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STEM-Centric Career Development for a Competitive Workplace

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STEM-Centric Career Development for a Competitive Workplace

Chapter 3

NEW JOBS AND NEW SKILLS FOR A CHANGING WORKPLACE:

STEM-Enabled Technicians and Professionals

by **Joyce Malyn-Smith** and **David M. Smith**

Introduction

Worldwide rapid technological advances of the last quarter century have produced a global innovation economy driven by technology. New technologies and their work applications have profoundly affected all industry sectors from medical imaging to large-scale databases used in financial services and research to construction of energy efficient and healthy buildings to the arts. At the same time connectivity brought about by the internet has created a new global workplace providing new ways of working online and in geographically distributed teams.

While familiar reports cite the need for more scientists and engineers (Business Round Table, 2005; National Academies of Sciences, 2005), the Thrive Report (Council on Competitiveness, 2008) speaks to our nation's need to retain a leadership position in technology in order to "outcompute" and thereby outcompete in the global innovation economy. Thrive cites the need for "more computational scientists and engineers to leverage America's IT advantage" (Council on Competitiveness, 2008, p. 6) as one of the four areas policymakers need to focus on to ensure that Americans can maintain our innovative advantage. The NSF set a bold Cyberinfrastructure Vision for 21st Century Discovery (NSF, 2007) and laid the groundwork for increased attention on STEM education to prepare a future work force with the skills and knowledge needed to design, deploy, adopt, and apply cyber-based systems, tools, and services (NSF, 2009). Sharing similar concerns, computer scientists and educators have approached this issue by exploring and advocating for the integration of computational thinking (CT) into the K–20 curricula in order to ensure that all learners leave school with the ability to think like computer scientists using cyberinfrastructure resources to carry out routine tasks and solve problems at schools and at work. These changes have created new jobs in America's workplaces and a demand for new skills needed for workplace success.

At the same time we are mindful of a new generation of digital natives developing a different skill set through their long-term intensive interactions with traditional and new technologies. In addition to changing social, communication and problem solving routines, many believe that these technology experiences are changing the way youth think and process information (Are digital natives wired differently?). If so, then while we are in the midst of rapid technological change we are also in the midst of profound cultural and social change. Combined, these two shifts – the shift towards using technology tools and processes for living, learning and working; and the shift in ways of thinking and problem solving associated with human/computer interaction – are reshaping the world of work. It also presents a significant challenge to career development professionals seeking to assist youth and adults in moving towards productive and rewarding careers.

Though this sea change is taking place, the number of STEM empowered workers in the United States is not able to meet our nation's needs despite a broad base of support from policy makers, practitioners and researchers concerned with developing our nation's next generation of STEM talent. Some of the factors leading to this skills shortage include: (1) The retirement of baby boomers with bachelor degrees. STEM workers are the fourth largest group of that population (Carnevale et al, 2011). (2) The decline in the number of post-secondary students in the U.S. seeking STEM degrees to about 18 percent, half of which are foreign students. Though producing the most degreed stem workers, the US ranks 27th in the percentage of STEM graduates in industrialized nations (STEM, 2012). And (3) The need for a *homegrown* STEM pipeline to fill positions in our secure national laboratories and defense agencies is of great national concern. Add to that the changing nature of STEM jobs needed for a changing workplace and the problem is heightened.

New Skills for New Jobs

As we explore the new world of work we can see many new jobs developing in large and small companies as well as substantive changes in the skills people need to succeed in these highly technological work environments. What does the research tell us about the new skills needed for new jobs in technology, science, engineering, and math? Below are examples of two new jobs whose creation was driven by technological change. They are followed by examples of research on skills that are needed to succeed in the new workplace, and suggested activities to help career professionals better understand the skill requirements of the new STEM workforce.

New Jobs for the New Workplace – Mecomtronics Technicians

The term **mecomtronics** is defined as *The combined disciplines of mechanics, computers, telecommunications and electronics; robotics* (ATE, 2004, p. 15). As technologies are driven deeper into the world of work, new occupations are emerging that require workers to be cross trained in more than one traditional career field. One of the first, and now commonly known mecomtronics occupations, is the Mecomtronics Technician who maintains, troubleshoots and repairs mechanical equipment driven by electronic components. As the need for such workers grew, so did the technical training programs that prepare these technicians for work. Program developers integrated the most relevant components in the curricula of mechanics, computers, telecommunications and electronics programs to train Mecomtronics Technicians to perform the routine tasks and solve problems related to this new career field. A Mecomtronics Technician might troubleshoot and repair equipment in a computer driven robotic manufacturing assembly line, or green building HVAC (heating, ventilation and air conditioning) system.

