods

In his account, critical thinking requires persistence of effort and examination of information in the light of facts and evidence. Glaser believed that problems could be solved and solutions discerned through the use of relevant information. The ability to interpret data, evaluate arguments, recognize relationships between ideas, draw conclusions, and

Figure 1.5 Applying Bloom’s Taxonomy in the 21st Century

<i>Bloom’s Taxonomy</i>	<i>21st Century Skill</i>	<i>21st Century Application</i>
<p>Knowing/ Remembering List, define, describe, name, locate, find, label, identify</p>	<ul style="list-style-type: none"> • Embedding learning in memory • Retrieving and recalling information and knowledge 	<ul style="list-style-type: none"> • Label a diagram. • Draw a picture of it. • Search and bookmark.
<p>Comprehending/ Understanding Interpret, summarize, paraphrase, classify, give an example, estimate</p>	<ul style="list-style-type: none"> • Fitting into prior learning • Organizing prior knowledge into a graphic • Constructing meaning 	<ul style="list-style-type: none"> • Summarize the story/illustrate your ideas. • Define the problem. • Give an example of each idea. • Make a rainbow to illustrate things you know about this. • Include it in a blog or Tweet.
<p>Applying Carry out, use, modify, discover, demonstrate, show, produce</p>	<ul style="list-style-type: none"> • Using learning/knowledge in multiple, novel, and personalized ways • Implementing ideas 	<ul style="list-style-type: none"> • Construct a theory as to why it happened that way. • Brainstorm ways to use this information, and try one. • Show a classmate how to do it using Google Docs or other application.
<p>Analyzing/Comparing Organize, outline, infer, distinguish, integrate, break down, differentiate, attribute to</p>	<ul style="list-style-type: none"> • Making meaning by exploring and questioning so that its structure and parts can be understood, related, and connected • Distinguishing between components 	<ul style="list-style-type: none"> • Take a position and compare it to others. • Figure out what others need to know to complete the task and help them. • Explain a choice the character made and why you think they did this. Would you do the same? • Map your ideas; create a mash-up.
<p>Synthesizing/Evaluating Hypothesize, critique, compile, devise, plan, reorganize, appraise, defend</p>	<ul style="list-style-type: none"> • Combining/putting ideas together • Judging the ideas based on criteria and standards • Testing hypotheses 	<ul style="list-style-type: none"> • Evaluate other’s solutions to a problem. • Self- and peer review of work • Create a flyer on your topic using multiple sources. • Post an editorial on your blog. • Network with others; combine ideas.
<p>Creating Reorganize, innovate, invent, adopt an unusual approach, plan and produce, generate something new</p>	<ul style="list-style-type: none"> • Generating something new • Putting elements into a coherent whole • Reorganizing ideas into new patterns 	<ul style="list-style-type: none"> • Create a new ending. • Design another way to convey the message of the story. • Come up with a new way to do, prepare, or fix something. • Create digital products: film, simulation, game, podcast.

make generalizations is essential. All of this is based on the propensity to comprehend and use language with accuracy, clarity, and discrimination. Seventy years later, we are building the foundations of 21st century learning on his core ideas.

Reflection

Several trends are emerging in the 21st century, and the pace of change is increasing every day. In the table below, a number of significant influences on education are listed. For each driver of change, you are invited to consider how it is influencing education. Reflect on the process you used, your thoughts during the process, and the effectiveness of your strategy.

<i>Driver of Change</i>	<i>Influences in Education</i>
Example: Instant access to information	Less time researching, more time evaluating and synthesizing information
Information amplification	
Technology	
Globalization of economies	
Personalized learning	
Social/professional networking	
Reformulated workplace skills	
Preparation for college and career	
Multiple platforms for communicating	

Developmental Perspectives

As you read this book, you’ll notice an emphasis on the secondary level. There is no doubt that all students can benefit from the inclusion of 21st century skills, and examples at all levels will be included. Of course, communication and collaboration are important even among our youngest students. There are opportunities to solve problems and sort information at all levels. But a solid foundation in literacy and numeracy is essential. During the elementary grades, it is reasonable to introduce critical thinking and concepts such as comparing, synthesizing, and reflecting. At the secondary level, it is more feasible and realistic to expand these building blocks to include higher-level thinking, metacognition, media literacy, and global awareness.

