Reskilling the Workforce with Technology-Oriented Training

Stacie Petter, Ph.D.
Baylor University

Laurie Giddens, Ph.D.
University of North Texas

IBM Center for
The Business of Government

2021

Reskilling the Workforce with Technology-Oriented Training

Stacie Petter, PhD

Baylor University

Laurie Giddens, PhD

University of North Texas

IBM Center for
**The Business
of Government**

2021

TABLE OF CONTENTS

FOREWORD

On behalf of the IBM Center for The Business of Government, we are pleased to publish this new report, *Reskilling the Workforce with Technology-Oriented Training,* by Stacie Petter, PhD, Baylor University, and Laurie Giddens, PhD, University of North Texas.

Government agencies are increasingly expected to provide more and higher levels of services for citizens with fewer resources. This difficult balancing act requires that government executives maximize the effectiveness of agency transformation efforts. Government agencies use technology to increase the efficiency of their services, but rapid changes in technology create a need for additional training to help the workforce remain current in their knowledge and application of new innovations.

Professors Petter and Giddens note that as organizational roles evolve and require new skills and knowledge, government agencies need to address the ever-growing information technology skills gap in their workforce by reskilling employees. One way to address the skills gap involves technology-oriented training programs. These programs enable individuals to learn new skills about systems and applications to solve problems in new or evolving organizational roles.

In this new report, the authors assess two technology-oriented training programs in which organizations set out to reskill members of a workforce with technical skills needed to conduct their jobs effectively or move into new roles. The report defines effective technology-oriented training as a transfer of technical, functional, and contextual knowledge to the workplace after training. The case studies are the DeliverFund's Counter Human Trafficking Intelligence Operations Course and Federal Cyber Reskilling Academy. Each program uses a range of methods and components to deliver technology-oriented training to employees. The authors outline the benefits and limitations of each program as to their ability to facilitate the transfer of training.

DANIEL J. CHENOK

MIKE CHON

Based on these case studies, the authors offer recommendations so that agencies can better achieve effective technology-oriented training outcomes when reskilling employees. Each recommendation supports one of the three practices:

- **Selecting Individuals for Technology-Oriented Training Readiness:** Choosing the right employees to engage in technology-oriented training programs for reskilling.

- **Designing or Choosing Technology-Oriented Training Programs Appropriately:** Selecting or creating technology-oriented training programs with essential elements needed for successful outcomes.

- **Providing Agency Support for Employees Post-Training:** Supporting the employee to use the skills learned post-training to benefit from the investment.

Petter and Giddens acknowledge that government agencies seeking to increase their staffs' technology-oriented skill sets can expect to face challenges as they seek to achieve effective training outcomes. However, their research indicates that organizations can achieve more positive outcomes from technology-oriented training when seeking to reskill their workforce.

As agencies engage in digital transformations, the workforce must also transform by reskilling to maintain and effectively use new technology. We hope that the cases studies, insights, and recommendations outlined in this report will help government agencies succeed in developing and reskilling the workforce of the future.

Daniel J. Chenok
Executive Director
IBM Center for The Business of Government
chenokd@us.ibm.com

Mike Chon
Vice President and Partner
Federal Talent & Transformation Leader
mike.chon@ibm.com

EXECUTIVE SUMMARY

Increasingly, government agencies must provide more and higher levels of services for citizens with fewer resources. One approach to achieve this goal is through the implementation and use of information technology to support the work and needs of government agencies.

However, the presence of new or upgraded information technology alone is insufficient to achieve the efficiency gains needed by most government agencies. As technology transforms the objectives and goals of many organizations, managers need to develop a workforce with new skills and knowledge for evolving and changing roles within the organization. Technology-oriented training programs teach employees the necessary technical, functional, and contextual knowledge required to adapt and shift into new organizational roles.

There are many reasons why agencies may encourage their employees to attend technology-oriented training programs. Some technology-oriented training programs teach employees how to use specific information technologies consistent with their role within an agency. These programs are often focused on upskilling employees, providing new knowledge and skills to support employees in their current role. Other training programs reskill employees by teaching technology-oriented skills to prepare them for new roles in the same or different agencies. Employees attending technology-oriented reskilling training programs must learn new uses and applications of information technology that often lead to new work roles within the agency. This report focuses specifically on technology-oriented training programs that seek to reskill employees for new roles within the organization. Reskilling technology-oriented training programs have outcomes that are different from programs seeking to upskill employees.

Technology-oriented training programs that seek to reskill employees can be a means to improve employees' efficiency and effectiveness in their current and future roles within an agency. Effective technology-oriented training outcomes occur when the following practices are implemented:

- **Selecting Individuals for Technology-Oriented Training Readiness:** Choosing the right employees to engage in technology-oriented training programs.

- **Designing or Choosing Technology-Oriented Training Programs:** Selecting or creating technology-oriented training programs with essential elements for successful outcomes.

