

## ***Work of the Future – Readiness for What? (Q1)***

Students beginning their K-12 education in 2017 are on course to graduate in 2030. Upon graduating high school, these students will face many choices for pursuing work and further learning. Traditionally, high school graduates have chosen between enrolling in postsecondary education or directly entering the workforce. Of 2017 high school graduates, for example, 67% enrolled in a postsecondary institution, 22% entered the work force, and 11% did neither.<sup>2</sup> Postsecondary education has typically been a four-year college, two-year college, or technical school. Entry-level jobs are those that permit the employee to enter the workforce with little experience or education, often with the goal of moving onto a career path through valuable on-the-job experience. The military is an alternate pathway, providing training, experience, and a job; some choose to make serving in the military their career.

While similar options will remain for the graduates of the future, marked differences are anticipated as well. Current projections suggest that enrollment in degree-granting postsecondary institutions will increase by 2026<sup>3</sup>, whereas participation in the work force among 16-24-year old Americans will decline during a similar time frame<sup>4</sup>. The lines between postsecondary education and work may also become blurred, as universities and corporations expand their partnerships<sup>5</sup> to offer new educational opportunities and employers begin to develop their own training and credentialing programs.<sup>6</sup>

Students will also likely continue to move in and out of, and between, postsecondary institutions<sup>7</sup> and work experiences; the curve and length of individual pathways will reflect personal needs, interests, and goals. And though they will vary in their timelines, each pathway will eventually lead to some form of work and for most a career, typically as part of the paid labor force. But what will the work of the future look like?

The graduates of 2030 will need to be prepared for a postsecondary experience that may look very different from that for which their parents and teachers were prepared. Although jobs that sound quite familiar to us now (e.g., teacher, veterinary technician, lawyer, engineer) will likely still be widely available, it is impossible to predict the range of specific jobs that will be available and sought-after more than a decade from now. Trends such as globalization, automation, and “big data” point to major changes in the world of work, both in terms of the available jobs and the work environment in which those jobs will be carried out.

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<sup>2</sup> United States Department of Labor. (2018). Economic News Release. *Table 1. Labor force status of 2017 high school graduates and 2016-17 high school dropouts 16 to 24 years old by school enrollment, educational attainment, sex, race, and Hispanic or Latino ethnicity, October 2017*. Retrieved from <https://www.bls.gov/news.release/hsgcec.t01.htm>

<sup>3</sup> National Center for Education Statistics (2018). *Projections of education statistics to 2026*. Retrieved from <https://nces.ed.gov/pubs2018/2018019.pdf>

<sup>4</sup> United States Department of Labor. (2017). Career Outlook. *Projections of the labor force, 2016-26*. Retrieved from [https://www.bls.gov/careeroutlook/2017/article/projections-laborforce.htm?view\\_full](https://www.bls.gov/careeroutlook/2017/article/projections-laborforce.htm?view_full)

<sup>5</sup> Smith, P. (2018). *Alternative pathways: A complex upheaval is unfolding but not a 50 percent failure rate*. Retrieved from [https://evollution.com/managing-institution/higher\\_ed\\_business/alternative-pathways-a-complex-upheaval-is-unfolding-but-not-a-50-percent-failure-rate/](https://evollution.com/managing-institution/higher_ed_business/alternative-pathways-a-complex-upheaval-is-unfolding-but-not-a-50-percent-failure-rate/)

<sup>6</sup> Bagley, R. (2017). *The future of jobs training: 2 promising career prep pathways*. Retrieved from <http://www.gettingsmart.com/2017/06/future-jobs-training-promising-career-pathways/>

<sup>7</sup> U.S. Government Accountability Office (2017). *Higher education: Students need more information to help reduce challenges in transferring college credits*. Retrieved from [https://www.gao.gov/products/GAO-17-574?utm\\_medium=email&utm\\_source=govdelivery](https://www.gao.gov/products/GAO-17-574?utm_medium=email&utm_source=govdelivery)

Technology linking employers and employees will allow geographically dispersed people to vie for the same job, leading to an environment in which American workers will compete with others from around the globe.<sup>8</sup> Once hired, they will be part of an increasingly dispersed and diverse work force. Advancements in communications technology will continue to bridge this distance, allowing for collaboration across space and time. Work of the future will often be contract-based, and workers for the future will need to be prepared to work as part of cross-cultural and mixed-discipline teams. With this increase in contract work, work environments will be more fluid, with individuals able to determine their own schedule and/or work space.