The value of incorporating children's development in teaching and learning is incontrovertible. The National Council for the Accreditation of Teacher Education calls for teachers to understand theories of development, and most teacher preparation programs include a class in educational psychology or human development. For example, Piaget's stages of cognitive development provide a good foundation for reflecting on the developmental process. The sequence from the preoperational stage through concrete operations to formal operations supports the progressive mastery of 21st century skills.

Due to developmental differences, a unit on immigration would look different in a third grade as compared to tenth grade classrooms. Both could be based on a formative Know/Want to Know/How to Learn (KWL) activity followed by teacher-planned delivery of essential content. After demonstrated mastery of content knowledge (i.e., traditional quiz, compare/contrast graphic organizer, learning log), third graders would create headlines and news stories about immigrants' experiences and assemble their work into a class newsletter on the immigration experience of different groups. This supports their concrete operational ability of classifying and sorting information and builds digital literacy/technology skills. High school students can use research data or interviews to compare the differences in immigration through the generations. Each small group would use technology—perhaps a wiki, a glogster, or an original video—to present a synthesis of their findings followed by a Socratic Seminar on current immigration laws. This would support the formal operational ability to apply abstract ideas. Learning would be assessed through multiple measures such as portfolios of work, checklists and rubrics, peer review, and teacher conferences.

Robert Marzano's (2007) and John Hattie's (2008) research supports and extends practical applications of much of the developmental research. As children mature, they make meaning, organize information, put parts and wholes together, and make social and emotional connections in more complex ways. Marzano's and Hattie's high yield strategies of clear goals, questioning, summarizing, and feedback, can be used to support these learning outcomes. Sarah Blakemore and Suparna Choudhury at University College London found that adolescents become "more self aware and more self-reflective, and develop the capacity to hold in mind more multi-dimensional concepts and are thus able to think in a more strategic manner" (2006, p. 296). Carol Dweck's research on motivation builds on the earlier work of Edward Deci and leads to the understanding that over time, extrinsic rewards become meaningless (Dweck, 2006). Establishing a learning mind-set is essential. Priming the brain for learning, helping it make meaning from new learning, and intrinsically recognizing the value of learning led Daniel Pink (2009) to his conclusion that autonomy, purpose, and mastery are the foundations of motivation and are best exemplified in student-focused classrooms. Synthesis, creativity, problem solving, and

metacognitive skills can be developed over time and Pink believes it is these right-brained thinkers who will be most successful in Thomas Friedman's (2005) "flat world."

Assessment must also match developmental abilities. I recently saw a second grader present his story about heroes and heroines. His reading was followed by a statement, "Upon reflection, the next time I write a story I will add more detail about the place where it happened." The audience was very impressed with this 7-year-old's ability to reflect on his work. On checking with the teacher, it was discovered that with prompts and scaffolds all students were able to make recommendations for how they could improve their work. Over time, less support will be needed for this student to reflect on his work independently.

TRANSFORMING ASSESSMENT

When the best ideas from effective practices, cognitive development, and neurological functionality are combined, some important principles stand out.

Responsive Assessment

Assessment in the 21st century will incorporate multiple methods and will be responsive to the individual student's abilities. Measurement of core skills can be the starting point but not the target. Many visionary educational theorists, John Dewey among them, advocated changes in assessment of student learning away from standardized testing and toward more relevant and authentic measures of learning.

There is evidence that 21st century learning and assessment can boost student engagement. Reports from Suzanne Morse (2006); John Bridgeland, John Dilulio, Jr., and Karen Morison (2006); William Hart and Dolores Albarracin (2009); Lannie Kanevsky and Tracey Keighley (2003); and the Center for Evaluation and Education Policy (2009) show that students are frequently bored, disengaged, and find the work meaningless. An achievement mind-set was strengthened by engaging work. Factors that support engagement include control, choice, challenge, complexity, and caring. These are some of the same characteristics that are found in 21st century teaching, learning, and assessing.