- **Providing Agency Support for Employees Post-Training:** Offering support for employees after participating in technology-oriented training is critical for employees to apply their skills and to ensure the organization benefits from the investment in training.

This report identifies recommendations for the above practices based on the results of two case studies of different types of technology-oriented training programs offered to reskill government employees. One program is offered by a nonprofit to train law enforcement officers on the use of information technology to combat human trafficking. Law enforcement officers attending this in-person training program gain extensive knowledge regarding how to use new and existing information technology to fight human trafficking and learn new investigative methods and techniques that differ from traditional investigative approaches used by most law enforcement agencies. The second training program, offered by the Office of Management and Budget (OMB), enables federal employees to gain new skills and credentials in an area with a severe personnel shortage: cybersecurity. This training program, which has been offered in-person and virtually, does not require participants to have prior information technology or cybersecurity experience. Trainees obtain cybersecurity skills and knowledge that enable them to successfully obtain cybersecurity credentials (i.e., Certified Information Systems Security Professional) needed for many cybersecurity roles within the federal government.

Based on the lessons learned from these two case studies, we offer ten recommendations for government agencies seeking to achieve effective technology-oriented training outcomes for reskilling their workforce. The following provides a synopsis of recommendations detailed in this report to help agencies achieve effective technology-oriented training outcomes when reskilling employees.

Selecting Individuals for Technology-Oriented Training

1. **Choose employees who exhibit technology engagement.** Employees attending technology-oriented training that demonstrate an interest in technology are more likely to be engaged during training, apply the lessons learned in their day-today work, and will find innovative uses for technology to transform the organization.

2. **Identify employees that have an expressed need or motivation for technology-oriented training.** Employees who are interested in participating in reskilling training programs, particularly because the training program is aligned with the employees' goals, are more likely to result in applying the knowledge and skills gained during training within the workplace.

3. **Prioritize aptitude over experience.** It is vital for government agencies to reskill employees for positions in new roles and disciplines as the workforce evolves in the twenty-first century. Identifying individuals with a cognitive ability suitable for the role also improves the potential for effective training outcomes. Rather than limiting technology-oriented training only to employees who have preexisting technical knowledge, creating pathways for employees with an interest and cognitive ability for the training broadens participation in technology-oriented reskilling training programs.

Designing or Choosing Technology-Oriented Training Programs

4. **Enable opportunities for community building.** Training provides an opportunity to network and meet counterparts at similar or different agencies. Increasing a participant's social support network can help employees learn new techniques and share not only technical

knowledge, but also functional and contextual knowledge, with others who support the efforts of the government agency.

5. **Provide reference resources during training that can be used post-training.** Training programs should provide accompanying course materials to trainees during training for reference while performing technology exercises. Providing training materials during training offers visual cues and instructions for trainees to refer to while experimenting and practicing the skills. Training materials also provide a reference for trainees using technology post-training.

6. **Incorporate feedback using learning assessments appropriate for the training need.** Participants should use and apply the technical and functional knowledge taught during training in the context of their day-to-day tasks during training to develop contextual knowledge. Furthermore, when learning technical skills during training, trainees need to learn how to use the technology successfully as well as recover from errors to gain self-confidence with using the technology. Providing a range of feedback opportunities related to the trainee's development of technical, functional, and contextual knowledge allows trainees to activate recall and reflect on their learning.

Providing Agency Support for Employees Post-training

7. **Ensure technology availability for those attending training.** The technology taught during training should be available for employees to immediately use and apply upon their return to achieve more benefits from attending training. Sending employees to training too far in advance of when the technology will be made available or when the trainee can apply the skills, can limit the value of training programs. Managers should consider the timing of reskilling efforts to ensure the training coincides with the acquisition of new technology within the organization.

8. **Offer the needed time to apply insights from training.** It takes time after learning a new technology at training to adapt the lessons learned from training to the day-to-day work within the organization. The agency should ensure there is adequate time for employees to apply skills learned from training in their current or new roles within the organization. It is unrealistic for managers to expect to see the benefits of training in a short amount of time. In fact, productivity will likely decrease while employees endeavor to transfer training to their new environment. After transferring training knowledge, organizations will reap the benefits of reskilling employees.

9. **Protect against skill decay with designated time for skill refreshers.** When employees are unable to practice or apply their knowledge from training in the work environment, skills begin to decay. Additionally, technical skills tend to lose relevance quickly and need to be updated continuously. As such, agencies should have a plan to provide employees with skill refreshers and enhancers on a regular basis for each of the type of knowledge gained during training: technical, functional, and contextual. These refreshers will reduce skill decay, encourage the transfer of training and protect the agency and employee training investment.

10. **Couple training with related experience requirements.** Technology-oriented reskilling training is not sufficient for workers to transition into new roles post-training. Certain roles may require applicants to demonstrate both skills and experience. Leaders may need to consider altering the experience requirements for positions.

