

*Learning Accelerator Research Paper*

# Do We Really Need to Build Better Students?

**Jeremy Burrus**

**Krista Mattern**

**Bobby Naemi**

**Richard D. Roberts**

**2017**

Burrus, J., Mattern, K., Naemi, B., & Roberts, R. (2017). Do we really need to “build better students”? In J. Burrus, K. Mattern, B. Naemi, R. D. Roberts (Eds.), *Building Better Students: Preparation for the Workforce*. New York, NY: Oxford University Press.

This is a draft of “Do we really need to ‘build better students?’” and the copy of record is with Oxford University Press. (DOI:10.1093/acprof:oso/9780199373222.001.0001)



## **Do We Really Need to Build Better Students?**

Jeremy Burrus  
Professional Examination Service

Krista Mattern  
ACT Inc.

Bobby Naemi  
Educational Testing Service

Richard D. Roberts  
Professional Examination Service

Burrus, J., Mattern, K., Naemi, B., & Roberts, R. (2017). Do we really need to “build better students”? In J. Burrus, K. Mattern, B. Naemi, R. D. Roberts (Eds.), *Building Better Students: Preparation for the Workforce*. New York, NY: Oxford University Press.

This is a draft of “Do we really need to ‘build better students’?” and the copy of record is with Oxford University Press. (DOI:10.1093/acprof:oso/9780199373222.001.0001)

### Abstract

In this chapter we introduce the book by asking the question of whether “building better students” to improve the current state of workforce readiness, which is currently experiencing a “skills gap”, is really a necessity. We conclude that building better students is indeed necessary and introduce one theory for how our society reached this point. This theory has four components. First, the rate of technological innovation is increasing. Second, this technological innovation has led to more technology usage at work. Third, more technology usage at work has led to a shift in the activities conducted at work. Finally, the shift in work activities has led to employers heavily emphasizing certain skills over others. The skills gap is occurring because our education system has not yet adjusted in accordance with these new emphases. Evidence for each component in the theory is provided.

*Keywords:* skills gap, building better students, 21<sup>st</sup> century skills, noncognitive skills, technological innovation, job market, job activities, O\*NET

## Do We Really Need to Build Better Students?

“Change will not come if we wait for some other person or some other time. We are the ones we've been waiting for. We are the change that we seek.” (Barack Obama, 2008)

Many have argued that the way we work, what we work to achieve, and how we go about unifying these two endeavors is rapidly changing. It is a story frequently told by the contemporary press and a recurring theme throughout the length and breadth of this book. If the requirements to succeed in the world of work are changing, then the world of workers may also need to change, perhaps precipitously, to meet these demands. If this statement is true, then it begs at least three questions: Is the world of work truly changing? If so, what kind of education and skills are required for workers to succeed in this new world? Finally, do workers currently have the education and skills it takes to succeed, or is there a need to alter our education systems in order to “build better students?”

In essence, as both the editors of this book and authors of its first chapter, we wanted an opening argument that provided a broad, evidence-related rationale for why we see a need to build better students. Furthermore, in the spirit of the quote from Barack Obama, 44th President of the United States, we saw ourselves as not only commentators, but also agents of change in a domain that will continue to impact generations to come. As a first step in this pursuit, we discuss the three questions raised in the opening paragraph. Next, we provide evidence that the world of work is indeed changing, and, by extension, that this new world of work demands that its workers be more educated and possess a different mix of skills than those that were previously required. In a final section, we argue that the current workforce falls short in these areas. This then lays out the terrain for the remaining chapters of the book, which seek to redress this unfortunate, but entirely tractable (or so we believe), state of affairs.

### **The Evolving Nature of Work**

One important mechanism that contributed to the change in the nature of the workplace is the rapid growth of technology occurring in the latter half of the 20<sup>th</sup> century that continues to this day. In this chapter, we focus on technological innovation, although certainly many other interrelated factors have also influenced the world of work, such as globalization, political and macroeconomic factors, and cultural shifts in attitudes toward work. Figure 1 provides a heuristic model that attempts to demonstrate one path through which technological innovation has led to changes in the types of skills needed for a productive 21<sup>st</sup> century workforce. The arrows in the figure represent the passage of time, with each factor on the left preceding, and partially causing, the factors that follow to the right. As the figure demonstrates, we posit that technological innovation has led to changes in many of the activities conducted at work. For instance, the development of the internet has led to the internet being used at work in countless impactful ways, whether for communication, research, or general work activities. This change in work activities has helped spur changes in the structure of the world's job market, with growth observed in some occupations and decline in others. Some jobs, for example, have become

nearly obsolete (e.g., switchboard operators, travel agent) because of changes in the way that work is accomplished, while others (e.g., information security analysts, data scientists) are growing at an increasingly fast rate (Bureau of Labor Statistics, 2015; Deming, 2015). Finally, this change in the world's job market requires a change in both workers' educational attainment as well as the skills required to fill new job openings (Carnevale, Smith, & Strohl, 2010). For instance, in the examples above, usually a high school education is required for switchboard operators and travel agents, whereas a bachelor's degree is required for information security analysts, and some level of graduate training is required of data scientists. The model is explicated in the paragraphs that follow.