New Jobs for the New Workplace – Health IT Specialists

More recently the computerization of health records created new jobs in a field now called Health IT (Information Technology). Health IT specialists maintain health records, facilitate information sharing across healthcare providers and public health authorities, and help redesign the flow of work within health and hospital settings. Their responsibility is to maximize the quality and efficiency benefits of electronic health records while maintaining privacy and records security. Through funding from the Department of Health and Human Services, community colleges nationwide are redesigning courses and establishing new programs to prepare workers for this new field. New Health IT occupations include (a) practice workflow and information management redesign specialists, (b) clinical practitioner consultants, (c) implementation support specialists, (d) implementation managers, (e) technical/software support staff, and (f) trainers.

New Skills for the New Workplace – Expert Thinking and Complex Communication

The changes we are experiencing today were discussed in 2004 in ***The New Division of Labor – How Computers Are Creating the Next Job Market*** by Harvard Graduate School of Education Professor Richard Murnane and MIT Economics Professor Frank Levy. Their premise was that many of the routine cognitive and manual work tasks performed by humans would be taken over by computers. The authors identified two general skills that are increasingly needed and which computers cannot replicate: expert thinking and complex communication. They predicted that routine cognitive tasks and routine manual tasks that can be described by deductive or inductive rules would be subject to computerization; consequently, jobs focused on those routine tasks would also be subject to elimination. On the other hand, non-routine manual tasks such as truck driving will remain unaffected, and expert thinking and complex communication will rise. *"Expert thinking, addresses the ability to solve new problems that cannot be solved by rules. New problems range from conducting research to fixing a new problem in a car (not covered in the manual), to creating a new dish in a restaurant. Complex communication, addresses the ability not only to transmit information, but to convey a particular interpretation of information to others in jobs like teaching, selling, and negotiation. If a student gets a calculus lesson from the web, the student will literally have the information. But there is no guarantee that the student will understand the information she is receiving. It takes a good teacher to present the information in a way that allows the student to translate the information into knowledge she can apply"* (HGSE, 2004).

New Skills for the New Workplace - Computational Thinking

Since the publication of Jeanette Wing's article **Computational Thinking** in 2006 -- in which she challenged us to believe that thinking like a computer scientist should be a core skill for all who live, learn, and work in the digital age -- the conversation on computational thinking has expanded into the discourse of the national community of computer science professionals as well as educators who are developing the next generation of STEM talent. Nonetheless, various groups concerned with evolving technological fluency have been struggling to define *computational thinking* operationally or to generate examples that clarify the concept for educators attempting to build pathways to STEM careers (Allan et al., 2010; Cuny, Snyder, & Wing, 2009; National Research Council, 2010; Wing, 2009).

Examples of computational thinking (CT) that could be integrated into K–12 learning were proposed by participants at the April 2010 **Thought Leadership for Computational Thinking Conference,** co-hosted by the Computer Science Teachers Association and the International Society for Technology in Education. The recently proposed images of a *computationalist* as a person who does computing and a *contextualized computationalist* as a person who engages in CT while working in domain-specific disciplines/jobs (Isabel et al., 2009) are helping us to imagine what CT might look like when used to solve workplace problems. "Building expressive and descriptive models of physical, human, or abstract systems" in medicine, engineering, environmental sciences, and other STEM fields is one example of how contextualized computationalists might do this (Isabel et al., 2009).

EDC Research: Computational Thinking in America's Workplace

In the National Science Foundation funded Advanced Technological Education project titled "Computational Thinking in America's Workplace", Education Development Center, Inc. (EDC) worked with a technical committee of scientists and engineers from the SANDIA and Los Alamos national laboratories and CT thought leaders from the University of Washington, Massachusetts Institute of Technology, Williams College, Santa Fe Institute, and Raytheon Corporation to identify and validate a common core of CT skill sets used by scientists, technicians/ technologists, engineers and mathematicians in America's STEM workplaces. This work resulted in a profile of the Computational Thinking-Enabled STEM Professional. A CT-Enabled STEM Professional "uses skills, habits and approaches integral to solving problems using a computer (e.g. abstraction, automation and analysis) as he/she engages in a creative process to solve problems, design products, automate systems, or improve understanding by defining, modeling, qualifying and refining systems, processes or mechanism generally through the use of computers. Computational thinking often occurs in collaboration with others." (EDC, 2011).

