eColloq Webinar: Building the Foundational Skills Needed for Success in Work at the Human Technology Frontier

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The Human-Technology Frontier

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With Thanks

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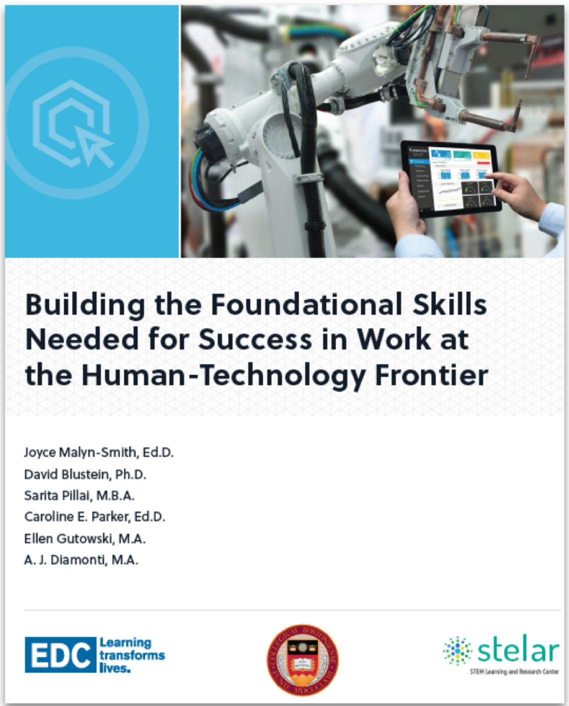
White Paper


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

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Psychology of Working Theory

Multiple human needs:

- Survival
- Social Connection
- Self-determination
- Well-being
- Work fulfillment

Reference: Duffy, R.D., Blustein, D.L., Diemer, M.A., & Autin, K.L. (2016). The Psychology of Working Theory. Journal of Counseling Psychology, 63, 127-148.

Decent Work

- Physical and interpersonally safe working conditions
- Hours that allow for free time and adequate rest
- Organizational values that complement family and social values
- Adequate compensation
- Access to adequate health care

What would STEM programs using psychology of working as the conceptual framework look like?

- Focus on identifying barriers and developing ways to work around obstacles
- Focus on enhancing empowerment and critical thinking
- Explore internalization of social identities
- Continue efforts at career exploration and skills development, with the intention of enhancing self-efficacy and interests
- Develop psychological attributes that help people navigate difficult social barriers
  - Proactive personality
  - Social support
  - Adaptive cognitive and psychological skills

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 a researcher with cyberlearning interests, what research questions/concerns come to mind as you think about this new world of work and the implications for education**?**

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 interpersonally competent
- Lead dynamic interdisciplinary teams to consensus
- Characterized by insight, diligence, persistence and cooperation

Questions

- How do you see these behaviors addressed in current research?
- What kinds of support would you need to increase attention to these within the research community?

STEM Career Competencies K-8

- Computational Thinking
- Design Thinking
- Cybersecurity & Digital Citizenship
- Digital Literacy
- Data Literacy
- STEM Career Development

STEM Career Competencies K-8: STEM CAREER DEVELOPMENT

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

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.

Educational Implications

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

Educational Implications

- Research
  - Close the research/practice cycle
  - Trends, patterns, big data
- Implementation
  - Access to standards, supportive curricula/instructional resources, professional development (both JIT and intensive)
  - Adequate funding to access to technology and computational tools, equipment

Educational Implications

- Implementation
  - Access to industry mentors and teacher externships
  - Support for integrating new instructional strategies and technologies
  - Need for assessment targeting new skills and dispositions

Who is the workforce of the future?

- 9.4% of all students in U.S. are English learners
- 13% of all students are identified with disabilities
- 50% of students identify as race/ethnicity other than white
- One third of students attend rural schools
- Half of all students are girls