**Flourishing of technological innovation.** The proliferation of computing power and its influence on our everyday lives has been well documented. Computers that were once the size of a room had far less computing power than today's hand-held devices. It is estimated that more than two billion personal computers will be in use by 2015 (see <http://www.worldometers.info/computers/>), and that the number of internet connected devices in the world is anywhere from eight to ten billion (Soderbery, 2013). The Organization for Economic Cooperation and Development (OECD) recently released a report stating that internet subscriptions in OECD countries nearly tripled from 1999 to 2009, and that mobile phone subscriptions more than tripled during that same time period (OECD, 2013). Worldwide, it is estimated that over 3.2 billion people now use the internet, an increase of 806% since 2000 (see <http://www.internetworldstats.com/stats.htm>).

This technological explosion has dramatically changed the way much of the world lives and interacts with one another. Today we can communicate instantaneously with people all over the world through email, instant messaging, Skype, and social media at any time, day or night. Information spreads quickly over social media sites (e.g., Facebook), so much so that it has even been suggested that such sites are largely responsible for transformative social movements, such as the "Arab Spring" that occurred in 2010 (Rosen, 2011). We can purchase nearly everything we need without leaving home and often have it delivered that very same day. Many activities that historically relied on the human memory system are now accomplished via the aid of technology. We no longer need to remember street names and the most direct route between point A and point B; there is GPS for that. We no longer need to remember our parents' or friends' phone numbers; there are smart phones for that. We no longer need to remember birthdays, anniversaries, or appointments; there are electronic calendars for that. In sum, the ways in which technology has influenced our lives are myriad. Naturally, technology has also changed the ways in which we work.

**Technology has changed the way we work.** Technology has changed the way we work in several ways. The speed of computing, data analysis, and decision-making has greatly increased. Communication happens nearly instantaneously. Telecommuting is more and more common as we are able to work collaboratively online. The OECD (2013) has estimated that over 95%, 85%, and 65% of large, medium, and small businesses, respectively, in OECD countries now use the internet in their jobs. One key driver of change is automation, as computing and robots are now able to take the place of humans in completing several types of tasks. It is estimated that the supply of industrial robots will be 186,000 in Asia, 55,000 in Europe, and 40,000 in the Americas by the year 2017 (International Federation of Robotics, 2014 as cited in Frey & Osborne, 2015). This supply is expected to grow as robots become cheaper and more technologically sophisticated. Frey and Osborne provide a few examples of the types of activities robots are now able to do: "[R]obots are beginning to be used for a diverse range of

professional service tasks, with sales continuing to grow for milking robots, robotic fencers, mobile barn cleaning robots, underwater robots and medical robots for assisted surgery” (p. 34). In turn, Autor and Price (2013) found that the share of routine cognitive and routine manual work tasks has fallen sharply since 1960. These are tasks that follow relatively well-defined procedures. Whereas computers can be programmed to complete routine tasks, they cannot be programmed to complete non-routine tasks. By contrast, the share of non-routine analytic and non-routine interpersonal work tasks has been on the rise since 1960. In general, non-routine tasks refer to types of tasks that cannot be automated. Non-routine analytic tasks require skills such as problem-solving, critical thinking, and creativity, whereas non-routine interpersonal tasks require skills such as persuasion, empathy, and teamwork. Thus, it is no surprise that these changes in work activities also coincide with the rising use of technology at work.

### **The Evolving Job Market**

**The shift in the way we work has contributed to a shift in the job market.** One would expect that the job market should change in response to technological change, as occupations that are routine, and thus can be conducted by computers and robots, are eliminated, and non-routine jobs grow. Some evidence suggests that this is the case. For example, the OECD (2013) has reported that the number of occupations requiring highly educated workers grew from 1998 to 2008. Frey and Osborne (2015) have estimated that 47% of U.S. jobs are at risk due to automation in the coming years, with the jobs most at-risk being the ones that are low paying and most likely to be automated. Consistent with these findings, an investigation of the top 30 fastest growing occupations indicates that the majority require at least some postsecondary education (Bureau of Labor Statistics, 2015) with 87% classified as Zone 3<sup>1</sup> or higher (O\*NET, 2016). Table 1 has a complete list of the top 30 occupations expected to show the largest growth (as percent change) over the next decade<sup>1</sup>.

