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# Improving 21st Century Skills in the U.S. Air Force

**T**he job skills needed for today—and tomorrow—are rapidly changing. Advances in technology, such as robotics and machine learning, are changing the work environment by transitioning certain tasks away from workers, which may free up those workers to do other tasks that require different skill sets.<sup>1</sup> By 2020, more than one-third of the desired core skill sets of most occupations will be composed of skills that are not considered crucial to the job today.<sup>2</sup> The United States is facing an unprecedented crisis of “skill mismatch” between the supply and demand of skills, and between current and anticipated skill needs.<sup>3</sup> Furthermore, even if we do not yet know the specific skill requirements for the future, it is clear that workers will need to be able to rapidly adapt to new contexts and needs.

These broad job skill shifts affect the U.S. Air Force. Today’s technology and threat environment demand an Air Force workforce that is not only deeply skilled in its areas of expertise, but also prepared to be effective in complex, unfamiliar, and sometimes unpredictable contexts. Airmen need to be agile to meet the needs

of changing work and world contexts. The Chief of Staff of the Air Force's (CSAF's) emphasis on pushing decision authority to squadron commanders will require complex decisionmaking skills at the squadron level. The CSAF's three focus areas emphasize "cohesive, ready, and agile fighting forces" and underscore the necessity of "situational awareness, rapid decisionmaking, and the ability to direct forces to achieve commander's intent" to multi-domain command and control.<sup>4</sup> Two of the Secretary of the Air Force's priorities are developing readiness; enacting cost-effective modernization; driving innovation; developing exceptional leaders; and strengthening alliances.<sup>5</sup> As emphasized in *America's Air Force: A Call to the Future* (Secretary of the Air Force, 2014) and reiterated in the *Human Capital Annex* (U.S. Air Force, 2015a), the Air Force must be "diverse, agile, and inclusive" to meet the needs of the current, rapidly evolving environment. Agility is a thread running throughout the Air Force's Strategic Master Plan (U.S. Air Force, 2015b), and the Air Force has

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made a substantial investment in identifying research-informed approaches to improving this critical area. This Perspective shares findings from closely related research in the private and education sectors regarding 21st century skills, which we believe will inform and improve Air Force efforts to increase airman agility.<sup>6</sup> Lessons from these sectors draw on conceptual models and expert analysis, as well as research evidence. We should note that the private sector is still in the early stages of developing a rigorous evidence base.

## What Are 21st Century Skills, and How Do They Relate to Agility?

21st century skills are soft skills that transcend specific areas of knowledge: They can be grouped into *cognitive* and *interpersonal* skills.<sup>7</sup> Cognitive skills include critical thinking, problem-solving, creativity, cognitive flexibility, judgment, decisionmaking, and the ability to acquire and utilize information. Interpersonal skills include adaptability, collaboration, leadership, oral and written communication (including foreign languages), cultural competency, and emotional intelligence (understanding and constructively managing one's own emotions).<sup>8</sup> These 21st century skills frame an individual's ability to assess and respond to a situation effectively. All are teachable to an extent, although some may require more time and training in order to learn them. We are not focusing in this Perspective on "intrapersonal skills" or attributes (e.g., positive attitudes, service orientation) that tend to be deeply ingrained in an individual's psyche.<sup>9</sup>

This skillset is directly relevant to the Air Force's institutional competencies that

are key to ensuring the ability of Airmen to operate successfully in a constantly changing operational environment . . . [The competencies] are broadly applicable and span all occupations, functions, and organizational levels. These competencies place the broad institutional demands into a context of how the individual should be developed and form the framework for force development in the Air Force.<sup>10</sup>

Under these institutional competencies are important subcompetencies, including strategic communication skills, vision, decisionmaking ability, adaptability, coalition- and team-building capabilities, cultural awareness, and demonstrated commitment to continuous improvement that parallel core 21st century skill constructs.<sup>11</sup> For example, previous Air Force strategy has encouraged foreign language learning among airmen, but repeated attempts have shown that the true unmet need lies in a “deeper international insight . . . and cultural understanding” of the people with whom airmen interact.<sup>12</sup> The Air Force's institutional subcompetency of “global, regional, and cultural awareness” should, in theory, address this need.<sup>13</sup> Examples and evidence of how education and the private sector have successfully developed cultural understanding in their workforces might help the Air Force operationalize this related institutional subcompetency.