Automation will reduce the number of human workers needed to perform routine tasks in some fields, while creating new job descriptions in other fields and adding jobs directly related to the machines used to automate work<sup>9</sup>. Many customer service and middle management positions are expected to disappear as increasing numbers of transactions are completed via automated functions, thereby reducing the need for cashiers, clerks, and similar service providers, as well as those who would supervise them.<sup>10</sup> Jobs relating to transportation and logistics, office and administrative support, manufacturing, and service are also expected to decline due to increased automation.<sup>11</sup> At the same time, increasing numbers of workers will rely on artificial intelligence to assist them in their jobs. Humans and machines will collaborate to make decisions in the future world of work.<sup>12</sup> Humans will also be responsible for designing and servicing these automated technologies.

Large quantities of data collected in real time will create job opportunities in data management and analytics, leading to expanded opportunities for those who can analyze and mine these data into information.<sup>13</sup> Data collection mechanisms will be seamlessly integrated into all parts of life, and jobs will require a broad range of employees to use data. Due to this unprecedented access to real-time data, organizations will change quickly to meet the demands of the markets in which they function.<sup>14</sup>

Job descriptions of the future will not be organized around clearly defined job titles, but rather around accumulated skills and experiences. Employers will leverage data to identify employees

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<sup>8</sup> Basu, K. (2016) *Globalization of labor markets and the growth prospects of nations*. Retrieved from [https://openknowledge.worldbank.org/bitstream/handle/10986/23929/Globalization00prospects0of0nation\\_s.pdf?sequence=1&isAllowed=y](https://openknowledge.worldbank.org/bitstream/handle/10986/23929/Globalization00prospects0of0nation_s.pdf?sequence=1&isAllowed=y)

<sup>9</sup> Atkinson, R. D., & Wu, J. (2017). *False alarmism: Technological disruption and the U.S. labor market, 1850-2015*. Retrieved from: [http://www2.itif.org/2017-false-alarmism-technological-disruption.pdf?\\_ga=2.117549709.544738862.1522704813-61893732.1522704813](http://www2.itif.org/2017-false-alarmism-technological-disruption.pdf?_ga=2.117549709.544738862.1522704813-61893732.1522704813)

<sup>10</sup> Andrew, P., Ip, J., & Worthington, J. (2014). *Fast forward 2030: The future of work and the workplace*. Retrieved from [file:///C:/Users/edickinson/Downloads/CBRE\\_Genesis\\_FAST\\_FORWARD\\_Workplace\\_2030\\_Full\\_Report\\_E.pdf](file:///C:/Users/edickinson/Downloads/CBRE_Genesis_FAST_FORWARD_Workplace_2030_Full_Report_E.pdf)

<sup>11</sup> Frey, C. B., & Osborne, M. A. (2013). *The future of employment: How susceptible are jobs to computerisation?* Retrieved from: [https://www.oxfordmartin.ox.ac.uk/downloads/academic/The\\_Future\\_of\\_Employment.pdf](https://www.oxfordmartin.ox.ac.uk/downloads/academic/The_Future_of_Employment.pdf)

<sup>12</sup> PwC. (2018). *Workforce of the future: The competing forces shaping 2030*. <https://www.pwc.com/gx/en/services/people-organisation/workforce-of-the-future/workforce-of-the-future-the-competing-forces-shaping-2030-pwc.pdf>

<sup>13</sup> Ross, A. (2016). *The industries of the future*. New York, NY: Simon & Schuster.