INTRODUCTION

As citizens' needs increase, government agencies must achieve more objectives with fewer resources. This difficult balancing act requires that government executives maximize the effectiveness of agency transformation efforts.

Government agencies use technology to increase the efficiency and effectiveness of their services, but the rapid changes in technology create a need for additional training to ensure the workforce remains current in their knowledge and application of technology. The World Economic Forum estimates that one billion people will need reskilling by 2030,[1] and companies expect to provide upskilling and reskilling opportunities to 73 percent of their current workforce.[2] Upskilling teaches employees new skills required for their current role within the organization, while reskilling educates employees on new skills that enable employees to perform new or different roles within their organization.

Within federal government agencies, the Government Accountability Office regularly identifies "Strategic Human Capital Management" as a high-risk area because of skills gaps related to technology (among other areas) within federal agencies.[3] As organizational roles evolve and require new skills and knowledge, government agencies need to address the ever-growing information technology skills gap in their workforce by reskilling employees. One way to address the skills gap is with technology-oriented training programs. These programs enable individuals to learn new skills about one or more technologies to solve existing or new organizational problems in new or evolving organizational roles. Yet, employees may struggle to apply the lessons learned from training within the organizational context for many reasons. When employees cannot use their newly gained technology skills to support the changing needs the government agency, the agency benefits less from providing technology-oriented reskilling training to its employees.

Government agencies incur multiple costs to train and reskill their employees. First, the agency assumes the financial costs of the training program and any associated travel. Second, employees are unable to complete day-to-day work while attending training, meaning tasks remain incomplete until employees return. Third, if employees attend training on new or existing technology, the organization must procure the relevant technology to benefit from the training activity. Fourth, unless individuals attending training share the knowledge learned with others in the organization, the training is useful only as long as the individuals remain in an organizational role in which the training is relevant.

Although the costs associated with training employees are significant, the benefits of effective technology-oriented reskilling training programs can be invaluable to a government agency. For employees who enjoy learning and mastering new skills, attending a training program can

---

1.   Zahidi, Saadia. "We Need a Global Reskilling Revolution—Here's Why." World Economic Forum, January 22, 2020. https://www.weforum.org/agenda/2020/01/reskilling-revolution-jobs-future-skills/.

2.   World Economic Forum, "The Future of Jobs Report 2020." The Future of Jobs. World Economic Forum, October 2020. http://www3.weforum.org/docs/WEF_Future_of_Jobs_2020.pdf.

3.   U. S. Government Accountability Office, "High-Risk Series: Dedicated Leadership Needed to Address Limited Progress in Most High-Risk Areas," High-Risk Series, March 2, 2021, https://www.gao.gov/assets/gao-21-119sp.pdf.

TRAINING

improve their motivation and morale. Training programs can enlarge employees' networks of peers within and across agencies, providing social support and access to knowledge within and across agencies. Effective training offers employees an opportunity to learn skills to solve existing or new problems and grow into new roles that emerge within the organization. Given the tangible and intangible costs of providing technology-oriented training, agencies should ensure they obtain these benefits post-training.

Ensuring employees within government agencies have higher levels of technology-oriented skills and knowledge is increasing in importance as agencies modernize the many information systems that rely upon outdated technology and processes. In 2019, the Department of Defense finished an upgrade of their 1970s-era nuclear weapons system to no longer require eight-inch floppy disks.[4] Many criticize federal government agencies for their outdated information systems that are vulnerable to cyberattacks or have inefficient processing power.[5] State governments have also experienced challenges with outdated information technologies as citizens in Florida and Texas struggled to use online systems to apply for unemployment in the early months of the SARS-CoV-2 pandemic.[6]

In 2017, the Modernizing Government Technology Act was signed and enacted, which created the Technology Modernization Board and Technology Modernization Fund to provide additional financial resources and support for federal agencies seeking to modernize their information technology. Furthermore, this program allows federal agencies to designate funds toward improving, replacing, and transitioning aging information technology to increase the efficiency and effectiveness of an agency. The Technology Modernization Board approves and oversees the effort to modernize a range of federal systems across agencies.[7] Modernization initiatives require many employees to upskill their technology-oriented knowledge as they learn new processes and technology to perform their current roles within the agency. However, modernization also creates significant, wide-ranging impacts to the organization, which often includes the creation of new roles or jobs within the organization to support technology modernization.

As agencies engage in digital transformations, the workforce must also be transformed by reskilling employees to enable the agency to maintain and effectively use the new technology.[8] Agencies must train current and new employees to thrive in dynamic technological environments[9] in which work habits, processes, and organizational roles change as technology is introduced and updated. To encourage more innovative, efficient, and effective uses of information technology, agencies must be prepared to reskill employees by providing technology-oriented training.

4.   Liam Stack, "Update Complete: U.S. Nuclear Weapons No Longer Need Floppy Disks," *The New York Times,* October 24, 2019, sec. U.S., https://www.nytimes.com/2019/10/24/us/nuclear-weapons-floppy-disks.html.