Not only has the job market changed structurally in response to technological innovation, there have also been structural changes *within* jobs as a response to technological innovation. Although we are unaware of any research that has explicitly looked at the issue, we predict that many job descriptions have changed over the years as a function of improving technology. Take the role of psychology professor as an example. The job of a psychology professor consists, essentially, of research, teaching, and service (e.g., committee work). At least two of these three job responsibilities, research and teaching, have been greatly impacted by technology. Research is greatly impacted in many ways. To list just a few examples:

- Studies can be conducted in less than an hour because of the availability of crowd sourced participant pools;
- Statistical analyses can be conducted much more quickly due to software;
- Papers can be written very quickly due to modern word processing software and reviewed and published even quicker with the advent of Open Source digital publishing platforms;
- Dissemination of one’s research is greatly enhanced through internet sources.

The impact of technology on professors’ job responsibilities has several potential implications. For example, professors might be expected to publish more often given the relative ease of conducting research now compared with several decades ago. Likewise, teaching is impacted by

---

<sup>1</sup> O\*NET (Occupational Information Network), classifies jobs into 1 of 5 zones based on the typical education level required. Refer to Table 1 for the Job Zone definitions.

technology in a number of ways. Each of these might also have important implications. For example:

- Lectures are conducted via PowerPoint rather than on a chalkboard;
- Students can communicate with professors at any time through email and even social media;
- Computer simulations of events close to real life are possible; one can see the workings of the brain, for example, in far more elaborate detail than was ever possible reading a text;
- Students can access learning materials over the internet - often for free.

It would not be difficult to generate examples of how technology has significantly impacted the structure of other occupations (medicine, astrophysics, and engineering). In sum, it is apparent that technology has not only changed the structure of the job market, but has also changed the structure of jobs themselves. Most pointedly, technology has allowed for more efficient work production processes/higher levels of productivity as well as led to the need for increased facility with a variety of tools and forms of communication as compared to the past.

**The shift in the job market has contributed to a shift in the skills required of workers.** The job market's increasing emphasis on non-routine and non-automated occupations necessitates workers with the requisite education and skills to fill these jobs. In particular, these jobs seem to require a more highly educated workforce. One analysis found that, in 1973, about 66% of all jobs in the U.S. required a high school diploma or higher (Carnevale et al., 2010). By 2007, these numbers had risen dramatically, with 89% of jobs requiring a high school diploma or higher and 51% requiring some type of training after high school. It is projected that by 2020, 35% of jobs will require at least a bachelor's degree and 30% of jobs will require some college or an associate's degree (Carnevale, Smith, & Strohl, 2013). Another analysis found that occupations requiring a master's degree are projected to have high growth through the year 2022, whereas those that require a high school diploma or less are projected to have little growth (Bureau of Labor Statistics, 2013).

Second, many of these jobs require strong *noncognitive* skills, "noncognitive" in the sense that they are typically not highly correlated with cognitive ability (e.g., Kyllonen, Lipnevich, Burrus, & Roberts, 2014). Noncognitive skills have also been referred to as personal skills, personal qualities, character traits, and psychosocial skills. Among these noncognitive skills, social skills seem to be especially important to the changing world of work. For instance, Deming (2015) found that most U.S. job growth since 1980 has come from difficult-to-automate jobs requiring strong social skills. Furthermore, he found that jobs requiring high levels of analytical and mathematical reasoning, but low levels of social skills, had poor job growth since 1980. Survey research of U.S. employers also suggests that noncognitive skills as well as more broad cross-cutting capabilities are greatly valued in today's workforce. A 2006 survey of U.S. employers found that skills such as communication, work ethic, teamwork, and critical thinking were more often considered important than traditional academic skills (Casner-Lotto & Barrington, 2006). A 2010 survey found that the U.S. employers thought that colleges should put more emphasis on teaching and developing students' communication, critical thinking, complex problems solving, ethical decision-making, teamwork, and creativity (Hart Research Associates, 2010). Furthermore, one recent study developed a parsimonious framework of the most important skills needed for college-educated workers based on O\*NET data (Burrus, Jackson, Nuo, & Steinberg, 2013). Specifically, a principal component analysis (PCA) of the importance ratings of knowledge, skills, abilities, and work styles of the 536 occupations in O\*NET that

require at least some college education informed the development of the framework. The final framework included five skills, of which three were noncognitive in nature: teamwork, communication skills, and achievement/innovation. The other two skills were problem solving (which may also have some noncognitive components) and fluid intelligence. It should be noted that the need for noncognitive skills is not merely an American issue, but something of great consequence all over the world. For example, policy issues around noncognitive skills are increasingly being recognized as important in large-scale testing programs such as the Program for International Student Assessment (PISA; Naemi et al., 2013).

The evidence seems clear that today's students will have to be more educated and possess a different set of skills than students in previous generations in order to succeed in the 21<sup>st</sup> century workplace. These demands seem to have come about—at least in part—because technological innovations have changed the way in which work is done and, by extension, have influenced the very makeup of the labor market. If the thesis of the current book is that there is a need to “build better students”, however, a discussion of whether today's students are meeting or falling short of these requirements is necessary. This is discussed in the next section (see also Mattern et al., 2014 for a review of these issues).