The expert panel identified three job functions which cross cut all of the work of a CT-enabled STEM Professional: engages in a creative process; collaborates; and documents. They also identified eight major job functions: identifies the problem; specifies constraints; designs the model/system; builds the model; develops experimental design; verifies the model; optimizes the user interface and model; and facilitates knowledge/discovery. For each job function the expert team identifies constituent tasks. Sixty-eight tasks, in all, were identified. In addition to the identification of essential job functions and work tasks, the importance of computer modeling in the life of the Computational Thinking-Enabled STEM Professional is worth noting **[Figure 1]** (EDC, 2011).

New Skills for the New Workplace – Social Media

The social media phenomenon made possible by internet technologies began as an outlet for personal expression and creating social groups. However, its value in building identity and in reaching target markets was quickly realized by business. We see social media used today to build business-to-business and business-to-consumer networks, market products and services, engage customers and build a strong business base. The use of social media by business is growing as is the need for Social Media Enabled Technicians.

The FedEx Office **Signs of the Times Small Business Survey** polled 500 small business owners across the country in 2011. In responses to the question about how they plan to grow their businesses in 2011, social media was one of the few methods that gained when compared to the 2009 and 2010 surveys. The study shows that 45 per cent of small-business respondents listed social media in their plans for business growth in 2011, compared to 36 per cent in 2010 and 24 per cent in 2009 (FedEx Office, 2011). This finding is further supported by a study by the University of Maryland's Smith School of Business that looked at the relationship between social media and small businesses. The study found that the "technology adoption rates in the U.S. have doubled in the past year from 12 to 24 per cent. Facebook and LinkedIn have become the predominant platforms for small business owners while it is expected more small businesses will use Twitter as a customer service channel in the year ahead" (Mashable.com, 2010).

EDC Research: Social Media Enabled Professional

Using the same modified DACUM approach (expert panel, development of the occupational profile) employed in the Computational Thinking research, EDC in partnership with the Advanced Technological Education (ATE) National Center for Information and Communications Technologies (ICT) at Springfield Technical Community College identified and validated social media skills needed by technicians to develop their business brand and social network. In addition, after the profile was developed the project team worked with the expert panel to develop examples of how technicians use social media tools in routine work, to solve problems, and manage a business enterprise. Armed with these examples, staff with technical and community college faculty developed rubrics to guide assessment of these new media skills. Future work in this continuing project will include developing problem-based learning scenarios to integrate social media business skills into community college technical program curricula.

The expert panel defined the Social Technology Enabled Professional as one who: builds, maintains, manages and leverages online social networks to engage with customers, business partners, employees and key influencers with the goal of building organizational success (EDC, 2012). The profile identified 59 related tasks and six major duties associated with that new job: conduct research; create a social networking strategy; establish an online presence; create content to engage community; manage online presence; and engage in professional development/ongoing learning.

The value of using social media to build a business brand and network is not limited to building a small business. Its value was clearly shown to this article's co-author, Dr. Malyn-Smith, as the Principal Investigator of the ITEST (Innovative Technology Experiences for Students and Teachers) Learning Resource Center. The ITEST team used social media to improve its service to the ITEST community. The team studied the Social

Media profile and information contained in its associated rubrics, then integrated some of the strategies into its dissemination plan. An editorial calendar was established (Social Technology Enabled Professional task 4A); content appropriate to the specific goal of building participation in an upcoming webinar was crafted (4C); content meaningful to the ITEST audience and consistent with organizational brand and voice was created (4D); compelling content using relevant media (text, audio, video, etc.) was produced (4F) and strategically, syndicated across social platforms and existing markets (4H). The result of this social media approach was a 500 per cent increase in attendance in the targeted webinar over previous webinar attendance with the same participant group.

Today the foundational skills required for this work – use of social media tools and a level of comfort using social technologies as communication devices – are learned in and out of school beginning in childhood. The new workplace skill requires individuals to build on their technology interests and capacities and learn to apply those to specific workplace functions. In this case that function was to use social media to build a business brand and network.