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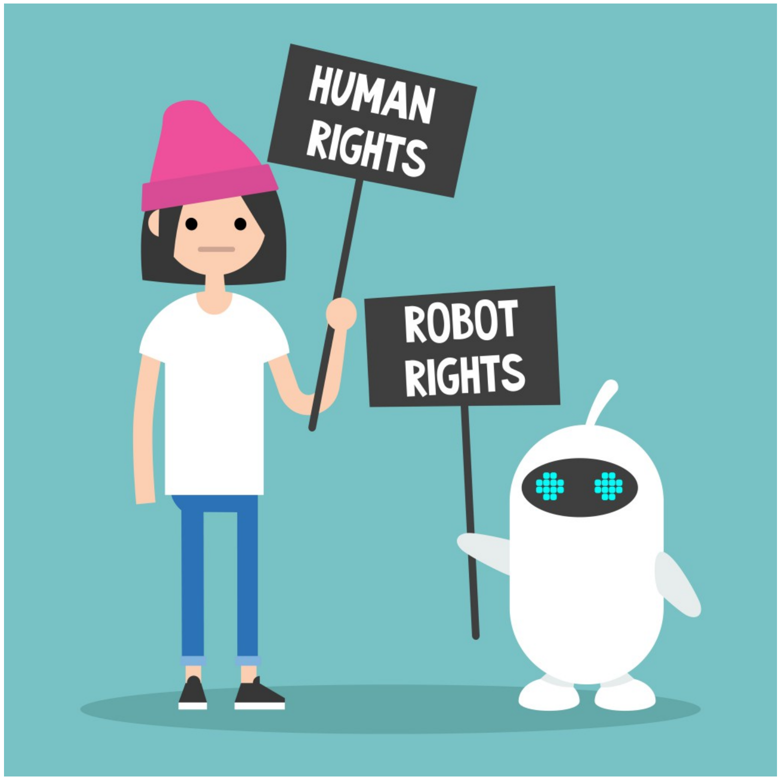
Equity, Access and Ethical Implications

- Growing inequity in STEM among underrepresented groups, hastened by AI and other technologies
- Shift in skills to enter labor market
- Diversity drives innovation
- Public policy implications

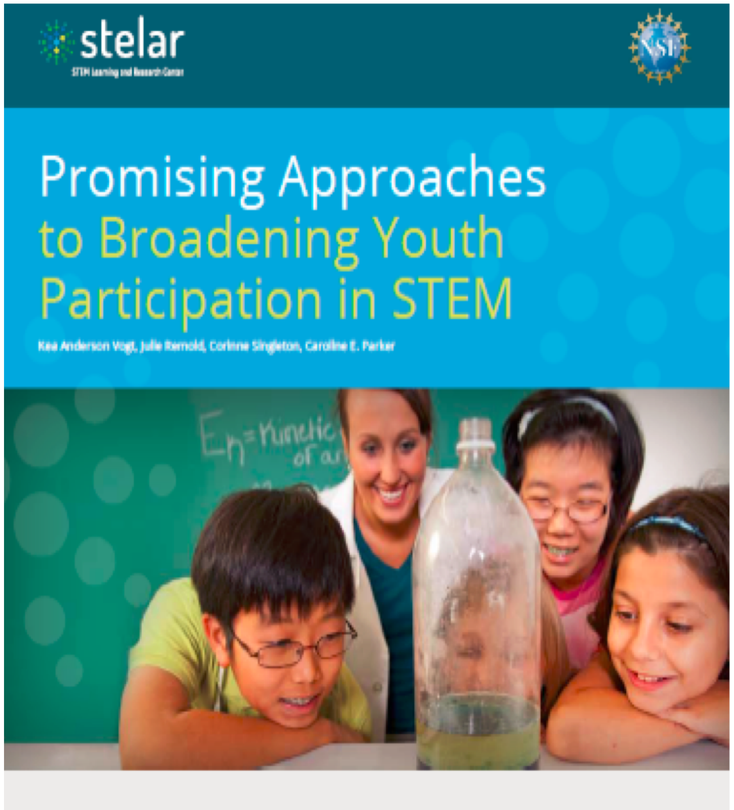


Barriers to STEM

- Access to grade level rigorous content courses
- Bias in discipline
- Pressure on teachers to teach to the test
- De facto segregation
- Deficit mindset
- School safety
- Out-of-school challenges including racism, economic instability, immigration uncertainty

Pushing the Conversation

How can we create spaces where culturally and linguistically diverse learners transform future possible workplaces?



Policy Implications

- Invest early in STEM learning incorporating STEM competencies
- Act now to shape the human-technology frontier for inclusion
- Continually address the ethical, safety, and security implications of the human-technology frontier
- Engage research and practice leaders within government agencies and institutions to engineer innovation and conduct research in STEM workforce education
- Share findings broadly to leverage change in both education and the future workplace

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