### **Is there a need to “build better students”?**

**Education shortfall.** How are U.S. doing to meet the education demands of an evolving job market, which requires a more educated workforce? Evidence suggests not very well. It has been projected that the U.S. economy will need 5 million more workers with an associate's degree or higher by 2020 than will be available (Carnevale et al., 2013). Furthermore, the U.S. seems to be falling behind other countries in producing college graduates. In 2008, the U.S. had the third highest percentage of individuals obtaining an associate's degree, behind only China and Japan (Carnevale & Rose, 2010). The picture looks bleaker when analysis are limited to 25-34 year olds. Among this group, the U.S. ranks tenth with just 42% of this age group obtaining a college degree. If the current trend holds, it seems that the U.S. will have to recruit much of its workforce from other countries. Indeed, this seems to be already happening, as half of all U.S. workers in STEM occupations with graduate degrees come from foreign countries (Information Technology Industry Council, 2012). Undoubtedly, the educational outlook does not paint an optimistic picture for the future of the U.S. economy. Less clearly articulated is how other countries stack up on these metrics, but it is likely the situation is not something only citizens from the U.S. should be concerned about.

**Skill shortfall.** There is some evidence that, even if the U.S. were producing enough college graduates, many would still be unprepared for work. A 2006 survey of over 400 employers found that 11% of two-year and 9% of four-year college graduates who were new entrants into the workforce were rated as “deficient” in their overall preparation (Casner-Lotto & Barrington, 2006). By contrast, 10% and 24% were rated as “excellent” in their overall preparation, respectively. The most common deficiencies were written communication, self-direction, and creativity for two-year college graduates, and written communication and leadership for four-year college graduates. In another survey, 60% of employers stated that two-year colleges and universities needed improvement in preparing students for the workforce, and 68% said that four-year colleges and universities needed to improve their students (Hart Research Associates, 2010). A more recent survey found that only 42% employers agreed that colleges and universities were doing a good job, “...ensuring that college graduates possess the full set of skills and knowledge that they will need for success...”, as compared to 74% of



students (Hart Research Associates, 2015), suggesting that students lack awareness of the skills and knowledge they need on the job.

In line with this argument, a summary of employer and student perceptions on college graduates' preparation of specific skills is displayed in Table 2. Percentages reflect the number of people who believe that recent college graduates are "well-prepared". There are at least two important points to note. First, many of these skills are noncognitive in nature. Second, the discrepancy between student and employer perceptions persists for each skill. Specifically, across skills, over half (54%) of students think recent college graduates are well prepared as compared to less than a quarter (24%) of employees. It should be noted that the skill shortfall—both cognitive and noncognitive in nature—is not simply restricted to the U.S.; it is a global problem (see Cedefop, 2015). In summary, much existing survey research evidence suggests that employers perceive a lack of skill in many of its recent hires, despite having earned a college degree.

### **Summary: Looking Forward to Change**

The purpose of this chapter was to examine whether there is a need to "build better students" and to set the stage for the rest of the book. In this chapter, we provided evidence that better prepared students are indeed needed if they are to succeed in the new world of work. Our reasoning can be summarized by the following six points:

1. Technological innovation is proliferating and has changed the way we live.
2. Technological innovation has also changed the way we work.
3. Changes in the way we work have led to structural changes in the job market, with some occupations growing and others shrinking in number. Technological innovation has also led to structural changes within jobs themselves.
4. These growing occupations tend to require a high level of education and a particular set of skills. Many of these skills are noncognitive in nature.
5. At the current rate, we are not producing enough highly educated students to fill these occupations.
6. Many of the new entrants into the workforce do not possess the requisite skills (which are increasingly noncognitive in nature) needed to succeed, even if they are highly educated.

Thus, the need to build better students is apparent. The chapters in this book offer several suggestions for ways to bolster student readiness and success. Below, we offer two general suggestions that follow from the previous sections of this chapter.

**Improve college retention rates.** Many students enter college academically unprepared and thus find it difficult to graduate with a degree. For example, in 2007-2008 about 1/5 of first year undergraduate students had to take a remedial course (U.S. Department of Education, 2013). Furthermore, a large-scale survey found that only 26% of college instructors thought the students they taught arrived at college "well" or "very well" prepared (ACT, 2013). Additionally, 31% of the ACT-tested high school graduating class of 2015 met none of the four college readiness benchmarks in English, Reading, Mathematics, and Science (ACT, 2015). These benchmarks correspond to the ACT scores associated with a 50% chance of obtaining a B or higher or about a 75% chance of obtaining a C or higher in corresponding college courses. Therefore, it is probably not surprising that only 6 out of 10 college students earn a degree within six years (U. S. Department of Education, 2016).