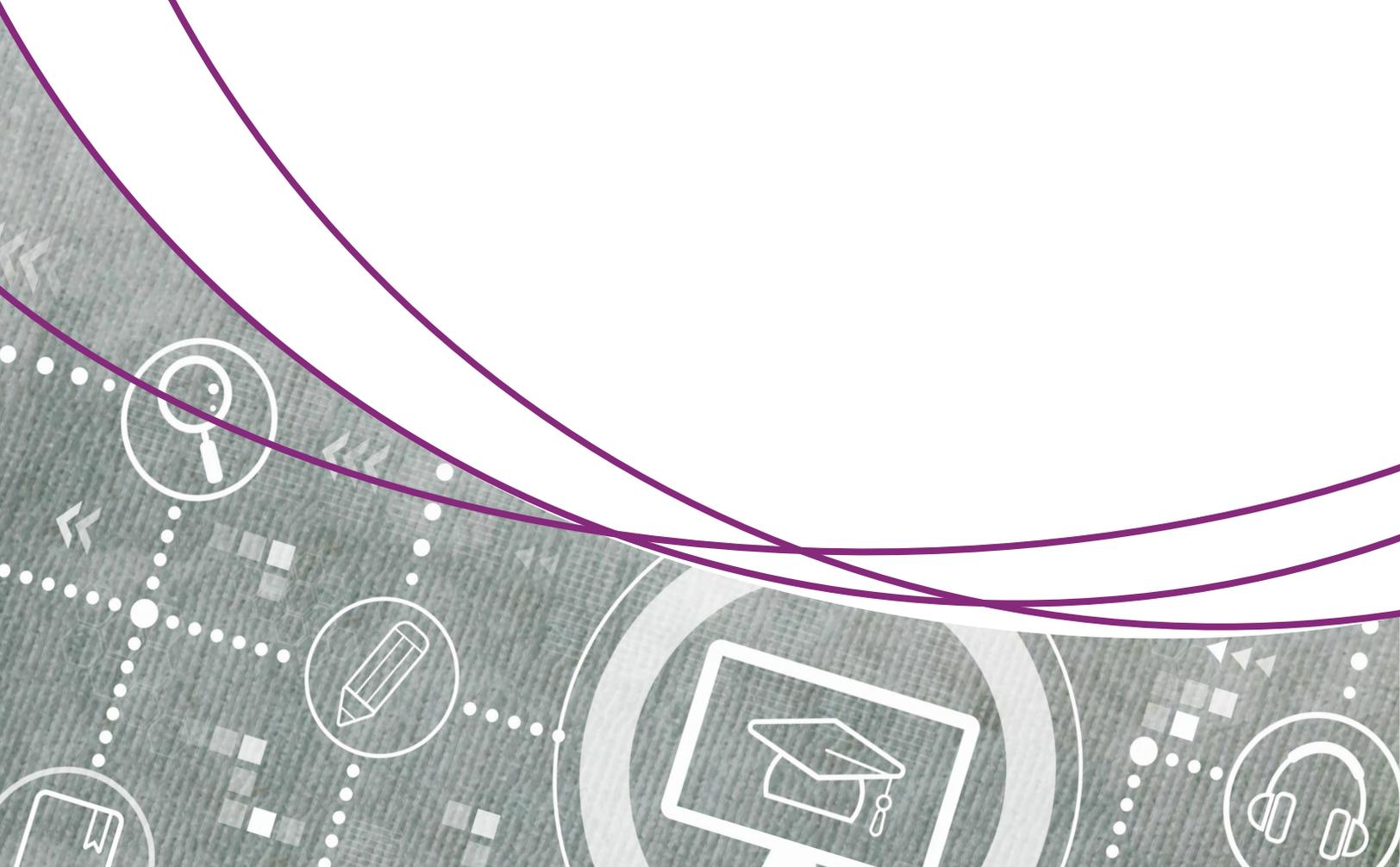5.   U. S. Government Accountability Office, "High-Risk Series."

6.   The United States Senate Republican Policy Committee, "Modernizing Government Information Technology," Policy Papers | The United States Senate Republican Policy Committee (RPC), May 15, 2020, https://www.rpc.senate.gov/policy-papers/modernizing-government-information-technology-.

7.   The Technology Modernization Fund, "Awarded Projects," Awarded Projects, March 12, 2021, /projects/.

8.   Rebekah Eden et al., "Digital Transformation Requires Workforce Transformation," *MIS Quarterly Executive* 18, no. 1 (March 1, 2019), https://aisel.aisnet.org/misqe/vol18/iss1/4.

9.   Nick van der Meulen, Peter Weill, and Stephanie Woerner, "Managing Organizational Explosions During Digital Business Transformations," *MIS Quarterly Executive* 19, no. 3 (September 1, 2020), https://aisel.aisnet.org/misqe/vol19/iss3/4.

