Work at the Human-Technology Frontier Webinar Three: Educational Implications

Thursday, February 22, 2018

Hosted by:
STEM Learning & Research Center
(STELAR)
Educational Development Center, Inc.

stelar
STEM Learning and Research Center

EDC Learning transforms lives.

NSF

The Human-Technology Frontier

stelar
STEM Learning and Research Center

EDC Learning transforms lives.

NSF

How Industry Leaders View Future Work

- Predominance of dynamic, interdisciplinary teams
- Focus on data
- Artificial intelligence
- Ubiquitous computational thinking
- Engineering design/design thinking
- Convergence and focus on life sciences

How Industry Leaders View Future Work

- Cybersecurity and working within insecure systems/ boundaries
- Blurred boundaries between humans and machines
- Education/training emphasis on problem-based learning and solving real world problems
- Increased focus on continuous, life-long learning
- Ethics at the human-technology frontier

Question

- As an elementary school teacher responsible for teaching various subjects across the curriculum, a middle or high school teacher focusing on one subject, an administrator or support specialist working with teachers – **what questions/concerns do you have around integrating some of these new expectations into your curriculum?**

New Type of Worker

- Deep knowledge of science, technology and engineering
- Technical skills
- Keep data safe, interpret and tell data stories
- Computational thinking – use, modify, create technologies
- Willing to think outside the box, be innovative and disruptive
- Solve problems and risk failure

New Type of Worker

- Self-directed, curious, resilient
- Cooperative and intepersonally competent
- Lead dynamic interdisciplinary teams to consensus
- Characterized by insight, diligence, persistence and cooperation

Question

- How do you address these behaviors in your curriculum?
- What kinds of support would you need to increase attention to these in your curriculum?

Educational Implications

- Macro-level
  - Set vision/goals, increase awareness and provide political support
  - Set policy, fund programs/professional development
  - Adapt to rapid pace of change
  - Ensure standards are frequently revised, flexible, include behaviors, are connected/aligned across disciplines – increased emphasis on entrepreneurship, business and learning to learn
  - Increase/intensify government/university/industry partnerships
  - Establish a secure portfolio system of credentials/skills/ experiences

Educational Implications

- Research – Close the research/practice cycle
- Implementation –
  - Access to standards, supportive curricula/instructional resources, professional development (both JIT and intensive)
  - Adequate funding to access to technology/computational tools, equipment
  - Access to industry mentors/guides/teacher externships
  - Support for integrating new instructional strategies e.g. Problem-based learning, virtual learning and collaborations with teams in different geographies
  - Need for assessments targeting new skill sets/dispositions
  - Skill building/disposition development starting early - Foundational Career Competencies

Implications for K-8 Educators

K-8 Career Competencies Team

- Winnie Black, PSAYDN Project Accelerate Coordinator, Center for Schools and Communities, Camp Hill, PA
- Catherine Cramer, Senior Program Developer, New York Hall of Science
- Anne Gold, Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado
- Lori Rubino-Hare, Center for Science Teaching and Learning, Northern Arizona University
- Joyce Malyn-Smith, STELAR Team, EDC

STEM Career Competencies K-8: DATA LITERACY 1.0

Data Literacy: The data literate individual understands, explains, and documents the utility and limitations of data by becoming a critical consumer of data, controlling hIs/her personal data trail, finding meaning in data, and taking action based on data. The data literate individual can identify, collect, evaluate, analyze, interpret, present and protect data. (EDC, 2016).

Focus on Data in STEM Careers: "Our world economy and jobs are increasingly shaped by data and by the knowledge and skills required to use it effectively. (EDC,2016). At the Human-Technology Frontier continuous streams of data between and among humans and machines are being used by scientists, engineers and business leaders to create, innovate and make decisions to optimize products and services. As we move towards biological and chemical-based innovation, working with big data will allow us to expand our mathematical models by putting together life science models based on trends. Managing networks of connected devices will change relationships among organizational partners. Data publicly available within minutes of capture will accelerate the pace of innovation and change. Data literate students will enter the STEM workforce better prepared to perform routine work tasks and solve problems in high tech work environments dependent upon data for discovery and innovation.

K-2	3-5	6-8
Understand and experience the meaning of using information/data to answer or solve meaningful questions Understand how information can be collected, used, organized, and presented; (MA DLCS) Decode data from simple charts/graphs	Create basic charts and graphs, and use them to tell a data story. Identify structural components of data representations (e.g. axes on a graph, table rows and columns, scale on a geographic map, key on a color map. Etc (RWRS.)) Collect, organize, manipulate, and transform data, identify databases. (MA DLCS)	Decode, analyze and interpret data describing meaningful patterns, separate factual information from inferences, make predictions Identify most appropriate visualization for a given data set

STEM Career Competencies K-8: DESIGN THINKING 1.0

Design Thinking: Design thinking is a creative, iterative approach used by engineers and many other problem solvers to develop meaningful solutions to real-world problems. Components of design thinking include: stating the problem as clearly as possible, generating a number of different solutions, and testing/refining solutions to identify the best solution within the constraints of a particular situation.