Of course, one way to improve college retention would be to increase the amount that students learn in high school, which, presumably, would lead to better grades in first-year college

courses. This is important because it is well-known that students who perform poorly in the first year are mostly likely to drop out of college (Pascarella & Terenzini, 2005). Moreover, grades are predictive of college completion over several demographic characteristics (Adelman, 1999). Another less obvious way to improve retention would be to foster the development of student noncognitive skills. Research has shown that factors such as having academic goals, high achievement motivation, and high academic discipline are related to retention in college (Allen, Robbins, Casillas, & Oh, 2008; Robbins, Lauver, Le et al., 2004). Furthermore, emotional stability, conscientiousness, agreeableness, and extraversion all predict retention via their relationship with adjustment to college (Crede & Niehorster, 2012). This discussion of noncognitive skills leads us to our second point.

**Emphasize the development of noncognitive skills.** In addition to college retention, noncognitive skills predict a host of academic, work, and life outcomes. For example, noncognitive skills have been shown to predict positive outcomes such as:

- Academic performance (Poropat, 2009);
- Job performance (e.g., Barrick, Mount, & Judge, 2001);
- Job satisfaction (e.g., Judge, Heller, & Mount, 2002);
- Happiness (e.g., Diener & Lucas, 1999);
- Health (e.g., Bogg & Roberts, 2004) and longevity (e.g., Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007);
- Marital satisfaction (e.g., Watson, Hubbard, & Wiese, 2000);
- Peer relationships (e.g., Jensen-Campbell et al., 2002);
- Volunteerism (e.g., Penner, 2002);

And negative outcomes such as:

- Academic discipline rates and truancy (e.g., MacCann, Duckworth, & Roberts, 2009);
- Behavioral problems (e.g., Ge & Conger, 1999).

It is important to note that noncognitive skills predict academic and work outcomes many years into the future. For instance, one study found that six year olds who scored higher on measures of behavioral problems were more likely to drop out of high school than six year olds who did not demonstrate such problems (Moon, 2012). Another study found that children's level of conscientiousness predicted their occupational status, wages, and job satisfaction 60 years later (when controlling for cognitive ability; Judge, Higgins, Thoresen, & Barrick, 1999). Furthermore, 10<sup>th</sup> grade students' work ethic ratings predicted their educational attainment and earnings 10 years later (controlling for cognitive ability; Lleras, 2008). These findings suggest that it may be important to focus on and foster children's noncognitive skills at early ages. Consistent with this assertion, recent work has shown that school programs that teach noncognitive skills through *social and emotional learning* (SEL) programs have a benefit to cost ratio of \$11 to \$1 for society, both in the USA and elsewhere (Belfield et al., 2015). That is, the monetary benefits of implementing a SEL program far outweigh the costs in terms of reducing the prevalence of substance abuse, delinquency, and mental health issues and increasing social competence. Given that the data clearly point to a positive return on investment, a component of educational reform should focus on investing both local, national, and global resources into inculcating, scaling, and evaluating these programs.

## **Conclusion**

The evidence provided in this chapter, as well as the chapters that follow, makes a strong case that we as a society need to find a way to "build better students". We provide two potential

solutions to this problem: increasing college retention and fostering noncognitive skills. Many of the chapters in this book further develop these, and other, options in greater detail. In the process, we are beholden to the insightful quotation with which this chapter was started and mention it again, for the reader also can play a pivotal role: "Change will not come if we wait for some other person or some other time. We are the ones we've been waiting for. We are the change that we seek". This book represents more than words on pages but a call to action. We argue that as a society we must come together to support the better preparation of our youth; together we can evoke change. Leaving this charge to some other person or for some other time will result in a future workforce that is not any more prepared than previous ones.