New Skills for the New Workplace - Arizona's New Workplace Employability Skills

In the preceding sections, we focused on the changing STEM employment environment nationally. We also see regional needs driving region-specific approaches to address industry, education and workforce needs. For example, Arizona's New Workplace Employability Skills initiative mirrors the call for new skills identified in the research discussed above. The workplace is an "increasingly dynamic space with a number of key drivers: rapid technological change, the interaction of multiple generations working side by side, and the pace of innovation, all of which place an increased demand for creativity and innovation on the workplace." (Arizona State University, 2011, p. 3). Regardless of the business or industry, no matter how proficient in the technical skills of a job, an employee who lacks the ability to communicate, collaborate, think, and demonstrate a work ethic that supports the goals and culture of the organization is not likely to get or keep, let alone advance in, a job (Arizona State University, 2011, p. 14). Over a two-year period, in a process facilitated by the University of Arizona's Workforce Education Development Office (WEDO), Arizona's employers, met, discussed, and vetted the basic workplace skills they expect their employees to possess in order to ensure productivity and success of their companies and to sustain a strong state economy.

As one Arizona employer noted during a skills standards development session *We hire for the hard skills, we fire for the soft skills* (Anonymous employer, 2012). Arizona's New Workplace Skills model builds upon, expands and deepens our traditional view of the *soft skills* needed for workplace success and reflects the complex and the integrated nature of work in the 21st century. As cited below, this model recognizes three types of skill sets needed for workplace success: Core Human Interaction Skills for the New Workplace, skills related to Developing the New Worker and skills needed for success in the Redefined New Workplace. It also deepens our understanding of the complexities of today's workplace by drawing focus to new skills such as intergenerational competence as well as cross-cultural competence, organizational culture, self-direction, ethical practices, and the nuances of the newly defined core skills of complex communication and expert thinking.

As we dig deeper into this model the Arizona report more precisely defines these skills as follows:

- Skills for Core Human Interaction in the New Workplace include:
- Complex Communication (worker employs complex communication skills in a manner that adds to organizational productivity);
- Collaboration (worker collaborates, in person and virtually, to complete tasks aimed at organizational goals); and
- Expert Thinking (worker integrates a mastery of technical knowledge and skills with thinking strategies to create, to innovate, and to devise solutions).

Skills for Developing the New Worker include:

- Professionalism (worker conducts oneself in a professional manner appropriate to organizational expectations),
- Initiative and Self-Direction (worker exercises initiative and self-direction in the workplace), and
- Intergenerational and Cross-Cultural Competence (worker interacts effectively with different cultures and generations to achieve organizational mission, goals, and objectives); and
- Skills for Success in the Redefined, New Workplace include:
- Organizational Culture (worker functions effectively within an organizational culture),
- Legal and Ethical Practices (worker observes laws, rules, and ethical practices in the workplace), and
- Financial Practices (worker applies knowledge of finances for the profitability and viability of the organization).

The work in Arizona adds to our understanding of the importance of employability within the context of developing STEM-Enabled Technicians and Professionals.

A Continuum Model for STEM

A continuum model for the application of STEM skills and knowledge to life and career roles was developed in 2010, at the Education Development Center, Inc. (EDC, 2010). The **STEM for Learning, Living, and Working** model works outward from (1) STEM skills needed for living and learning to (2) use of STEM skills in all work. These are surrounded by (3) intensive skills and competencies needed for STEM application throughout all industry sectors. The outside band (4) includes technical skills and competencies specific to STEM industry workers and researchers. As one moves along a continuum from the level one inner circle to the level four outside band the depth, breadth, and complexity of needed STEM skills and knowledge increases. Many educators have used this model as a reference point as they have explored ways to address STEM within their school programs and curricula.

Application of Fundamental STEM Skills for Living and Learning.

The center circle contains the core skills of a STEM-Enabled literate society. This level represents foundation knowledge gathered and skills practiced from informal and discipline specific learning within K-12 education. Included in this circle is the application of Science Technology, Engineering, and Math concepts to daily life. Some application examples: balancing a checkbook (Math); online research and purchasing (Math and Technology); waste recycling (Science and Engineering).

Application of Core STEM Skills for Work

Core STEM Skills undergird our world of work. The following examples reflect only a few of the existing applications. The use of technology tools provide a foundation for most business practices and operations from email to data and information management, HR systems, decision modeling and asset tracking. Science and Engineering concept application ranges from selection of ergonomically designed furniture, space allocation, construction planning, material selection, product design and manufacturing, etc. Math concepts underlie development of accounting, payroll, sales, and inventory systems.