In recent years, the Air Force has been keenly focused on agility, which involves “flexibility, adaptability, and responsiveness,” particularly in “how we organize, train, equip, and employ our Air Force.”<sup>14</sup> Research on 21st century skills is consistent with the Air Force focus on agility. Education and private sector research on 21st century skills

may help the Air Force consider effective ways to develop related subcompetencies.

## Best Practices for Developing 21st Century Skills

The education and private sectors have invested substantially in developing 21st century skills in students and staff, and research on their efforts may inform the Air Force's professional military education and training efforts. In particular, education and private sector research has identified approaches to teaching and assessing 21st century skills.

## Best Practices for Teaching 21st Century Skills

21st century skills require a different kind of thinking, and learning these skills requires a different kind of teaching. For example, traditional modes of instruction, such as *transmission* of content through lectures or readings, may help a learner understand a solution to a specific problem, but does not develop the ability to understand and apply knowledge and skills in new situations.<sup>15</sup> On the other hand, project-based learning promotes the development of cognitive skills such as transferring knowledge to new situations, reasoning, and problem-solving.<sup>16</sup> In particular, workforce theory and substantial amounts of research support the use of project-based learning to develop 21st century skills.

Instructors or trainers are able to create an environment that fosters higher-order thinking skills, such as analysis, evaluation, and information synthesis. It is important to explicitly teach students *how* to learn, so

that they can evaluate and improve their own thinking processes—also known as metacognition. To help develop metacognition, instructors could assign students challenging tasks and then help the learners verbalize and test their own approaches for solving the problems posed by these tasks. To facilitate deeper learning, instructors or trainers should provide examples and model the problem-solving process. Instructors could indirectly encourage participants to explain their thinking by using “why” and “how” questions in class discussions. Formative assessments could help learners understand the lesson objectives and develop proficiency in mapping their own knowledge against those objectives. Instruction also should address learner misunderstandings directly, so that learners can deliberately rethink their approach and build a solid foundation for future learning.

Explicit instruction and self-awareness practice can help develop 21st century skills, such as creativity and teamwork ability, as well as cognition. Instructors should treat teamwork as an outcome, deliberately building collaborative skills through team activities. The instructors can foster creativity by teaching directly about the stages in the creative process (preparation or intense study; incubation or pondering; illumination or sudden insight, often while doing other things; and verification or testing the idea), and encouraging learners to create opportunities to go through these four stages.<sup>17</sup>

To develop learning transfer, in which learners explicitly apply skills and knowledge from one context to another, instructors should teach the underlying principles that apply across different contexts. To practice learning transfer, instructors could use different representations of ideas in teaching and activities in which learners map

across these representations. Research also supports the judicious use of technology to expand learning applications. Learners might be assigned to communicate an idea through a wiki, podcast, video, website, or other application; each mode challenges the learner to rethink the essential points of the idea in order to communicate it effectively.<sup>18</sup> Instruction through simulations and game-based learning also can support the development of critical thinking and problem-solving skills, and the ability to effectively multitask.<sup>19</sup>

Additionally, these strategies might promote learners’ self-regulation strategies—such as mental flexibility and taking initiative—as well as interpersonal skills, such as collaboration and communication; however, the impact research on the effectiveness of these strategies is less extensive.

There is some debate as to whether 21st century skills, such as reasoning and problem-solving, are discipline-specific or generalized.<sup>20</sup> If these skills are generalized, then a learner who develops systematic thinking in relation to engineering would be able to apply that skill to, for example, threat analysis. If these skills are discipline-specific, then they must be taught in combination with specific content. A meta-analysis of 117 studies found that three factors working together have the greatest impact on learners’ critical thinking skills: (1) explicitly teaching students about critical thinking, (2) incorporating content in the lessons, and (3) using instructional strategies designed to promote critical thinking.<sup>21</sup> Thus, instruction designed to develop critical thinking should not be content-free; nor is it effective to expect students to develop critical thinking without clear direction. When instructors did not explicitly teach critical thinking, the outcomes were significantly poorer.