<sup>14</sup> Breu, K., Hemmingway, C., Bridger, D., & Strathern, M. (2002). Workforce agility: the new employee strategy for the knowledge economy. *Journal of Information Technology* 17, 21–31.

who possess the experiences and skills specific to the job at hand.<sup>15</sup> Potential employees will market themselves as uniquely qualified for the specifics of a project via online talent platforms and social media. Careers will be built out of freelance arrangements or other such “gigs”.<sup>16</sup> Even those who opt for a more traditional career will likely hold around 12 jobs,<sup>17</sup> either within one organization or across several organizations, over the course of their life. This will necessitate a continuous process of education and training throughout these future workers’ careers.<sup>18</sup> Employers of the future will likely demand and incentivize on-going and just-in-time skill development to meet changing workforce needs.

Changes in the world of work have implications for postsecondary education as well. The graduates of 2030 will vary in terms of their high school experiences. Some will leave high school with college credits, Associate’s degrees and/or industry certifications, equipped with academic and job-specific knowledge and skills. Some will have paid work experience under their belts, in addition to or in lieu of service learning or other unpaid work experiences. Many will weigh decisions regarding what pathway is the best fit given their financial situation, their family’s needs, and their own goals, interests, and perceived abilities. Postsecondary institutions will need to use available data to make appropriate placement decisions, and then offer individualized instruction and a variety of student-focused services and support structures to ensure that students persist and ultimately graduate with competency in specific and generalized skills. Further, postsecondary institutions will need to adapt to meet the needs of an agile workforce that will be seeking opportunities for lifelong learning through additional credentials or courses designed to build new, or enhance existing, job skills.

### ***Requisite Skills for Future Work – Skills for What? (Q2)***

With this vision of the work of the future in mind, the skills needed to thrive in such an environment become apparent. Foundational academic skills, such as literacy and numeracy will continue to be valued and valuable in the postsecondary world of 2030. However, postsecondary success will also require a range of other cognitive, interpersonal and intrapersonal skills, as well as essential life skills. Cognitive skills include facility with technology, digital skills, computational thinking, and statistical literacy. Interpersonal skills include problem solving, communication, collaboration and cultural sensitivity. Intrapersonal skills include time management and flexibility. Essential life skills include financial and health literacy, as well as citizenship skills.

#### ***Cognitive Skills***

Facility with technology will be in demand for jobs at all levels. Routine tasks formerly performed by humans may be taken over by robots or other technological advancements<sup>19</sup>, leaving the human worker to service the technology or collaborate with the technology to complete more

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<sup>15</sup> Lazarus, K. (2017). *Machine learning: Revolutionizing how employers find and hire the best talent*. Retrieved from <https://www.hrtechnologist.com/articles/recruitment-onboarding/machine-learning-revolutionizing-how-employers-find-and-hire-the-best-talent/>

<sup>16</sup> Intuit. (2016). *Dispatches from the new economy: The on-demand economy worker study*. Retrieved from: <https://intuittaxandfinancialcenter.com/wp-content/uploads/2017/06/Dispatches-from-the-New-Economy-Long-Form-Report.pdf>

<sup>17</sup> U.S. Department of Labor. (2018). National Longitudinal Surveys. *Frequently asked questions*. Retrieved from <https://www.bls.gov/nls/nlsfaqs.htm#anch41>

<sup>18</sup> PwC. (2018). *Workforce of the future*.

<sup>19</sup> Ibid.

complex tasks. Employers will continue to increasingly seek individuals with computational thinking and digital skills to interact with data and new and emerging technologies.<sup>20</sup>

Basic digital skills will be essential for developing other skills. Education and on-the-job training will increasingly be delivered via digital platforms and will incorporate virtual reality simulations more frequently.<sup>21</sup> More advanced digital skills include those required to create and use digital tools. The creation of digital tools, such as artificial intelligence and machine learning, requires STEM, analytic, and computational thinking skills. Employers will need programmers and innovators to develop new technologies to tackle more difficult challenges and improve collaboration, efficiency, and cost effectiveness.