## References

- ACT (2013). *ACT National Curriculum Survey 2012: Policy Implications on Preparing for Higher Standards*. Iowa City, IA: ACT.
- ACT (2015). *The Condition of College & Career Readiness 2015*. Iowa City, IA: ACT.
- Adelman, C. (1999). *Answers in the Toolbox: Academic Intensity, Attendance Patterns, and Bachelor's Degree Attainment* (Document # PLLI 1999-8021). Washington, DC: U.S. Department of Education.
- Allen, J., Robbins, S. B., Casillas, A., & Oh, I. S. (2008). Third-year college retention and transfer: Effects of academic performance, motivation, and social connectedness. *Research in Higher Education*, 49, 647-664.
- Barrick, M. R., Mount, M. K., & Judge, T. A. (2001). Personality and performance at the beginning of the new millennium: What do we know and where do we go next? *International Journal of Selection and Assessment*, 9, 9-30.
- Belfield, C., Bowden, B., Klapp, A., Levin, H., Shand, R., & Zander, S. (2015). *The Economic Value of Social and Emotional Learning*. Columbia: Center for Benefit-Cost Studies in Education.
- Bogg, T., & Roberts, B. W. (2004). Conscientiousness and health behaviors: A meta-analysis. *Psychological Bulletin*, 130, 887-919.
- Bureau of Labor Statistics (2013). Overview of projections to 2022. *Monthly Labor Review*, December 2013.
- Bureau of Labor Statistics (2015). *Fastest growing occupations*, Retrieved from: [http://www.bls.gov/emp/ep\\_table\\_103.htm](http://www.bls.gov/emp/ep_table_103.htm)
- Burrus, J. Jackson, T., Nuo, X., & Steinberg, J. (2013). Identifying the Most Important 21st Century Workforce Competencies: An Analysis of the Occupational Information Network (O\*NET). *Educational Testing Service Research Report*. Princeton, NJ: Educational Testing Service.
- Carnevale, A. P., & Rose, S. J. (2010). *The Undereducated American*. Georgetown University, Center on Education and the Workforce.
- Carnevale, A. P., Smith, N., & Strohl, J. (2010). *Help Wanted: Projections of Job and Education Requirements Through 2018*. Lumina Foundation.
- Carnevale, A. P., Smith, N., & Strohl, J. (2013). *Recovery: Job Growth and Education Requirements Through 2020*. Georgetown public policy institute.
- Casner-Lotto, J., & Barrington, L. (2006). *Are They Really Ready to Work? Employers' Perspectives on the Basic Knowledge and Applied Skills of New Entrants to the 21st US Workforce*. Unites States: The Conference Board, Corporate Voices for Working Families, Partnership for 21st Century Skills and Society for Human Resource Management.
- Cedefop (2015). Matching skills and jobs in Europe: Insights from Cedefop's European Skills and Jobs Survey. Retrieved from <http://www.cedefop.europa.eu/en/publications-and-resources/publications/8088>
- Credé, M., & Niehorster, S. (2012). Adjustment to college as measured by the student adaptation to college questionnaire: a quantitative review of its structure and relationships with correlates and consequences. *Educational Psychology Review*, 24, 133-165.
- Deming, D. J. (2015). *The Growing Importance of Social Skills in the Labor Market* (No. w21473). National Bureau of Economic Research.
- Diener, E., & Lucas, R. E. (1999). Personality and subjective well-being. In D. Kahneman, E.

- Diener, & N. Schwarz (Eds.), *Well-Being: The Foundations of Hedonic Psychology* (pp. 213-229). New York: Russel Sage Foundation.
- Frey, C. B., & Osborne, M. (2015). *Technology at Work: The Future of Innovation and Employment*. Retrieved from [http://www.oxfordmartin.ox.ac.uk/downloads/reports/Citi\\_GPS\\_Technology\\_Work.pdf](http://www.oxfordmartin.ox.ac.uk/downloads/reports/Citi_GPS_Technology_Work.pdf)
- Ge, X., & Conger, R. D. (1999). Adjustment problems and emerging personality characteristics from early to late adolescents. *American Journal of Community Psychology*, 27, 429-459.
- Hart Research Associates. (2010). *Raising the Bar: Employers' Views on College Learning in the Wake of the Economic Downturn*. Washington, DC: Author.
- Hart Research Associates. (2015). *Falling Short? College Learning and Career Success*. Washington, DC: Author.
- International Federation of Robotics (2014). *World Robotics 2014: Executive Summary*. Retrieved from [http://www.worldrobotics.org/uploads/tx\\_zeifr/Executive\\_Summary\\_WR\\_2014.pdf](http://www.worldrobotics.org/uploads/tx_zeifr/Executive_Summary_WR_2014.pdf).
- Hart Research Associates. (2010). *Raising the Bar: Employers' Views on College Learning in the Wake of the Economic Downturn*. Washington, DC: Author.
- Information Technology Industry Council, the Partnership for a New American Economy, and the US Chamber of Commerce (2012). *Help Wanted: The Role of Foreign Workers in the Innovation Economy*. Washington, DC.
- Jensen-Campbell, L. A., Adams, R., Perry, D. G., Workman, K. A., Furdella, J. Q., & Egan, S. K. (2002). Agreeableness, extraversion, and peer relationships in early adolescents: Winning friends and deflecting aggression. *Journal of Research in Personality*, 36, 224-251.
- Judge, T. A., Heller, D., & Mount, M. K. (2002). Five-factor model of personality and job satisfaction: A meta-analysis. *Journal of Applied Psychology*, 87, 530-541.
- Judge, T. A., Higgins, C. A., Thoresen, C. J., & Barrick, M. R. (1999). The big five personality traits, general mental ability, and career success across the life span. *Personnel Psychology*, 53, 621-652.
- Kyllonen, P. C., Lipnevich, A. A., Burrus, J., & Roberts, R. D. (2014). *Personality, motivation, and college readiness: A prospectus for assessment and development*. ETS RR-14-06. Princeton, NJ: Educational Testing Service.
- Lleras, C. (2008). Do skills and behaviors in high school matter? The contribution of noncognitive factors in explaining differences in educational attainment and earnings. *Social Science Research*, 37, 888-902.
- MacCann, C., Duckworth, A., & Roberts, R. D. (2009). Identifying the major facets of Conscientiousness in high school students and their relationships with valued educational outcomes. *Learning and Individual Differences*, 19, 451-458.
- Mattern, K. D., Burrus, J., Camara, W. J., O'Connor, R., Gambrell, J., Hanson, M. A., Casillas, A., & Bobek, B. (2014). *Broadening the definition of College and Career Readiness: A Holistic Approach*. Iowa City: IA, ACT, Inc.
- Moon, S. H. (2012). *Decomposing Racial Skill Gaps in the US*. Unpublished manuscript, University of Chicago, Department of Economics.
- Naemi, B., Gonzalez, E., Bertling, J., Betancourt, A., Burrus, J., Kyllonen, P. C., Minsky, J., Lietz, P., Klieme, E., Vieluf, S., Lee, J., & Roberts, R. D. (2013). Large-scale group score assessments: Past, present, and future. In D. H. Saklofske, C. B. Reynolds, & V. L.