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## Best Practices for Improving 21st Century Skills in the Workplace

Despite the dearth of academic research on specific ways to improve 21st century skills in the workplace, there are a number of recommendations that are widely considered conducive to improving such skills. These recommendations have worked for a variety of organizations, but it is important to consider the specific characteristics of the organizations themselves—such as technological capacity—that might affect the viability of a given recommendation. The Conference Board has conducted several case studies and surveys of organizations that have attempted to improve specific 21st century skills in their workplaces.<sup>22</sup> Organizations like IBM, GE, Kaiser Permanente, Amgen, and PwC have successfully integrated a particular system for internal collaboration known as an “enterprise-wide virtual environment,” which gives employees the opportunity to share knowledge and ideas, as well as feedback, input, and questions on the knowledge and ideas of others.<sup>23</sup> In each organization, this system was most successful when members of senior leadership were the first to openly use and encourage the use of the tool. *User advocates*, early adopters of the technology who shared their experiences with other employees and helped others get acclimated to using the tool, were also vital in ensuring the tool’s ability to improve collaboration in the workforce.

To improve leadership skills among employees, the recommendations from the research focused on training and coaching that is formal, is personalized, and allows the learner to work with realistic scenarios of specific events and decision points.<sup>24</sup> Role-playing in order to develop communication skills and taking part in simulations can be effective strategies for developing understanding of and skills for leadership. Mentoring is another way to improve

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leadership skills in both current and future leaders. This can occur through formal mentoring programs or informal mentorships where junior employees seek out senior leaders (and vice versa) to gain new perspectives.<sup>25</sup>

The Campbell Soup Company, the Fifth Third Bank, and other organizations have successfully used certain internal and external coaching practices to develop 21st century skills. Performance-focused coaching can improve leadership skills by aligning leaders with employees and stakeholders at all levels of the organization. Development-focused coaching encourages individuals to be prepared for potential future roles, improving employee flexibility and the ability to transition into another role. Transition and onboarding coaching also improves these skills by helping employees understand how to best succeed in new roles, both on their own and with organizational support. Onboarding coaching is also important to instill core organizational values in new employees, which is crucial for organizations looking to benefit from 21st century

skills. Team coaching can improve communication and collaboration in a team, bringing individual level skills to the team level. The use of diversity and inclusion coaching can improve leadership, collaboration, and cultural competencies. Finally, coaching that taps into 360-degree debriefing and feedback can improve communication skills and emotional intelligence by allowing employees to understand their own behaviors and others' perceptions of their behaviors.<sup>26</sup>

There is a fairly rich evidence base supporting strategies for improving the transfer of learning from one context to another, a process that is central to the Air Force approach of integrating formal education and on-the-job training. According to multiple meta-analyses, characteristics of the learning, training, and working environment help learners transfer knowledge and skills from training to working in a variety of workplaces. For example, training in which an expert models desired behaviors and provides opportunities to make and correct mistakes promotes the transfer of knowledge and skills from training exercises to the workplace. Similarly, practicing complex behaviors and continually refining the approach (*successive approximation*) can help learners hone their behaviors.<sup>27</sup> When learners set goals and understand the relevance of the training to the job, they more effectively transfer the skills from that training. Having opportunities to use the training on the job soon after learning, receiving feedback, and being supported by supervisors and peers also corresponded to better skills transfer.<sup>28</sup> Corporate research suggests that work conditions, such as task autonomy and a manageable workload, provide opportunities to use newly learned 21st century skills. These factors suggest ways that on-the-job training can extend formal education on 21st century skills.