Technology-Oriented Training Programs For Reskilling The Workforce

Technology-oriented training programs for reskilling include three distinct training components:

- **Technical training** teaches specific, systematic instructions on how to use a technology or information system. Technical training includes not only step-by-step instructions to perform tasks using the technology, but also instructs trainees on new skills, concepts, and processes that accompany the technology.

- **Functional knowledge** training teaches skills that transfer to a variety of contexts and organizational roles. These skills can include general knowledge such as general technical, communication, or leadership knowledge and skills. Functional knowledge is transferable across job roles. Employees who need reskilling typically possess some level of functional knowledge related to using and managing new technology, but often need additional functional knowledge as they increase their technical knowledge and shift into new organizational roles.

- The final component of technology-oriented training is instruction to increase **contextual knowledge**. In contrast to functional knowledge, which is applicable across contexts and environments, contextual knowledge is specific to a particular context or problem.[10]

Consider a training program to reskill employees on the use of data science to gather, analyze, and interpret data to inform decision-making. A purely technical training program to upskill employees might teach trainees how to import data, analyze the data using a clustering feature, and create reports within a statistical software package. A reskilling technology-oriented training program would not only provide technical training, but also it would offer additional instructional components. The training would include a functional knowledge training component with lessons on statistics, data visualization techniques, and data governance. Contextual knowledge training would include training on industry standards, best practices, and applying the technical and functional data science knowledge gained during training to specific organizational contexts. It is the combination of the three elements of technology-oriented training that provide a holistic training experience for employees who need reskilling.[11]

For any training to be effective, employees must transfer the skills and knowledge learned during training to their respective agencies and work processes.[12] Unfortunately, only a small percentage of trainees are able to apply the skills learned during training to their job, with estimates indicating that only 10-12 percent of trainees successfully transfer their training to the workplace.[13] Moreover, half of training programs do not result in positive organizational or individual outcomes.[14] The inability for employees to apply their knowledge from training to the workplace is known as the "transfer problem."[15] Although the transfer problem is pervasive, organizations and employees who overcome the transfer problem can yield important benefits from effective training programs, such as improved job and organizational performance, organizational commitment, knowledge acquisition, and company innovation.[16] Ensuring transfer of training is especially critical now given the number of employees expected to need reskilling and upskilling going forward.

10. Patrick Brezillon, and Jean-Charles Pomerol, "Contextual Knowledge and Proceduralized Context," *American Association of Artificial Intelligence,* 1999. https://www.aaai.org/Papers/Workshops/1999/WS-99-14/WS99-14-004.pdf.

11. The Office of Management and Budget created a Data Science Training Academy (based on a pilot program developed by the U.S. Census Bureau) that incorporated technical, functional, and contextual knowledge training components. CIO.gov, "Data Science Training," https://www.cio.gov/programs-and-events/data-science-training-program/.

12. Lisa A. Burke and Holly M. Hutchins, "Training Transfer: An Integrative Literature Review," *Human Resource Development Review* 6, no. 3 (September 2007): 263–96, https://doi.org/10.1177/1534484307303035.

13. Karla Gutierrez, "10 Statistics on Corporate Training and What They Mean for Your Company's Future," January 28, 2016, https://www.shiftelearning.com/blog/statistics-on-corporate-training-and-what-they-mean-for-your-companys-future.

14. Alan M. Saks, "So What Is a Good Transfer of Training Estimate? A Reply to Fitzpatrick" (American Psychological Association, 2002), https://doi.org/10.1037/e576922011-004.

15. Timothy T. Baldwin and J. Kevin Ford, "Transfer of Training: A Review and Directions for Future Research," Personnel Psychology 41, no. 1 (1988): 63–105, https://doi.org/10.1111/j.1744-6570.1988.tb00632.x.

16. J. Bruce Tracey et al., "The Influence of Individual Characteristics and the Work Environment on Varying Levels of Training Outcomes," *Human Resource Development Quarterly* 12, no. 1 (2001): 5–23, https://doi.org/10.1002/1532-1096(200101/02)12:1<5::AID-HRDQ2>3.0.CO;2-J.

Factors Affecting Training Transfer

Several factors influence an employee's ability to transfer knowledge and skills learned during training. Broadly speaking, the transfer of training knowledge to the workplace is affected by the employee's personal characteristics, training design and delivery, and the work environment. Table 1 summarizes some of the factors that influence the transfer of training, which is a critical outcome expected from any training program.