Data management and analysis skills will also be in demand across job categories as data become more accessible and easier to distribute and share.<sup>22</sup> Computational thinking and statistical literacy skills will be sought after as employers seek those who can effectively use, visualize and manipulate, and draw conclusions from data. Statistical reasoning skills will also be in demand as new technologies require humans who are able to train machine learning algorithms, explain how they work, and keep them operating.<sup>23</sup>

### **Interpersonal Skills**

Regardless of the specific technical skill, workers of the future will not only need to possess such skills, but also will need to effectively apply those skills to real world problems. Problem-solving is an essential preparedness skill, one that will be required in more than one-third of jobs by the time the class of 2030 graduates high school.<sup>24</sup> Employers and postsecondary educational institutions will seek graduates who are able to identify and select among many courses of action, and to do so in a dynamic work environment. Persistence in the face of uncertainty, and the ability to handle failure and identify next steps when things don't go as planned, will also be essential for future postsecondary success.

Working as part of the dispersed and diverse workforce of the future will require communication and collaboration skills. Communication in the future world of work will require the ability to work with emerging communication technologies, along with the more traditional elements of communication such as listening and engaging in conversation. Active listening, in particular, is sought after by potential employers as it helps to create a positive work culture and supports collaboration, which in turn spurs innovation.<sup>25</sup> Conversation skills are important because they

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<sup>20</sup> Grover, S. (2018). *The 5th 'C' of 21st century skills? Try computational thinking (not coding)*. Retrieved from: <https://www.edsurge.com/news/2018-02-25-the-5th-c-of-21st-century-skills-try-computational-thinking-not-coding>

<sup>21</sup> Gasparevic, D. (2018). *Why virtual-reality training for employees is catching on*. Retrieved from <https://www.shrm.org/resourcesandtools/hr-topics/technology/pages/why-virtual-reality-training-for-employees-is-catching-on.aspx>

<sup>22</sup> Kauflin, J. (2017). *The five most in-demand skills for data analysis jobs*. Retrieved from <https://www.forbes.com/sites/jeffkauflin/2017/07/20/the-five-most-in-demand-skills-for-data-analysis-jobs/#ff958f02c7ce>

<sup>23</sup> Wilson, H. J., Daugherty, P., & Morini-Bianzino, N. (2017). *The jobs that artificial intelligence will create*. Retrieved from [http://ilp.mit.edu/media/news\\_articles/smr/2017/58416.pdf](http://ilp.mit.edu/media/news_articles/smr/2017/58416.pdf)

<sup>24</sup> Thompson, C. (2016). *The top 10 skills that will be in demand by all employers by 2020*. Retrieved from <https://www.businessinsider.com/wef-report-skills-workers-need-2016-1>

<sup>25</sup> Nowogrodski, A. (2015). *Why listening might be the most important skill to hire for*. Retrieved from: <https://www.fastcompany.com/3042688/why-listening-might-be-the-most-important-skill-to-hire-for>

contribute to an organization's shared understandings, which may be critical for agile decision-making.<sup>26</sup>

Working collaboratively to solve problems will be an essential skill of the future, and will require building relationships, maintaining sensitivity to cultural differences, and seeing others' perspectives. Forging positive relationships in the workplace will be key for an individual's job satisfaction and will be an essential building block in the creation of a productive work environment. In the context of the workplace, cultural sensitivity includes working effectively alongside someone from a different cultural background who may approach workplace behaviors differently. Coworkers from different cultural backgrounds may engage in different behaviors and hold different work-related values, and culture-based misinterpretations can have implications for the success of collaborative efforts.<sup>27</sup> Perspective taking involves awareness of others, regulating one's emotions and empathy, and correctly interpreting what others are trying to communicate.

### ***Intrapersonal Skills***

The fluidity of work arrangements in the future will necessitate time management skills, as individuals work on multiple project teams or juggle multiple gigs. Time management requires a variety of skills: estimation of effort, scheduling, prioritizing, delegation, and monitoring a to-do list, among myriad others. An individual with strong time management skills can not only project the amount of time and effort a given task will require, but also inhabit the mindset to meet deadlines and, perhaps as importantly, recognize when a deadline cannot be met and adapt accordingly. While employers have historically valued employees with solid time management skills, in the expanding gig economy the individual entrepreneur's personal success will depend upon it.