Application of STEM Intensive Skills/Competencies to the STEM-Enabled Workforce

The third ring of the model reflects skills and knowledge needed by STEM-Enabled workers. Employment opportunities for these workers exist in sixteen career clusters identified by the U.S. Education Department. As knowledge and innovation economies grow and progress, this STEM-enabled workforce will require a deeper understanding of science, technology, engineering, and mathematics concepts, and more skills in the sophisticated use of technology tools and systems applied to specific industry and business environments. Today's STEM enabled workers are found in every industry sector, for example, educators using e-textbooks, smart whiteboards and websites to teach subject matter; engineers using Computer Aided Design (CAD) and collaboration software to design new products online in geographically distributed teams; and neurointerventionalists who use minimally invasive therapy in to perform angioplasties of blood vessels in the brain to increase blood flow of victims of intracranial aneurisms.

Industry-Specific Technical Skills/Competencies for STEM Professionals.

The outer two circles represent the technical skills and competencies specific to the STEM industry. Scientists, engineers, and technologists who use STEM systems to do their work are part of the innermost of these two circles. Use of computer modeling, technology tools, and cyber infrastructure characterize the work lives of today's scientists and engineers. The outermost circle represents researchers, creators, and developers of science, technology, and engineering products and services. Technology researchers and product designers—those scientists, engineers, technologists, and mathematicians who design and create the STEM products and services—provide the resources that are used by people who populate the other circles.

Including New STEM Skill Areas in Career Development Activities

The *Making Sense of STEM for Living, Learning and Working model* provides a useful tool for career counselors and other career development professionals to visualize the STEM skills progression needed to live, learn and work in today's innovation economy driven by technology; and to differentiate between STEM-enabled careers and careers as STEM professionals. Career development is a process that begins early in life at home, is nurtured in and out of school during childhood, adolescence and adulthood, and is translated into a productive and rewarding career. Even when the career development process is nurtured and supported and a long term vision is cast for a future career, individuals may have difficulty understanding the marketability of their skills/knowledge and how to translate that into a paying job. We offer the following real life example of a high school student who worked for several summers helping his father install computer labs at a local college. When it was time for him to find summer work on his own, his first thought was to try to get a job folding pizza boxes. He was unable to make the connection between the value of the networking technology skills developed in his summer work and the value of his skills to an employer he did not know. In today's world -- where youth and adults develop technology skills in informal, community-based environments, as well as school-based learning environments-- it falls upon those supporting career development to help individuals understand the marketability of their skills and knowledge and translate those into job opportunities. To help career development professionals better understand the skill requirements of STEM technical and professional workers , we suggest the following activities.

- Learn about the new jobs and new skill requirements inherent in a global innovation economy driven by technology by spending time in the workplace.
- Create externships for self and others to learn about the changes taking place in industries in communities from which your clients are drawn.
- Develop partnerships with local businesses to facilitate internships for students and externships for teachers.
- Join business associations to develop relationships with potential employers. Seek a mentor from the business community. Develop partnerships with local businesses to facilitate internships for students and externships for faculty.
- Bring the new workplace into your space. Host in-person and online learning exchanges between employers seeking workers for new jobs and/or with new skills and people seeking employment. Video tape/archive these exchanges to share with others. Repurpose the videos/webinars inviting industry guests to participate in follow-up Q&A.

As few assessments take into account the new workplace skills, listen carefully to what individuals say about their work and leisure interests and prior experience. Probe with questions to determine their talents in relation to new workplace skill requirements. Help them understand the marketability of their capacities and connect them to employment opportunities. Millennials, for example, may need help connecting their technology talents to workplace needs. More mature clients may need assistance understanding and valuing their prior experiences navigating organizational cultures.

Seek out clearly articulated language that describes new jobs and new skills, particularly what workers need to know and do to succeed at work. Use the duties and tasks found in new worker profiles, such as those included in this article, to develop career activities/assessment for your clients. For example, have clients circle the tasks they can perform and use that language in resumes. Help individuals to prepare for job interviews by reviewing tasks listed on the profiles and discussing examples of their work successes and challenges they have overcome in relation to these tasks.

New jobs integrating the previously separate industry and education/training sectors challenge us all to rethink the world of work. Expert thinking, complex communication, computational thinking, intergenerational communication, navigating organizational cultures, collaborating face to face and in virtual environments, working in geographically distributed teams, and using social media to build business are only some of the new skills needed for success in today's highly dynamic world of work. The emergence of new jobs and new skills requires leaving our comfort zones, making new connections outside the box and developing new relationships with others. As we consider how to prepare others for success in this new world of work – we must ask: How ready are we?