## Best Practices for Measuring 21st Century Skills

Measuring competencies—even hard-to-measure competencies—is important for several reasons. First, assessments demonstrate whether an individual has acquired the necessary skills or needs more or different learning opportunities. Second, assessments can be used to identify effective programs and practices for developing skills. Finally, high-accountability situations (e.g., performance evaluations) typically rely on measurable skills: What gets measured matters.<sup>29</sup>

Burke (2017) provides an instrument for measuring learning agility—the ability to successfully adapt and learn

### Considerations When Selecting Measures of 21st Century Competencies

#### Instructional considerations

- formative or summative
- actionable information to instructors
- useful feedback to students
- context appropriate
- engaging, meaningful, and authentic for learners
- encourages effective teaching and learning

#### Practical considerations:

- cost
- ease of training
- ease of scoring
- ease of administration
- ease of technological implementation

#### Technical considerations:

- reliability
- validity
- fairness

SOURCE: Soland et al., 2013, p. 9.

in unfamiliar and uncertain situations.<sup>30</sup> Soland et al. (2013) provide criteria that can be used to select assessment measures (see box).<sup>31</sup>

Centers, educational organizations, and consulting firms focused on executive selection have developed processes for measuring 21st century skills in adults. For example, Polaris Learning Ltd. and Developmental Dimensions International work with industries to develop assessments, evaluate employee competencies, and design training programs.<sup>32</sup> Lipscomb University has developed a Competency Assessment and Development Center around a subset of the Polaris competencies, reminiscent of assessment centers long used in the private sector.<sup>33</sup> It features a day-long, competency-based assessment that involves collaborative problem-solving, individual and collaborative analysis, group decisionmaking, and debate. Such assessments are typically task-oriented, with the participant having to address an “in-basket” of emails, memorandums, and messages, most of which are urgent and problematic, within a short period of time. Trained Lipscomb faculty members observe students’ behavior over a full day of intensive activities and, using a highly structured, collaborative process, determine performance levels for each participant for each competency. Following the exercise, they debrief participants, providing guidance on how to capitalize on areas of strength and develop areas of weakness. Using hands-on simulations—whether live or simulated—combines development and assessment, so participants have the opportunity to practice the focal skill and improve from the feedback that is incorporated into the assessment experience.

Such purposeful, realistic, task-based, competency-based, and cognitively based assessments and assessment centers are not new, and they have been widely and

effectively leveraged by the private sector for decades. However, the Air Force has not yet leveraged these well-researched and predictive technologies.<sup>34</sup> While the Army and the Marine Corps have used avatar-like simulations to help soldiers practice interacting with local nationals, the Air Force is not yet using this type of technology to develop or assess cultural competencies. The computer game *Tactical Iraqi Language and Culture Training System* was used to train marines on situational language, gestures, and cultural nuances prior to their deployment to Iraq.<sup>35</sup> Now would be a propitious time to explore, appropriately adopt, and fully leverage assessment technologies, as it becomes increasingly important to acquire airmen with 21st century skills and assist them in the development of those skills.

## **Air Force–Specific Research Can Guide Next Steps**

To further understand the importance of 21st century skill sets to the Air Force, as well as how to continue developing and selecting for these types of knowledge, skills, and abilities, the Air Force must pursue further research on the topic. This research should seek to answer the following questions:

1. Which 21st century skills are important to the Air Force? How can the Air Force develop a culture that values these skills?
2. How does the Air Force assess 21st century skills, and how can the Air Force improve the assessment of those skills? To what degree do 21st century skills currently exist in the Air Force workforce?

3. How can the Air Force efficiently create the structures needed to develop 21st century skills and develop these skills in its workforce within existing structures?

## Plan for Research

### Valuing 21st Century Skills

First and foremost, the Air Force might revisit and compare current institutional competencies with 21st century skills to draw out relevant competencies and identify potential updates or nuances. While many of the key 21st century skills are embedded in existing Air Force competencies, a supplementary document that calls out these skills and prioritizes them would provide the framework needed to foster their development. As long as these skills are buried in separate subcompetencies, they are unlikely to be considered critical for airman agility. The Air Force

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The Air Force might explore strategies to elevate the importance of these skills by incorporating concrete assessments of 21st century skills in promotion decisions.

might explore strategies to elevate the importance of these skills by incorporating concrete assessments of 21st century skills in promotion decisions. Further, by proactively communicating the importance of 21st century skills to airmen and expectations of skill level to candidates, the Air Force could encourage K–12 schools and colleges to continue their efforts to help students—and potential future airmen—develop these skills.