Engineering Design/Design Thinking – Engineers innovate scientific discoveries. As the pace of technology, discovery and innovation increases, so will the need for Engineers who translate fundamental experiments into products and services that have societal impact. Design thinking plays a significant role in the future of work, not only because it captures the process by which ideas are translated into products, but also because it provides a common language and process for engineers and team members from other disciplines to define a problem and develop pathways towards a solution.

K-2	3-5	6-8
Identify a problem to be solved Develop a simple sketch, drawing, or physical model for a solution Test, retest, compare different solutions; decide which is the best choice	Identify a problem to be solved Identify the criteria for success and constraints on materials, time, etc. Identify and compare multiple possible solutions, considering the criteria for success and constraints Plan and carry out fair tests using variables related to success criteria and constraints Identify what aspects of the model or prototype can be improved	Describe a design problem and possible solutions, taking into account the system it is part of (including social and environmental benefits and costs) Identify the evidence that can be used to compare the positives and negatives of each solution (including scientific knowledge, information about past solutions to similar problems, evidence about social and environmental impacts) Develop a systematic way to weight the evidence and compare possible solutions Evaluate the evidence for each solution and assess the relative effectiveness of each solution

STEM Career Competencies K-8: DIGITAL LITERACY 1.0

Digital Literacy: The ability to use digital technology, communication tools or networks to locate, evaluate, use, and create information. (Digital Strategy Glossary of Key Terms, accessed August 21, 2008: www.digitalstrategy.govt.nz/Media-Centre/Glossary-of-Key-Terms/) A person's ability to perform tasks effectively in a digital environment. Literacy includes the ability to read and interpret media, reproduce data and images through digital manipulation, and evaluate and apply new knowledge gained from digital environments.(Barbara R. Jones-Kavalier and Suzanne L. Flannigan: *Connecting the Digital Dots: Literacy of the 21st-Century*)

Creativity and innovation at the Human-Technology Frontier will require individuals to develop a deep understanding of how to use technologies, modify them to their specific purposes/interests, use technologies to create and innovate products and systems and develop new technologies to meet societal needs. Digital tools are critical for conducting research, communicating, collaborating and creating in social, work, and personal environments. Digital tools are used to create, manipulate, analyze, edit, publish, or develop artifacts; to collaborate and communicate and to conduct research. (MA DLCS stds). Developing foundational skills in Digital Literacy will enable youth to successfully navigate the work we live in and take full advantage of the digital tools/resources available to access and create information.

K-2	3-5	6-8
Develop basic use of digital tools and research skills to create simple artifacts, communicate or exchange information; Explore how people use technology and how technology influences people. Explore differences between humans and computing devices	Use digital tools and keyboarding skills to publish multimedia artifacts, communicate or exchange information; develop intermediate research skills to create artifacts and attribute credit. Describe how technology influences people including a basic understanding of digital media messaging and equity of access issues. Differentiate tasks best done by computing systems.	Understand that different digital tools have different uses; Use a variety of digital tools to create artifacts, online content, and online surveys; communicate and publish online; advance research. Understand consequences of inappropriate technology use. Describe how emerging technology impacts schools, communities, and societies. Evaluate digital media bias and messaging. Differentiate tasks/problems best solved by computing systems or by humans.

STEM Career Competencies K-8: CYBERSECURITY & DIGITAL CITIZENSHIP 1.0

Cybersecurity and Digital Citizenship: (define)

Cybersecurity/working within insecure systems/boundaries – Valuable employees will know how to keep their data secure and create comfortable technology environments in which to work. This will become increasingly challenging as we are moving into an era where, no matter how we try, our technology systems won't be secure. Workers will need to continually assess their levels of risk, learn to function and get comfortable working in an unsecure environment; and learn how to code when our environment can't be trusted. To make judgements in these areas a solid understanding of security/cybersecurity is needed.

K-2	3-5	6-8
Understand the basic safety and security concepts when using technology and sharing information. Develop an understanding of what it means to be a good digital citizen. Explore how people use technology and how technology influences people.	Understand safety and security concepts including safe and appropriate use of technology and how to deal with cyberbullying. Demonstrate responsible use of technology, digital content, and interactions. Describe how technology influences people including a basic understanding of digital media messaging and equity of access issues.	Understand safety and security concepts including online identity, privacy, and how to deal with cyberbullying and inappropriate content. Demonstrate responsible use of technology and digital content with regards to ownership, licensing, and fair use. Understand consequences of inappropriate technology use Describe how emerging technology impacts schools, communities, and societies. Evaluate digital media bias and messaging.

STEM Career Competencies K-8: COMPUTATIONAL THINKING 1.0

Computational Thinking: Computational thinking is a problem solving process that requires people to think in new ways to enable effective use of computing to solve problems and create solutions. The capacity of computers to rapidly and precisely execute programs makes new ways of designing, creating, and problem solving possible. Computational thinking is characterized by:

- analyzing, modeling, and abstracting ideas and problems so people and computers can work with them;
- designing solutions and algorithms to manipulate these abstract representations (including data structures); and
- identifying and executing solutions (e.g., via programming).