Most students would benefit from an approach that would better prepare them for the 21st century than standardized tests currently do. Here's the story of one of such student. I first met Aaron as a high school senior in my section of the Senior Capstone Project. He was a special education student with a shock of red hair and freckles. As I got to know him, I learned that he had been teased throughout his life and thus was very reticent. As he became more comfortable with the other students in the class, he talked more about his ideas for a project. These included some of

the traditional type of projects: do some volunteer work, learn to cook, or save the world. During the planning process, each time Aaron shared his experience with playing music, participating in a drum and bugle corps, and working at a summer camp for children interested in music, his eyes grew wide and his enthusiasm became more evident. His classmates encouraged him to develop a project that would allow him to pursue this passion. He was paired up with a mentor, wrote a proposal, and began his project. His plan was to write a few songs for trumpet, baritone, and tuba. During the semester, his modest project became a full-blown symphony. His passion, dedication, and confidence grew. By the end, this shy student was willing to go on stage and conduct the school orchestra in a performance of his symphony. This student who believed he was not capable of attending college is now majoring in music education.

STANDARDS AND SKILLS

Starting With Standards

The Common Core State Standards (CCSS) are available through the U.S. Department of Education (www.corestandards.org). They were written in partnership with the Council of Chief State School Officers (CCSSO) and the National Governor's Association (NGA). Their purpose is to "ensure that all students are college and career ready no later than the end of high school." When these standards were released in 2010, the response from political and educational sectors ranged from strong support to robust opposition.

The connection between CCSS and 21st century skills is at times subtle and at other times strong. For example, one might suppose that "Reason with shapes and their attributes" was a higher-level skill, but this geometry standard is included at the kindergarten level. The standard for high school statistics is more clearly connected to 21st century skills; it requires that students be able to "make inferences and justify conclusions from sample surveys, experiments, and observational studies." To succeed in today's world, students need to master core skills and knowledge. They also need the skills necessary for personal and career success. In blending the two together, the core is honored and the 21st century skills are embedded.

Large-scale assessments will be based on CCSS. Timeliness and fairness in scoring while maintaining validity and reliability are important considerations. But equally important is assessment that determines a student's ability to use information and apply skills in real world situations. These types of assessment are more complex to administer and assess. Students should have multiple opportunities in the classroom to display their ability to solve problems, create, collaborate, and demonstrate leadership and global understanding. Teachers will need the skills and knowledge to assess them.

Connections to the Common Core State Standards

A review of the CCSS reveals a mixture of traditional skills and 21st century skills. Many are intended to build a foundation in literacy and numeracy. The list below shows some that connect the basics with 21st century skills. After that, Figure 1.6 shows how the common core foundational skills extend into higher-level analysis and evaluation.

K–12 anchor standards in speaking and listening:

- Participate effectively in a range of conversations and collaborations with diverse partners, building on other’s ideas and expressing their own.

K–12 anchor standards in presentation of knowledge and ideas:

- Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to the task, purpose, and audience.
- Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations.

K–12 anchor standards in writing:

- Text types: Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
- Production and distribution: Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.
- Research: Gather relevant information from multiple sources, assess the credibility and accuracy of each source, and integrate the information.
- Draw evidence from literacy or informational texts to support analysis, reflection, and research.

K–12 anchor standards in reading:

- Key ideas: Analyze how and why individuals, events, and ideas develop and interact over the course of a text.
- Craft and structure: Assess how point of view or purpose shapes the content and style of a text.
- Integration of knowledge and ideas: Delineate and evaluate the argument and claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.

Agreement among all stakeholders on what is important for students to know and be able to do will guide best practice in measuring them. When we start with these core skills and extend them into 21st century skills such as creating and solving authentic problems, then assessments can be designed to sustain those skills.