### Assessing 21st Century Skills

To determine the need for and scope of skill development efforts, the Air Force should first determine whether current assessments fully capture the prioritized skill set. Some of these current assessments include the following:

- accession tests for potential airmen
  - The Armed Services Vocational Aptitude Battery is a timed multi-aptitude test used to determine qualification for enlistment and includes some tests of reasoning, comprehension, and other cognitive abilities.
  - The Air Force Officer Qualifying Test (AFOQT) primarily measures verbal and mathematics aptitude and aptitudes related to specific career fields (e.g., aviation knowledge), but it also includes a subtest on situational judgment that may be relevant to 21st century skills.<sup>36</sup> Items on the AFOQT self-description inventory may also be relevant.
- promotion tests for current airmen
  - The Specialty Knowledge Tests (SKTs) assess knowledge specific to a career field and position. It is not clear whether any items on the SKTs will yield useful information about 21st century skills.

- The Promotion Fitness Exam draws primarily on the Professional Development Guide, which includes such relevant topics as leadership, communication, critical thinking, and decisionmaking.
- The United States Air Force Supervisory Exam, which also draws on the Professional Development Guide but at a higher level than the Promotion Fitness Exam, focuses on military, supervisory, and managerial knowledge.

Although there are numerous existing Air Force assessments that may measure 21st century skills, it is important to determine the validity of these assessments alone, or in combination with one another, for measuring 21st century skills. Analyzing the Air Force's current skill measurement instruments could show whether 21st century constructs are already covered in current instruments. If the constructs are not already measured by the Air Force's instruments, the Air Force might consider whether and how to incorporate these constructs into the existing assessments. Doing so would help identify areas for individual development.

The Air Force might then consider adoption of new assessment technologies. An initial analysis comparing existing Air Force assessments with such assessments as the Burke Learning Agility Inventory or Lipscomb University's Competency Assessment (for consistency between constructs and correlations between outcomes of the assessments) would be prudent. Alignment could suggest that existing assessments are adequate, but it is much more likely that the Air Force might need to expand existing assessments or consider separate assessments.

The Air Force also might consider using data from existing assessments, new assessments, or both to take stock of how well airmen embody specific 21st century skills across the organization in order to better target future development of both the workforce and its skills.

### Developing 21st Century Skills

Measuring existing competencies with targeted assessments would help the Air Force scope development requirements across the organization and to best match each individual airman. Air Force Education and Training Command can then adjust learning opportunities to best develop the needed skills. Where there are gaps in skill development, the Air Force can take stock of strategies for training, education, and on-the-job learning to determine whether these strategies align with best practices and how trainers, educators, and supervisors can improve their practices to better develop needed skill sets.

### Conclusion

The Air Force prioritizes agility in its airmen. The education and private sectors have also prioritized related skills, calling them 21st century skills. These skills can be challenging to conceptualize, develop, and assess. Tapping existing knowledge from outside of the military might help the Air Force avoid missteps in implementing new strategies to improve agility. The actions suggested in this Perspective could ultimately inform the continuum of learning and development in the Air Force, which could help airmen perform better in new and complex contexts for a more cost-effective and flexible force.