Table 1: Summary of Influencers for Transfer of Training[17]

Category	Factor	Description
Employee's Personal Characteristics	Personality	Traits such as openness to experience, which is related to one's level of curiosity and imagination, and conscientiousness, which is one's level of responsibility and self-regulation
	Cognitive Ability	Ability of an individual to perform simple and complex tasks that depend on attention, memory, processing, and logic, often measured by aptitude tests
	Motivation	Internal desire to learn new skills during training and apply skills post-training
	Self-Efficacy	Sense of self-confidence or perceived ability to learn skills taught during training and the development of self-confidence or perceived ability to perform skills gained during training
Training Design and Delivery	Variety of Learning Strategies	Range of learning activities incorporated throughout the training program that may include case studies, examples, discussion to enable trainees to approach concepts using multiple learning techniques
	Error Management Training	Incorporation of examples to demonstrate how errors negatively impact outcomes and to discuss how to recover when an error is made during a task
	Practice and Feedback	Incorporation of practice activities throughout training with varying levels of difficulty to simulate activities performed in the work environment
	Goals	Clear articulation of the goals of training that are identified (1) within the training program as objectives of training or (2) by the trainee as their desired outcomes from the training program
Work Environment	Supervisor Support	Activities engaged in by supervisors during and post-training, such as discussing skills learned during training, participating in training, and encouraging trainees
	Peer Support	Activities engaged in by peers to support training outcomes, such as networking with colleagues about training content and sharing ideas about training content with others
	Opportunity to Perform	Ability for the trainee to incorporate and apply skills learned during training in the work environment as soon as possible post-training

17. The contents of Table 1 are based on findings from the following articles:

Timothy T. Baldwin and J. Kevin Ford. "Transfer of training: A review and directions for future research." Personnel psychology 41, no. 1 (1988): 63-105.

J. Kevin Ford and Daniel A. Weissbein. "Transfer of training: An updated review and analysis." Performance improvement quarterly 10, no. 2 (1997): 22-41.

Lisa A. Burke and Holly M. Hutchins. "Training transfer: An integrative literature review." Human resource development review 6, no. 3 (2007): 263-296.

J. Kevin Ford and Timothy T. Baldwin, and Joshua Prasad. "Transfer of training: The known and the unknown." *Annual Review of Organizational Psychology and Organizational Behavior* 5 (2018): 201-225.

Extensive research and lessons learned from practice indicate that training effectiveness is influenced by the employee, the training program, and the work context. Ensuring that all three elements are working in concert to achieve the desired result is crucial for employees to apply skills learned during training to the workplace.

Options for Technology-Oriented Training

The transfer problem is a significant issue on its own, but it becomes increasingly challenging when coupled with the ever-growing information technology skills gap within the workplace. Training has evolved in the last ten years and includes a rich portfolio of options for both employers and employees. Many courses and training opportunities are available for employees to learn both technology-oriented skills and accompanying soft skills needed to manage, govern, secure, maintain, and support technology. The range of training opportunities to teach future or current employee's new skills, such as technology-oriented skills, can be grouped into five broad categories.[18]

- **On-ramps:** Short-term, highly specific training to enable those who are unemployed or underemployed to find opportunities to enter the workforce into a specific role

- **Upskilling:** Training to increase an employees' skill set to ensure their knowledge and skills related to a specific role remain relevant and advance with changes in technology

- **Reskilling:** Programs to prepare employees for new roles by training them on new skills needed for new roles and positions within an organization or for a different organization

- **Outskilling:** Training programs for employees who are likely to be targeted for layoffs due to automation or other technology-oriented advancements to prepare for new roles in a different organization

- **Education as a Benefit:** Training programs, discounts, or tuition remission for employees as a means to retain employees and enable self-motivated employees who wish to move to new positions to gain new skills

Government agencies may use one or more of these strategies to offer technology-oriented training for their employees. Many organizations realize that it is not feasible to hire new people with the necessary skills to fill the roles and responsibilities of open positions and instead rely on training to improve employees' skill sets.[19] To gain the intended benefits from training, the organization must clearly identify the new skills needed for the positions. As new roles are created and existing positions are disrupted, often due to changes in technology, organizations should support the ongoing training and reskilling needed among employees.[20] After identifying the necessary skills needed for current and future roles within the agency, a range of training options are available to support technology-oriented training.

Organizations may also create their own training programs to teach employees technology-oriented skills. This type of training is common with upskilling employees, particularly when new information technologies are introduced or updated within the organization. However, for organizations seeking to reskill employees, a common practice is to rely on external companies to provide employees with technology-oriented training. Some external training programs provide specific, customized training programs to teach employees specific technology-oriented skills unique to the organization or technology needs. In contrast to customized training programs,

18. Allison Dulin Salisbury, "As Pressure To Upskill Grows, 5 Models Emerge," *Forbes* (blog), October 2019, https://www.forbes.com/sites/allisondulinsalisbury/2019/10/28/as-pressure-to-upskill-grows-5-models-emerge/.

19. Michael B. Horn, "Education, Disrupted," *MIT Sloan Management Review,* January 27, 2020, https://sloanreview.mit.edu/article/education-disrupted/.