- Schwean (Eds.), *Oxford handbook of child psychological assessment*. (pp. 129-149). Cambridge, MA: Oxford University Press.
- Obama, B. (2008). Barack Obama's Feb. 5 Speech. *New York Times*. Retrieved from [http://www.nytimes.com/2008/02/05/us/politics/05text-obama.html?\\_r=0](http://www.nytimes.com/2008/02/05/us/politics/05text-obama.html?_r=0)
- O\*NET (2016). *Browse Bright Outlook Occupations*. Retrieved from <https://www.onetonline.org/find/bright?b=1&g=Go#foot1>
- Organisation for Economic Co-operation and Development (OECD; 2013). *OECD Skills Outlook 2013: First Results from the Survey of Adult Skills*. OECD Publishing. <http://dx.doi.org/10.1787/9789264204256-en>
- Pascarella, E. T., & Terenzini, P. T. (2005). *How college affects students: A third decade of research* (Vol. 2). San Francisco, CA: Jossey-Bass.
- Penner, L. A. (2002). Dispositional and organizational influences on sustained volunteerism: An interactionist perspective. *Journal of Social Issues*, 58, 447-467.
- Poropat, A. E. (2009). A meta-analysis of the five factor model of personality and academic performance. *Psychological Bulletin*, 135, 322-338.
- Robbins, S.B., Lauver, K., Le, H., Davis, D., Langley, R., & Carlstrom, A. (2004). Do psychosocial and study skill factors predict college outcomes? A meta-analysis. *Psychological Bulletin*, 130, 261-288.
- Roberts, B. W., Kuncel, N. R., Shiner, R., Caspi, A., & Goldberg, L. R. (2007). The power of personality: The comparative validity of personality traits, socioeconomic Status, and cognitive ability for predicting important life outcomes. *Perspectives on Psychological Science*, 2, 313 – 345.
- Rosen, R. J. (2011). *So, Was Facebook Responsible for the Arab Spring After All?* <http://www.theatlantic.com/technology/archive/2011/09/so-was-facebook-responsible-for-the-arab-spring-after-all/244314/>
- Soderbery, R. (2013). *How Many Things Are Currently Connected To The "Internet of Things" (IoT)?* Retrieved from <http://www.forbes.com/sites/quora/2013/01/07/how-many-things-are-currently-connected-to-the-internet-of-things-iot/>
- U.S. Department of Education, National Center for Education Statistics. (2013). *First Year Undergraduate Remedial Coursetaking: 1999–2000, 2003–2004, 2007–2008 (NCES 2013- 013)*. Washington, DC: National Center for Education Statistics.
- U.S. Department of Education, National Center for Education Statistics. (2016). *The Condition of Education 2016 (NCES 2016- 144)*. Washington, DC: National Center for Education Statistics.
- Watson, D. Hubbard, B., & Wiese, D. (2000). General traits of personality and affectivity as predictors of satisfaction in intimate relationships: Evidence from self- and partner-ratings. *Journal of Personality*, 68, 413-419.