Figure 1.6 Extending Foundational Skills

<i>CCSS Foundational Skills/Grade</i>	<i>CCSS Extension of Skills</i>
Reading, writing, speaking, and listening/K–5: <ul style="list-style-type: none"> • Write narratives using effective techniques. • Write informative texts to convey ideas. 	<ul style="list-style-type: none"> • Engage in collaborative discussions
Reading/6–12: <ul style="list-style-type: none"> • Determine the theme or central idea. • Determine an author’s point of view. 	<ul style="list-style-type: none"> • Analyze how style and content contribute to the text.
Writing/6–12: <ul style="list-style-type: none"> • Produce clear and coherent writing. 	<ul style="list-style-type: none"> • Write arguments to support claims with valid reasoning and relevant evidence.
Speaking and Listening/6–12: <ul style="list-style-type: none"> • Prepare for and participate in a range of conversations and collaborations. 	K–12 Anchor <ul style="list-style-type: none"> • Evaluate a speaker’s reasoning and use of evidence.
Literacy in Social Studies and Science/6–12 <ul style="list-style-type: none"> • Cite specific textual evidence to support analysis of sources. 	Grades 6–8 <ul style="list-style-type: none"> • Distinguish among fact, opinion, and reasoned judgment in a text. High School <ul style="list-style-type: none"> • Integrate and evaluate multiple sources of information.
Math Grade 3: Number and Operations <ul style="list-style-type: none"> • Understand fractions as numbers. 	<ul style="list-style-type: none"> • Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects.
Math Grade 5: Measurement and Data <ul style="list-style-type: none"> • Convert like measurement units. 	<ul style="list-style-type: none"> • Represent and interpret data.
Math Grade 7: Geometry <ul style="list-style-type: none"> • Draw and describe geometrical figures. 	<ul style="list-style-type: none"> • Solve real-life problems involving angles, area, and volume.
Math High School: Statistics <ul style="list-style-type: none"> • Understand random processes underlying statistical experiments. 	<ul style="list-style-type: none"> • Make inferences and justify conclusions from surveys, experiments, and observational studies.

21st Century Skills

Standards, assessment, and technology are all driving change. National standards are driving local decisions. Instruction is moving away from traditional seat time to an engaged and collaborative model with the teacher as facilitator rather than deliver of learning. Assessment at all levels, from standardized tests to minute-by-minute classroom formative assessment, is being transformed. Technology is becoming the platform for learning as students have instant access to real-time information and use

this to generate new ideas. Clearly, the task of infusing 21st century skills into this milieu is both exciting and challenging.

I recently saw a presentation to a board of education on a learning collaboration between the local school and a school in Tanzania. These fifth-grade students used technologies to share information on their country's government, geography, climate, natural resources, schools, and family life. Grounded in language arts, math, and social studies, this exchange brought an understanding of the similarities and differences between the countries and awareness that people around the world are alike in many ways. In their presentation, the students were eloquent in their use of music, art, dance, and food to explain how each of these reflected life in their country. Through the use of technology, collaborative learning, and critical thinking, the students' worldviews were expanded. Throughout the project, students kept journals, self-assessments, and rubrics to measure progress.

There is no shortage of groups and organizations, locally and globally, that have been working to define 21st century skills. Readers will find many commonalities and patterns in each of their formats and descriptions. Yet each has its own unique approach. Some are very simply written and displayed, and others are highly complex and intricate. Some are newer and others have been available for decades. Upon reading and reviewing them, the common elements become clear. It's also evident that terminology varies with each source. A review of basic vocabulary and multiple perspectives on 21st century learning is a good starting point for the patterns and models in the next chapters.

It is in fact nothing short of a miracle that the modern methods of instruction and assessment have not yet entirely strangled the holy curiosity of inquiry; for this delicate little plant, aside from stimulation, stands mainly in need of freedom; without this it goes to wrack and ruin without fail.

– Albert Einstein

Reflection

If you were to select three of the most relevant skills for you and your students from the various models of 21st century skills, what would they be?

- Compare your selections to those of others in your learning community.
- Collaborate to create one list of the three most important.
- Begin to think about ways to include them in teaching and learning.
- What would be a relevant first step to make this happen?
- Envision and describe instruction that is refocused on 21st century skills.