Flexibility and adaptability will also be essential skills, whether as an independent contractor providing services to multiple clients or as a career employee adjusting to changing roles and expectations in a dynamic environment. In fact, flexibility and adaptability, particularly in the context of interpersonal communication, are among the uniquely human skills that may prevent some occupations from becoming fully automated.<sup>28</sup> In addition to being key to specific careers, flexibility will also be integral to managing the projected evolving career path an individual will undertake over the course of a working lifetime. As companies demand upskilling or reskilling, the adaptable employee will be at an advantage.

### ***Life Skills***

Finally, graduating high school students will be best prepared for postsecondary success if they have acquired essential life skills. Skills such as financial literacy, and health and wellness literacy will help to ensure that decisions are made with long term implications in mind, setting the stage for continued success. Finally, high school graduates of 2030 will require citizenship skills, understanding the relations between individuals and society, the organization of the state

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<sup>26</sup> Heidema, P. J. (2017). *Why you need crucial conversation skills*. Retrieved from: <https://www.linkedin.com/pulse/why-you-need-crucial-conversation-skills-paul-j-heidema/>

<sup>27</sup> Sherman, F. (2018). *Cultural sensitivity skills in the workplace*. Retrieved from: <http://smallbusiness.chron.com/cultural-sensitivity-skills-workplace-20375.html>

<sup>28</sup> Sawhney, M. (2018). *As robots threaten more jobs, human skills will save us*. Retrieved from <https://www.forbes.com/sites/mohanbirsawhney/2018/03/10/as-robots-threaten-more-jobs-human-skills-will-save-us/#e8ad0f53fce6>



and how democracy functions, and the roles and responsibilities of the individual in the world around them.<sup>29</sup>

### ***Measures of Preparedness – Measures for what? (Q3)***

Postsecondary preparedness is a culmination of in-school and out-of-school experiences leading up to high school graduation. It is a multi-faceted concept that will require a multidimensional measurement approach. Currently, there is no uniform and comprehensive measure of postsecondary preparedness. NAEP measures academic preparedness for college without remediation with its reading and math assessments, but this does not address the wide range of skills discussed above. Existing measures such as NAEP assessments of academic skills will need to be combined with other existing data sources and will likely need to draw on new data sources or innovative measurement approaches, to gain a full picture of the state of postsecondary preparedness.

NAEP assesses a wide range of content areas at grade 12, including civics, economics, foreign language, geography, math, reading, science, technology and engineering literacy, U.S. history, and writing. The NAEP civics frameworks, for example, outline “intellectual skills” such as analyzing and evaluating, taking, and defending positions, along with participatory skills such as interacting, monitoring, and influencing.<sup>30</sup> These intellectual skills may align with several interpersonal skills outlined above (e.g., communication, collaboration). Similarly, the technology and engineering literacy assessment frameworks outline three practices (understanding technological principles, developing solutions and achieving goals, and communicating and collaborating) that may reflect some of the described technical, intrapersonal, and interpersonal skills.<sup>31</sup> NAEP also administers complex and interactive item types that may tap into skills beyond the academic skills measured. For example, a reading item may tap into cultural awareness skills, or a writing item may tap into effective communication skills. Finally, students who participate in NAEP are also encouraged to complete a student survey, which collects information about students’ educational experiences.<sup>32</sup>

NAEP also collects data as part of the High School Transcript Study. This study is designed to reflect a nationally representative sample of U.S. schools and a sample of students that is representative of the graduates from each participating school.<sup>33</sup> Data collected include the courses taken during high school, high school credits earned (including those earned in middle school), and final course grades. Information about course-taking patterns are not only informative about academic skills to which students have been exposed, but also provide indirect information about other important skills such as persistence and time-management.