20. Lynda Gratton, "New Frontiers in Re-Skilling and Upskilling," *MIT Sloan Management Review,* July 8, 2019, https://sloanreview.mit.edu/article/new-frontiers-in-re-skilling-and-upskilling/.

other training programs are more generic and focus on providing lessons to enable the employee to pursue credentials or certifications for specific skills. These external training programs can be particularly useful for organizations or agencies with skill needs that are consistent across organizations. For example, when the Office of Management and Budget (OMB) created a Data Science Training program to enable government agencies to increase the data skills among their employees, OMB identified several credentialed programs for employees to choose from as they learned data science skills. To assist the trainee in applying the skills learned during training to their current role, each trainee from the Data Science Training Program completes a capstone project relevant to their federal agency.[21] This combination of externally provided training about data science that is applicable across multiple agencies along with customized experiences specific to the trainees' current agency role mitigates the transfer problem that often arises in training.

Other considerations for training programs include variations in modes of delivery. Many training programs rely on instructor-led training (ILT) that are typically in a face-to-face format. ILT can also be delivered via video or online, synchronously (with students meeting at the same time as the instructor) or asynchronously (students watching instructor videos at a separate time). ILT may be offered onsite or offsite, depending on the number of employees participating in the training program. Generally, ILT programs require attendees to be devoted to training for multiple hours per day over several days or weeks. ILT provides trainees the ability to have a high level of focus on the content provided during training. After completing an ILT program, the employee must then transition the lessons learned from an intensive period of training to their work context. The greater the differences between the training context and the work context, the more difficult for the employee to transfer the lessons learned from training to the workplace.

Another training format is student-led training programs (SLT). In SLT programs, students move at their own pace to watch videos, read content, and engage with the coursework. Students can repeat modules, which may include videos, readings, and practice exercises as quickly or slowly as needed to feel comfortable with the material. For SLT programs, employees may be given time during the workday to complete training, or they may be expected to complete the training in addition to their work (and possibly outside of work hours). Employees participating in SLT programs are more likely to find opportunities to apply skills learned during training to their work quickly because the employee is engaging in both work and training simultaneously. This immediate application of lessons learned from training facilitates the transfer of training. However, employees in SLT programs must be highly motivated to complete these training programs in that trainees may find it difficult to focus on training while also needing to complete their work-related tasks.

21.   David Nyczepir, "Federal Data Science Training Program Will Make Use of Coronavirus Datasets, Be Entirely Online," FedScoop, August 4, 2020, https://www.fedscoop.com/data-scientist-training-omb-coronavirus/.

Case Studies

This section describes two technology-oriented training programs in which organizations set out to reskill members of a workforce with the technical skills needed to conduct their jobs effectively or move into new roles within their organization. In the description of each technology-oriented training program, we identify benefits and limitations of each program related to its ability to facilitate the transfer of training. We define effective technology-oriented training as a transfer of technical, functional, and contextual knowledge to the workplace after training. Each training program utilized a range of training methods and components to deliver technology-oriented training to employees.

Case Study A—DeliverFund's Counter Human Trafficking Intelligence Operations Course

DeliverFund, a nonprofit organization, seeks to end human trafficking by providing reliable, actionable, and verifiable intelligence on human trafficking activity to local, state, and federal law enforcement officers and agencies. In addition, DeliverFund provides technology-oriented training courses to teach officers how to conduct human trafficking investigations using a range of technologies and new investigative techniques. DeliverFund's primary training course is the Counter Human Trafficking Intelligence Operations Course (CHTIOC). DeliverFund designed CHTIOC to train law enforcement officers who investigate human trafficking cases. This seven-day training course provides officers with the knowledge and tools to conduct effective investigations to identify human trafficking networks.

The course includes a range of topics, such as the use of readily available technology for investigations, social media exploitation, victim interviewing, and officer safety during operations. Trainees practice the skills taught during training with real cases and data. Attendees include law enforcement officers from varying backgrounds. Many officers attending training were from organizations that developed or were intending to develop new roles within the agency to support human trafficking investigations.

Technology-oriented training is vital for law enforcement officers for several reasons. First, most law enforcement officers do not enter the profession with an extensive knowledge of or a deep interest in technology. Similar to other government employees, law enforcement officers learn technology as needed to perform the tasks associated with their role, but few have the resources to find new and innovative uses of technology to enhance their performance. In the context of human trafficking, many criminal activities are facilitated online, and law enforcement officers must learn technology-oriented skills to conduct these investigations. Second, law enforcement officers investigating human trafficking frequently collaborate with other jurisdictions and agencies given the nature of the crime. The variation in technology used across governmental agencies creates complexities in storing and sharing information to complete the investigation. Many governmental agencies must coordinate or work closely with other agencies that rely on different technologies to complete their work. As such, it is important for individuals to learn how to use new and existing technologies to solve complex problems. Finally, human trafficking investigations require a sense of urgency among the law enforcement officers pursuing these cases. Officers must use technology effectively and efficiently to identify and locate victims and traffickers as quickly as possible. The urgency in human trafficking investigation is similar to many government agencies that are seeking to use technology to complete tasks with legislative or regulatory deadlines.