Ubiquitous Computational Thinking (CT) - As humans and machines become more interdependent and share more work tasks, more workers across all industry sectors will engage in computational thinking. CT is already recognized as essential to the creativity and innovation in a world driven by technology (Council on Competitiveness, 2008; Cuny, Snyder & Wing, 2010; Isabel et al, 2010; Moran, 2016; President's Information Technology Advisory Committee [PITAC], 2005; Wing, 2016). Developing foundational skills in Computational Thinking will enable youth to explore their own interests and abilities in order to make preliminary STEM career decisions such as choosing to take elective or advanced coursework and participating in out of school STEM activities.

K-2	3-5	6-8
Break down an idea/problem into smaller parts; make smaller parts work together; Explore differences between humans and computing devices; Explore abstraction through identification of common attributes; Create and enact a simple algorithm. Create a simple computer program. Use basic models and simulations.	Differentiate tasks best done by computing systems; Differentiate between data and information; Create a new representation and break down a larger problem into sub-problems; Write, debug, and correct basic algorithms and programs; Explore differences in how data is represented, depending on the application.	Build a project with code using development environments; Work effectively with a group; understand team roles; Differentiate tasks/problems best solved by computing systems or by humans. Create new representations, define functions and use decomposition; Write, debug and analyze advanced algorithms and programs; Create models and modify simulations. Understand good network practices, protocols, and structures.

STEM Career Competencies K-8:
STEM CAREER DEVELOPMENT 1.0

STEM Career Development: Iterative lifelong learning experiences during which individuals develop their knowledge, skills, and dispositions and translate their interests, abilities, and values into a productive and rewarding career.

Future STEM Workplace Rationale: Career development begins at home, is nurtured through in-school and out-of-school experiences and is manifested in changing adult career choices. Career development is grounded during youths' formative years when they are developing the skills, knowledge and dispositions they will carry through into the workplace. When well-guided, students progress through stages of career development beginning with career awareness at the elementary level when children learn about their families and communities; and that people work in various careers. During the career exploration phase middle school youth explore and align their interests and values with adult roles and lifestyle choices that can be made possible through various careers. Youth then proceed to the career preparation stage when they make preliminary career decisions by selecting courses, enrolling in programs and selecting career pathways. Purposefully guiding STEM career development in K-8 helps to ensure that all students have opportunities to become aware of, explore, and, if interested, start on a pathway towards STEM careers. Well-guided STEM career development that begins early increases opportunity for students to develop interest in, and persist along STEM career paths that enable them to access the benefits afforded by high tech STEM careers available in the future.

K-2	3-5	6-8
Students will identify and discuss the different kinds of work and STEM Careers Students will know about goal setting and decision making Students will know what it is to be a good worker and a collaborative community member	Students develop positive attitudes about themselves as unique and special individuals by identifying personal interests, skills and abilities and how they might relate to various careers Students make choices about and demonstrate behaviors that lead to success in school/work Students identify social and life skills and demonstrate behaviors that influence interpersonal relationships in positive ways. Students will discuss STEM career pathways and clusters	Students explain how specific interests, skills and attitudes support and help maintain a positive self-concept Students analyze how personal traits, choices and behaviors affect success in school. Students demonstrate behaviors (communication, critical thinking, teamwork strategies, and managing conflict) that reflect positive interpersonal and life skills. Students will relate careers to individual interests, abilities, values, and aptitudes and the relationship of learning to future jobs and education and select 3 different STEM pathways to explore

Series of 4 Webinars: Work at the Human-Technology Frontier

- **Future Work at the Human-Technology Frontier.**
  - Thursday, January 25, 2018 2:00 – 3:00 pm ET
  - Joyce Malyn-Smith, Sarita Pillai, Caroline Parker (STELAR Center)
- **The Psychology of Working.**
  - Thursday, February 8, 2018 2:00 – 3:00 PM ET
  - David Blustein (Boston College)
- **Educational Implications of Future Work at the Human-Technology Frontier**
  - Thursday, February 22, 2018 2:00 – 3:00 pm ET
  - Joyce Malyn-Smith (STELAR Center)
- **Policy Implications of Future Work at the Human-Technology Frontier.**
  - Thursday, March 8, 2018 2:00 – 3:00 pm ET
  - Sarita Pillai, Caroline Parker (STELAR Center)

stelar STEM Learning and Research Center

EDC Learning transforms lives.

NSF


Q&A

The Human-Technology Frontier

Building the Foundational Skills Needed for Success in Work at the Human-Technology Frontier

Joyce Malyn-Smith, Ed.D.
David Blustein, Ph.D.
Sarita Pillai, M.B.A.
Caroline E. Parker, Ed.D.
Ellen Gutowski, M.A.
A. J. Diamonti, M.A.

EDC Learning transforms lives.

stelar
STEM Learning and Research Center

go.edc.org/HTF-Whitepaper

For More Information Contact:

stelar@edc.org

stelar
STEM Learning and Research Center

EDC Learning transforms lives.

NSF