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Joyce Malyn-Smith's body of work focuses on developing strategic initiatives in workforce and human development. She is principal investigator of workforce education projects in EDC's Division of Learning and Teaching where she leads various national projects funded by the National Science Foundation (NSF), Education Department (ED), state and local agencies. A seasoned project leader, she is principal investigator of the Computational Thinking (CT) in America's Workplaces (NSF) project working with scientists and engineers from national laboratories and industry to create a framework that details the work of U.S. STEM professionals empowered with computational thinking. This project is informing and advancing ongoing national efforts to define CT and to integrate CT into K–20 education programs aimed at building the next generation of STEM innovators. She also leads the New Media Technician project funded by NSF to define how technician entrepreneurs use social media tools/resources to build a business brand and network; and to integrate social media tools into technician education programs in community colleges nationally. As principal investigator of the ITEST (Innovative Technology Experiences for Students and Teachers) Learning Resource Center (NSF, 2003-2013.) serving more than 195 NSF projects, and partnering with national organizations, she provided overall conceptual leadership guiding the LRCs philosophy, goals, activities and services; develops partnerships and is responsible for raising the public visibility of ITEST nationally. For nine years she led NSF's Information Technology Across Careers initiative that integrated core IT skills into career programs in community colleges using a problem-based learning approach. She served as Project Director for the U.S. Education Department's initial IT Career Cluster Initiative project (Building Linkages in IT) leading education leaders from 13 states in developing and piloting a skills framework for pathways to IT careers; and for the National School-to-Work Office led EDC's Techforce Initiative highlighting and expanding IT employer activities in School-to-Work nationally. She was the skill standards developer for 3 National Skill Standards Board projects (Bioscience, Chemical Process, Human Services) and the leader of EDC's Power Users of Technology Initiative. Prior to joining EDC, she served Boston Public Schools as a teacher and citywide administrator for more than 20 years. As Program Director Occupational Instructional Design she directed the competency-based curriculum development and production process for 29 vocational skills programs and managed business education for the city's 15 high schools (4,000 students). She led three significant reform efforts in BPS: 1) the move from traditional teacher-centered lecture/demonstration-based teaching and learning programs to a student-centered competency-based curriculum and assessment model for Boston's vocational/technical programs; 2) the reform and program evaluation process for Boston's Business Education programs; 3) with the Director of Education and Employment led the merger of Madison

Park High School and the Hubert Humphrey Occupational Resource Center into a single comprehensive technical high school. A sought after speaker at national conferences and published in peer reviewed journals, she is a graduate of Boston Univesity (EdD), Boston State Teacher's College (MEd) and Universidad Interamericana, Hato Rey, Puerto Rico (BS). Contact her as follows:

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APPENDIX ON THE FOLLOWING PAGES:

Figure 1: Profile of a CT Enabled STEM Professional Research Scientist.

Figure 2: Profile of a Social Technology Enabled Professional.

Figure 3: Arizona's New Workplace Skills.

Figure 4: STEM Concentric Circle Model

Figure 1: Profile of a CT Enabled STEM Professional Research Scientist

A Profile of a Computational Thinking Enabled STEM Professional in America's Workplaces - Research Scientists/Engineers

A computational thinking enabled STEM professional uses skills, habits and approaches integral to solving problems using a computer (e.g. abstraction, automation and analysis) as he/she engages in a creative process to solve problems, design products, automates systems, or improve understanding by defining, modeling, qualifying and refining systems, processes or mechanism generally through the use of computers. Computational thinking often occurs in collaboration.

