21st Century Skills: Preparing Students for THEIR Future

Sue Z. Beers
President/Consultant, Tools for Learning
ASCD Author

What are the skills students will need in the 21st century?

The 21st century dawned as the beginning of the Digital Age – a time of unprecedented growth in technology and its subsequent information explosion.   Never before have the tools for information access and management made such an impact on the way we live, work, shop and play. New technologies and tools multiply daily and the new technologies of today are outdated almost as soon as they reach the market.

Numerous studies and reports have emerged over the past decade that seek to identify the life, career, and learning skills that define the skills needed for success in the 21st century world.   While there are some differences in how the skills are categorized or interpreted, there are also many commonalities. Common skills across most of the studies include

> **"Exemplary science education can offer a rich context for developing many 21st-century skills, such as critical thinking, problem solving, and information literacy. These skills not only contribute to a well-prepared workforce of the future but also give all individuals life skills that help them succeed." (NSTA, 2011)**

Creativity and Innovation	Using knowledge and understanding to create new ways of thinking in order to find solutions to new problems and to create new products and services.
Critical Thinking and Problem Solving	Applying higher order thinking to new problems and issues, using appropriate reasoning as they effectively analyze the problem and make decisions about the most effective ways to solve the problem.
Communication	Communicating effectively in a wide variety of forms and contexts for a wide range of purposes and using multiple media and technologies.

Collaboration	Working with others respectfully and effectively to create, use and share knowledge, solutions and innovations.
Information Management	Accessing, analyzing, synthesizing, creating and sharing information from multiple sources.
Effective Use of Technology	Creating the capacity to identify and use technology efficiently, effectively and ethically as a tool to access, organize, evaluate and share information
Career and Life Skills	Developing skills for becoming self-directed, independent learners and workers who can adapt to change, manage projects, take responsibility for their work, lead others and produce results.
Cultural Awareness	Developing cultural competence in working with others by recognizing and respecting cultural differences and work with others from a wide range of cultural and social backgrounds.

Integrating 21st Century Skills with Content

These skills are about the thinking processes and behaviors students will use as they learn subject area content and work with others to deepen their understanding of the content. All of the frameworks emphasize the need to ground 21st century skills in core content, and especially in an interdisciplinary fashion. Organizing instruction around important concepts and "big ideas" helps students create conceptual structures for storing, retrieving and using information in new and unanticipated ways. As the 21st century skills are integrated into content, some key design principles include

- Connecting the content knowledge to real-world applications and problem situations that enable students to see how what they are learning connects with their lives and the world around them. The work that is asked of students must be authentic work that is relevant and that mirrors real life.
- Emphasizing deep understanding of the learning by focusing on projects and problems that require students to use the content knowledge in new ways and to extend their understanding through collaboration with others.

- Helping students understand and monitor the thinking processes they are using by including metacognitive activities that ask students to reflect on their use of thinking structures and the effectiveness of the thinking strategies they employed.

- Using technology to help students access, analyze, organize and share what they are learning and allow students to independently locate appropriate tools for the task.

"The highest ranked skills for students entering the workforce were not facts and basic skills; they were applied skills that enable workers to use the knowledge and basic skills they have acquired."
(Key Findings: Are They Really Ready for Work? Conference Board 2006)

- Providing opportunities for students to become "creators as well as consumers of published information" (Apple, 2008) by providing opportunities for creating and verifying their own entries in collaborative sites and evaluating contributions of others.

- Engaging students in solving complex problems that require higher order thinking and application of content and that result in new perspectives and solutions to problems.

- Providing opportunities for students to work collaborative as they gather information, solve problems, share ideas, and generate new ideas.

- Developing life and career skills by creating opportunities for students to become self-directed learners who take responsibility for their own learning and who learn how to work effectively with others.

- Helping students make connections between subjects, concepts and ideas and with others, including those outside of the classroom.

The keys to integrating 21st century skills into the classroom are application, connections and participation. German psychologist Herman Ebbinhaus first advanced our understanding of learning and retention over 125 years ago. His research showed that retention is very low when there context for the learning and when the learning is not reinforced with practice. "Most humans tend to forget 50% of newly learned knowledge in a matter of days or weeks. … meaningful material (e.g. things that make sense because they relate to things we already know) takes only about one tenth the effort to learn and the forgetting is relatively gradual." (Haines, 2006) Infusing 21st century skills with subject area content, and

especially cross-curricular content, provides students with strong learning capacity and helps them retain the learning for ongoing use.

How Should Instruction Change to Prepare Students for Success in the 21st Century?

The 21st century skills are not really different. We have always wanted students to be creative thinkers and problem solvers who have the skills necessary to function effectively in society and in the workplace.   However, the way in which these skills are incorporated in the classroom and how technology is integrated will greatly change instruction. Indeed, with technology, today's classroom transcends physical walls and reaches around the globe. In addition, we need to plan instruction with an understanding of the "digital natives" (Prensky, 2001) who have grown up in the Digital Age and who expect learning to be interactive, engaging and up-to-date.

Instruction that meets the needs of today's students will incorporate

- A variety of learning opportunities and activities

- The use of appropriate technology tools to accomplish learning goals

- Project- and problem-based learning

- Cross-curricular connections

- A focus on inquiry and the student-led investigations

- Collaborative learning environments, both within and beyond the classroom

- High levels of visualization and the use of visuals to increase understanding

- Frequent, formative assessments including the use of self-assessment.

The role of teachers in a 21st century classroom shifts from that of the "expert" to that of the "facilitator." The focus for instruction shifts from "knowing" to being able to use and apply information in relevant ways. Students who are being prepared for the 21st century will be involved in "continuous cycles of learning" (Lemke, et al, 2003) that lead to deeper understanding of the subject area content and that develop the critical skills for meeting the challenges of the future.

How does S.T.E.M. reflect 21st Century Skills?

There is a natural match between 21st century skills and the basic tenets of S.T.E.M. Designing 21st century instruction begins with identifying basic themes and concepts that incorporate multiple subject content. Through the integration of science, technology,

engineering and technology, a S.T.E.M. curriculum exemplifies the cross-curricular learning that is the foundation of a 21st century curriculum.

To prepare students for their future lives and careers, they need to wrestle with real-life problems that are engaging and relevant. S.T.E.M. projects require students to be active learners who learn important concepts through creative and innovative projects. Their involvement in the problem-solving process builds a culture of inquiry, in which asking and answering their own questions becomes the centerpiece of the learning process. As problem solvers, students use high levels of thinking as they apply content knowledge in innovative ways.

S.T.E.M. curriculum incorporates the "four C's" of 21st century skills: creativity, critical thinking, collaboration and communication. Students work together to create innovative solutions to real-world problems and communicate their solutions with others. As they carry out their investigations and projects, they must access, analyze, and use the information they need to complete the learning tasks. While working through the task, students build important life and career skills by learning to manage their time, to become self-directed workers and to collaborate effectively with others. Using appropriate technology tools to complete their task, students discover the most effective and efficient ways to access and manage the world of digital information that is available to them. "Digital natives" find a S.T.E.M. classroom an inviting and challenging environment that incorporates their need to be interactive participants in their learning.

> **Our students have changed radically. Today's students are no longer the people our educational system was designed to teach.**
> *(Prensky 2001)*

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