## Notes

- <sup>1</sup> World Economic Forum, 2016, p. 19.
- <sup>2</sup> World Economic Forum, 2016.
- <sup>3</sup> World Economic Forum, 2016.
- <sup>4</sup> Goldfein, 2016; Goldfein, 2017.
- <sup>5</sup> Secretary of the Air Force Public Affairs, 2017.
- <sup>6</sup> Both individual and organizational agility are important for the Air Force; this Perspective focuses only on individual agility. See U.S. Air Force, 2015a.
- <sup>7</sup> Pellegrino and Hilton, 2012.
- <sup>8</sup> Ananiadou and Claro, 2009; Cassel and Kolstad, 1998; the Conference Board, Corporate Voices for Working Families, the Partnership for 21st Century Skills, and the Society for Human Resource Management, 2006; Glossary of Education Reform, 2016; Levy and Murnane, 2005; Partnership for 21st Century Learning, 2016; Secretary's Commission on Achieving Necessary Skills, 1991; Vane, 2011; World Economic Forum, 2016.
- <sup>9</sup> Pellegrino and Hilton, 2012.
- <sup>10</sup> Curtis E. Lemay Center for Doctrine Development and Education, 2017.
- <sup>11</sup> Curtis E. Lemay Center for Doctrine Development and Education, 2017; U.S. Air Force, 2016.
- <sup>12</sup> Brady, 2006.
- <sup>13</sup> Brady, 2006; Hardison et al., 2012.
- <sup>14</sup> Secretary of the Air Force, 2014.
- <sup>15</sup> Richey and Nokes-Malach, 2014.
- <sup>16</sup> Bell, 2010; Pellegrino and Hilton, 2012; Saavedra and Opfer, 2012; Trilling and Fadel, 2012.
- <sup>17</sup> Wallas, 1926.
- <sup>18</sup> Bell, 2010.
- <sup>19</sup> Boyle et al., 2016; Qian and Clark, 2016.
- <sup>20</sup> Abrami et al., 2008; Pellegrino and Hilton, 2012.
- <sup>21</sup> Abrami et al., 2008.
- <sup>22</sup> Abel, 2014; Greenes and Rothman, 2014; Sinar et al., 2018.
- <sup>23</sup> Greenes and Rothman, 2014.
- <sup>24</sup> Abel and Popiela, 2018; Sinar, 2018.
- <sup>25</sup> Neal, 2018.
- <sup>26</sup> Abel et al., 2014.
- <sup>27</sup> Allen and Sites, 2012; Botke et al., 2018.
- <sup>28</sup> Blume et al., 2010; Grossman and Salas, 2011.
- <sup>29</sup> Griffin and Care, 2015.
- <sup>30</sup> Burke and Smith, 2017; DeRue, Ashford, and Myers, 2012; Lombardo and Eichinger, 2000.
- <sup>31</sup> Soland, Hamilton, and Stetcher, 2013.
- <sup>32</sup> Polaris Learning, 2017.
- <sup>33</sup> Reliability of almost all assessments is 0.80 or higher, and concurrent validity between assessments and employer ratings is high. McLarty and Gaerter, 2015; Long, 2014.
- <sup>34</sup> See, for example, Keller et al., 2014.
- <sup>35</sup> Stilwell, 2016.
- <sup>36</sup> The primary accession test for students and enlistment, the Armed Services Vocational Aptitude Battery, assesses specific skills (primarily literacy) and knowledge and likely is not a strong source of information on 21st century skills.

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## About This Perspective

This Perspective shares research from the private and education sectors on a topic of interest to the Air Force—21st century skills—and suggests ways in which further exploration could inform and improve Air Force efforts to increase agility of its airmen. It gives a brief definition of 21st century skills, and compares common conceptions on the topic to Air Force institutional competencies, which currently guide workforce development in the Air Force. The research approaches suggested in this Perspective could ultimately inform the continuum of learning and development in the Air Force.

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This research was sponsored by the Assistant Secretary of the Air Force for Manpower and Reserve Affairs (SAF/MR), and the Deputy Chief of Staff for Manpower, Personnel, and Services, U.S. Air Force (AF/A1) and conducted within the Manpower, Personnel, and Training Program of RAND Project AIR FORCE as part of a fiscal year 2017 project, "Human Capital Strategic Planning," under contract FA7014-16-D-1000.

We thank Daniel Sitterly, the Principal Deputy Assistant Secretary of the Air Force for Manpower and Reserve Affairs, for his guidance and support of this work. We also thank our reviewers for their insightful feedback: David Conley, director of the Center for Educational Policy Research at the University of Oregon and president of EdImagine; Peter Schirmer, senior management scientist and former director of emerging policy research and methods at the RAND Corporation; and Jim Soland, research scientist at the Northwest Evaluation Association.

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