Engages in a creative process

Collaborates

Documents

CATEGORY	JOB FUNCTIONS	ACTVITY 1	ACTVITY 2	ACTVITY 3	ACTVITY 4	ACTVITY 5	ACTVITY 6	ACTVITY 7	ACTVITY 8	ACTVITY 9	ACTVITY 10	ACTVITY 11	ACTVITY 12	ACTVITY 13
Defines	A. Identifies problem.	A1. Identifies the scope of the problem.	A2. Selects relevant aspects of the problem.	A3. Identifies data sources.	A4. Identifies risks of failure.	A5. Defines assumptions and limitations.	A6. Identifies existing tools and solutions.	A7. Researches existing knowledge.	A8. Determines if problem is already solved.	A9. Identifies the need for a computational approach.				
	B. Specifies constraints.	B1. Determines if stakeholder has articulated the correct problem.	B2. Identifies stakeholder.	B3. Conducts needs analysis.	B4. Resolves conflicting requirements.	B5. Specifies requirements of the solution.	B6. Specifices resource requirements.	B7. Specifies accuracy to be achieved.						
Models	C. Designs the model / system.	C1. Proposes solution(s) / outcome(s) related to the problem.	C2. Identifies why the proposed solution is better than existing solutions.	C3. Strategizes computational approach.	C4. Identifies what modeling technique / solution / approach to employ. (Defines accuracy to be achieved)	C5. Defines relationships among data (1:1, isomorphism).	C6. Reverse engineers processes and/or products.	C7. Applies systematic techniques to isolate cause & effect.	C8. Selects common features / properties from specific examples of the model / scenario / process.	C9. Decomposes problem / objects / processes / data.	C10. Abstracts the real world scenario /object into an analog.	C11. Abstracts physical behavior of the problem.	C12. Selects salient features to be included in the model.	C13. Designs the User interface.
	D. Builds the model.	D1. Defines variables.	D2. Defines interactions among variables, objects or elements.	D3. Chooses an appropriate representation (e.g. data structures to represent the world).	D4. Uses applicable existing code / technology.	D5. Leverages existing solutions, algorithms.	D6. Writes programs.	D7. Modularizes the model.	D8. Identifies sources of error.	D9. Debugs / troubleshoots.	D10. Conducts fuzz testing (permutation testing).	D11. Builds the User interface.		
	E. Develops experimental design.	E1. Defines parameter space of the experimental test bed.	E2. Defines initial conditions under which the model operates.	E3. Develops testing equipment.	E4. Executes model / experiments using model.	E5. Tests limits and sweeps parameter space.								
Qualifies	F. Verifies the model.	F1. Assures model correctness.	F2. Generates potential solutions / possibilities.	F3. Compares the behavior of the model/ work product to a known solution or analytic solutions).	F4. Compares model with manufactured solutions.	F5. Tests the User interface.	F6. Validates the model.	F7. Assesses the degree to which the solution meets the product specifications or intended results.	F8. Analyzes the sensitivity of the solution with respect to model parameters.					
Refines	G. Optimizes the user interface and model.	G1. Improves input / Interface.	G2. Creates visual representation of output data.	G3. Optimizes the model.	G4. Uses iterative refinement to focus on the problem.	G5. Proposes strategies to improve solution.	G6. Identifies risks (e.g. sub-optimal solution).	G7. Executes improved strategies.	G8. Selects improved solution.					
	H. Facilitates knowledge/ discovery.	H1. Generates new hypotheses that feedback to experimental design.	H2. Observes phenomena to determine relationships (emergent behavior).	H3. Explains observed phenomena.	H4. Discovers new relationships.	H5. Refines experimental design.	H6. Assesses the degree to which the solution produces new findings / knowledge.	H7. Analyzes experimental data.						

Figure 2: Profile of a Social Technology Enabled Professional

Learning Occupation: The Social Technology Enabled Professional builds, maintains, manages and leverages online social networks to engage with customers, business partners, employees and key influencers with the goal of building organizational success.

DUTIES	TASKS											
1. CONDUCT RESEARCH	1A. Consults with communications or marketing colleagues.	1B. Identifies target market.	1C. Determines value of social media to organization.	1D. Evaluates social network platforms.	1E. Evaluates new methods, tools and devices (technologies).	1F. Determines required skill set and resources to implement strategy.	1G. Analyzes social networking activities of competitors/ influencers.	1H. Identifies applicable legal and regulatory policies.	1I. Adopts best practices in social media deployment.	1J. Assesses hard costs for implementing social networking strategy.	1K.	1L.
2. CREATE A SOCIAL NETWORKING STRATEGY	2A. Defines goals and objectives of social media strategy.	2B. Creates strategies to support the organizational goals and objectives (e.g. business plan).	2C. Defines success metrics aligned to organizational objectives.	2D. Determines content tactics to achieve social network strategy objectives.	2E. Aligns social networking strategy to business/ marketing strategy.	2F. Defines social media policy, guidelines and procedures.	2G. Incorporates key messages to promote business.	2H. Creates budget to support strategy.	2I. Allocates resources, staff, etc.	2J.	2K.	2L.
3. ESTABLISH AN ONLINE PRESENCE	3A. Ensures professional persona supports organizational objectives.	3B. Sets up accounts on selected social network platforms.	3C. Ensures consistent visual and key message branding across platforms (style guide)	3D. Enables users to share content across platforms.	3E. Links accounts to each other, to the website, and email signatures.	3F. Establishes initial voice (i.e. subject matter expertise).	3G. Promotes social accounts across all media and platforms.	3H. Posts relevant content to social networks.	3I. Invites others to engage with online presence.	3J.	3K.	3L.
4. CREATE CONTENT TO ENGAGE COMMUNITY	4A. Establishes editorial calendar.	4B. Monitors industry news for topical content.	4C. Crafts content that supports organizational functions.	4D. Solicits content from internal/ external sources.	4E. Creates content meaningful to audience and consistent with organizational brand and voice.	4F. Produces compelling content using relevant media (text, audio, video, ...).	4G. Assigns tags and key words to content to optimize discoverability.	4H. Syndicates content across social platforms and existing markets.	4I. Requests content contributions from online community.	4J.	4K.	4L.
5. MANAGE ONLINE PRESENCE	5A. Collects social analytic data.	5B. Analyzes social analytic data.	5C. Refines social strategy based on established metrics.	5D. Refines the profile based on experience.	5E. Monitors personal and professional brand mentions.	5F. Engages in online reputation management.	5G. Optimizes size and quality of online community to achieve organizational goals.	5H. Manages online community (don't feed the trolls)	5I. Responds (to both positive and negative comments) to community in a timely fashion and constructive manner.	5J. Creates new communities in response to needs.	5K. Utilizes new and emerging technologies and platforms.	5L. Integrates social networking into core organizational processes (e.g. sales, customer support, HR, fund raising).
6. ENGAGE IN PROFESSIONAL DEVELOPMENT/ON-GOING LEARNING	6A. Seeks out mentors.	6B. Stays current on emerging technologies.	6C. Attends relevant conferences.	6D. Maintains professional online C.V.	6E. Maintains professional library.	6F. Participates in professional organizations.	6G. Mentors others.	6H. Engages in cross discipline training.	6I. Articulates value of social networking activities to other departments/ functions of the organization.	6J. Articulates a changing role in supporting organizational goals.	6K.	6L.