Other data sources outside of NAEP, such as data regularly collected by or stored at state education agencies, may also be useful in informing our understanding of postsecondary preparedness. Participation in education and work experiences, from course attendance, to

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<sup>29</sup> UNESCO. (2010). *Citizenship education for the 21<sup>st</sup> century*. Retrieved from [http://www.unesco.org/education/tlsf/mods/theme\\_b/interact/mod07task03/appendix.htm](http://www.unesco.org/education/tlsf/mods/theme_b/interact/mod07task03/appendix.htm)

<sup>30</sup> NCES. (2015). *What does the NAEP civics assessment measure?* Retrieved from <https://nces.ed.gov/nationsreportcard/civics/whatmeasure.aspx>

<sup>31</sup> NCES. (2018). *Technology and Engineering Literacy (TEL) Assessment*. Retrieved from <https://nces.ed.gov/nationsreportcard/tel/>

<sup>32</sup> NCES (2018). *Survey Questionnaires. Questionnaires for students, teachers, and school administrators*. Retrieved from [https://nces.ed.gov/nationsreportcard/experience/survey\\_questionnaires.aspx](https://nces.ed.gov/nationsreportcard/experience/survey_questionnaires.aspx)

<sup>33</sup> NCES (2018). *High School Transcript Study*. Retrieved from <https://nces.ed.gov/nationsreportcard/hsts/>

maintaining employment, to engaging in volunteerism or service learning experiences can provide evidence of individuals' development of important preparedness skills that can be aggregated to higher levels. Data embedded in these education and work experiences are another potential source of preparedness data. For example, experiences with technology, individual portfolios, or team projects are elements of applied educational and work experiences that yield information about relevant skills.

Data from assessments administered at the state level could also be mined for relevant information. For example, performance tasks designed to reflect real-world contexts may provide insight into blends of skills, such as problem-solving within an academic content area. Computer-based assessments could be a source of data on digital skills. Performance-based assessments may tap into persistence, problem solving skills, and analytical thinking skills.

New and emerging technological resources present additional opportunities to gather data from education and work experiences. Micro-credentials, also known as digital badges, are earned upon completion of a short course, administered online or in a more traditional classroom setting. In the future, blockchain technology may allow parties to record transactions and maintain a permanent digital record of them, which could be used to document achievements within a particular organization or program.<sup>34</sup>

### **Current Context/National Need**

NAEP has been a leader in understanding and communicating what the nation's students know and can do for decades. It has recently been argued that the timing is right for expansion of 12th grade NAEP testing, citing the need for trustworthy data on college and career readiness, and for a data source that would allow states to compare themselves to one another and to the country as a whole.<sup>35</sup> With its well-established infrastructure, NAEP is in a unique position to gather postsecondary preparedness data at the state level. NAEP data, along with other NCES data sources, will inform those interested in postsecondary preparedness policy, and will be useful to states as they work with industry and business partners to expand job opportunities, and to support local-level efforts to prepare students for life after high school. These data will also be of use to postsecondary education providers and employers as they seek to ameliorate gaps in preparedness, and to inform the public about how prepared high school graduates are for their next steps.

Over half of states have developed definitions of *college and career readiness*.<sup>36</sup> In a large majority of these states, a single definition is used to describe readiness for college and readiness for career, and some address preparedness for postsecondary life more broadly. Some of these definitions focus on academic skills necessary to enter credit-bearing college courses without remediation or to successfully complete postsecondary job training program that will lead to a career that can support a family. Others describe additional skills beyond the academic, such as communication and collaboration. A very small number also include activities such as lifelong learning and civic engagement. Although there has been a substantial amount of work done at the state level, there are still states that have not developed a formal definition.

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<sup>34</sup> Iansiti, M. & Lakhani, K.R. (2017). *The truth about blockchain*. Retrieved from <https://hbr.org/2017/01/the-truth-about-blockchain>

<sup>35</sup> Finn, C.E. (2018). *Time for twelfth grade state-level NAEP*. Retrieved from <https://edexcellence.net/articles/time-for-twelfth-grade-state-level-naep>

<sup>36</sup> American Institutes for Research. (2014). *Overview: State definitions of college and career readiness*. Retrieved from [https://ccrcenter.org/sites/default/files/CCRS%20Defintions%20Brief\\_REV\\_1.pdf](https://ccrcenter.org/sites/default/files/CCRS%20Defintions%20Brief_REV_1.pdf)

Further, the existing state-level definitions are varied enough to make comparisons among the states confusing. NAEP is in a unique position to lead the charge in collecting data to inform a common understanding and, by extension, identifying the most essential elements of postsecondary preparedness.