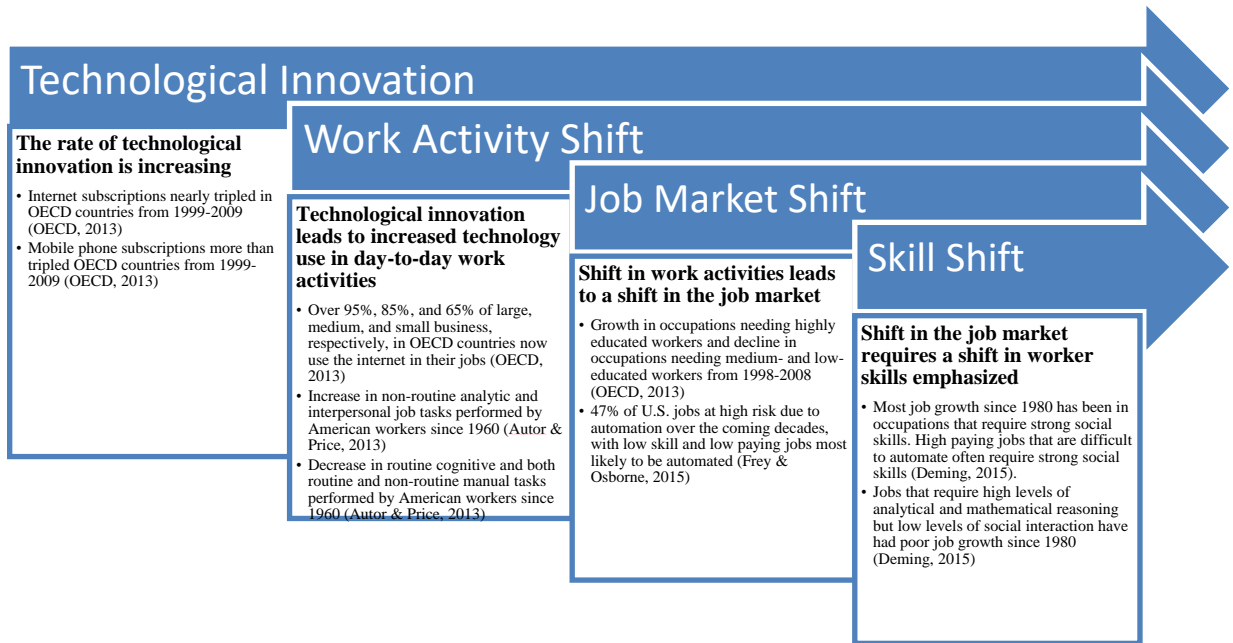


Figure 1

**Model describing how technological innovation has led to a shift in worker education and skill requirements and some supporting evidence**

Table 1

**Top 30 Projected Fastest Growing Occupations from 2014 to 2024 (BLS, 2015) and Corresponding Job Zone (O\*NET, 2016)**

<b>Occupation</b>	<b>Percent Change (2014 to 2024)</b>	<b>Job Zone</b>
Wind turbine service technicians	108.0	3
Occupational therapy assistants	42.7	3
Physical therapist assistants	40.6	3
Physical therapist aides	39.0	3
Home health aides	38.1	2
Commercial divers	36.9	3
Nurse practitioners	35.2	5
Physical therapists	34.0	5
Statisticians	33.8	5
Ambulance drivers and attendants, except emergency medical technicians	33.0	2
Occupational therapy aides	30.6	3
Physician assistants	30.4	5
Operations research analysts	30.2	5
Personal financial advisors	29.6	4
Cartographers and photogrammetrists	29.3	4
Genetic counselors	28.8	5

Table 1 continues over page

Table 1 continued

<b>Occupation</b>	<b>Percent Change (2014 to 2024)</b>	<b>Job Zone</b>
Interpreters and translators	28.7	4
Audiologists	28.6	5
Hearing aid specialists	27.2	3
Optometrists	27.0	5
Forensic science technicians	26.6	4
Web developers	26.6	3



Occupational therapists	26.5	5
Diagnostic medical sonographers	26.4	3
Personal care aides	25.9	2
Phlebotomists	24.9	3
Ophthalmic medical technicians	24.7	3
Nurse midwives	24.6	5
Solar photovoltaic installers	24.3	2
Emergency medical technicians and paramedics	24.2	3
<b><i>Total, all occupations</i></b>	<b>6.5</b>	<b>All</b>

Notes. Zone 1: Some of these occupations may require a high school diploma or GED certificate. Zone 2: These occupations usually require a high school diploma. Zone 3: Most occupations in this zone require training in vocational schools, related on-the-job experience, or an associate's degree. Zone 4: Most of these occupations require a four-year bachelor's degree, but some do not. Zone 5: Most of these occupations require graduate school.

Table 2

**Percent of employers and students who believe that recent college graduates are “well-prepared” in each skill. From Hart Research Associates (2015)**

<b>Skill</b>	<b>Employers</b>	<b>Students</b>
Working in teams	37%	64%
Staying current on technologies	37%	46%
Ethical judgment and decision making	30%	62%
Locating, organizing, and evaluating information	29%	64%
Oral communication	28%	62%
Working with numbers/statistics	28%	55%
Written communication	27%	65%
Critical/analytical thinking	26%	66%
Being innovative/creative	25%	57%
Analyzing/solving complex problems	24%	59%
Applying knowledge/skills to the real world	23%	59%
Awareness/experience of diverse cultures in the US	21%	48%
Staying current on technologies on developments in science	21%	44%
Working with people from different backgrounds	18%	55%
Staying current on global developments	18%	43%
Proficient in other languages	16%	34%
Awareness/experience of diverse cultures outside the US	15%	42%

## Endnotes

---

<sup>1</sup> O\*NET refers to the Occupational Information Network, an extensive job analysis of over 900 jobs. Jobs are classified into 1 of 5 zones based on the typical education level required. Refer to Table 1 for the Job Zone definitions.