Figure 3: Arizona's New Workplace Skills

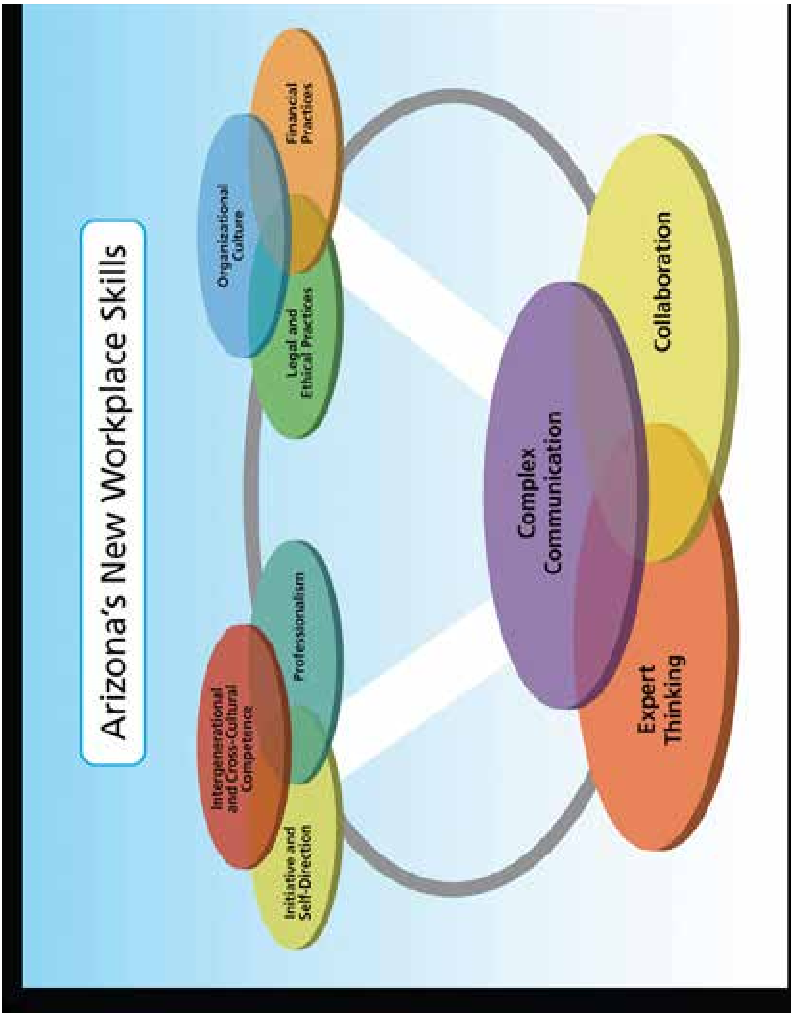

Figure 4: STEM Concentric Circle Model