Pre-training

Many law enforcement officers attending DeliverFund's training course learned about the course through positive endorsements from prior attendees. Others participated in CHTIOC because a supervisor requested that they attend to learn new skills or gain new knowledge related to human trafficking.

Mandatory versus voluntary training attendance

The CHTIOC was voluntary for some attendees, but mandatory for others. Officers who voluntarily attended training followed different pathways to gain access to this training program. Sometimes a supervisor within an agency wanted to send an officer to the CHTIOC and asked for volunteers. One or more officers then volunteered or applied to attend the training program. In other cases, a supervisor expressed positive sentiments regarding DeliverFund's CHTIOC, but officers had to demonstrate an interest and necessity for training before receiving approval to attend. Finally, other officers learned about DeliverFund and their training program through referrals and sought approval to attend training. In this case, officers identified a need and had a strong motivation to learn the skills taught during DeliverFund's CHTIOC. Many of these officers were experiencing challenges during human trafficking investigations and had specific goals in mind for attending training. One trainee even chose to delay attending DeliverFund's training until after gaining a sufficient understanding of human trafficking investigations in order to be more prepared when learning new technologies and methodologies for their role.

Typically, voluntary participants had already considered how the training might transfer to their work processes and organizational role prior to attending training. Trainees who volunteered for or requested training often were prepared and motivated to engage during training as they sought knowledge to address an identified skills gap. For instance, some of these trainees worked specific cases during training as they applied their newly developed knowledge in real-time. Those who applied their knowledge during training to current cases worked through the software more extensively, asked more questions, and were more likely to utilize the training and software in their respective agencies post-training.

In contrast to those who attend DeliverFund's CHITOC voluntarily, other trainees were required to attend training because of a mandate by their supervisor or agency. Some officers expressed that their supervisor thought that obtaining training on conducting human trafficking investigation would be useful, but they were uncertain if there would be a need or requirement to transfer their training from DeliverFund into their role post-training. For those who were required to attend training by a supervisor or agency, few knew what to expect from the training and did not mentally prepare to engage in training activities. Additionally, these trainees were less likely to know how the knowledge, skills, and technology presented during training would transfer to their jobs as compared to voluntary participants. Thus, the motivations and goals among those who were required to attend the training program were quite different from trainees who volunteered to attend training.

Technology engagement

Trainees with prior technology experience and those who enjoyed experimenting and using technology were more prepared for and engaged with the technology-oriented training of the CHTIOC. Trainees with technology experience more quickly understood the concepts related to the technology-oriented training portion of the course. These trainees also more quickly understood the value of the technology for their role. Several of the trainees who were more comfortable with technology described themselves as "techies," "data nerds," or "tech savvy." These individuals had higher levels of self-efficacy and seemed more open to the experience of learning new technologies during training.

In contrast, some participants expressed less interest in learning new technologies or struggled to keep up with ever changing technology landscape. Less technically engaged trainees often viewed technology as less crucial to their job. For example, one trainee noted that although technology was helpful, they could effectively perform their duties as a law enforcement officer without technology. Many attendees described how they would rely on non-technology-based techniques to complete investigations, such as interviewing and sting operations. Specifically,

one trainee noted that "technically I can do these investigations without the technology." Trainees who were less interested in technology were more inclined to become discouraged when learning new technology. These trainees were more likely to find the functional knowledge components of training more useful than the technical knowledge training component. While some could understand the value that the new technology could provide to others, they did not see the value that the technology could offer to themselves or their agency. As such, these trainees were less likely to transfer technical training than more technology-engaged attendees.

Lessons learned pre-training

When identifying which employees should participate in technology-oriented training for the purpose of reskilling, managers should consider who will initially participate in these training programs. It may be that eventually all employees must participate in the technology-oriented training program to learn new skills required for their role. However, managers can build momentum for the technology-oriented training program by carefully identifying who receives training first. This first cohort of trainees can set the expectation and tone for those employees who will follow.

When identifying who should attend technology-oriented training, managers should:

- Invite employees to volunteer for technology-oriented training because they see a need to improve or gain new skills and knowledge.

- Select employees with a high level of technology interest, an openness to learning about new technologies, and a sense of self-confidence when using technology.

Individuals who volunteered for training had higher levels of motivation during and post-training to gain new skills and were more likely to transfer their training to the workplace after the training course was completed. In contrast, employees who were mandated to attend training were less likely to transfer their training. Furthermore, employees with higher comfort levels with technology were more engaged with technical knowledge components of training, which allowed the trainee to capitalize on learning this knowledge during the training.

In the case when all employees need to complete technology-oriented training due to modernization of an agency or changes in organizational roles due to technology, managers should:

- Communicate the importance and value of the technology beyond the mandate.

- Identify employees with higher levels of technology interest and a collaborative mindset to participate in early training courses and to be a resource for others learning the technology.

Managers who are reskilling large portions of their workforce through technology-oriented training need to prepare employees for this change. Explaining the value of learning new skills and the opportunities associated with new and evolving roles in the organization can lead to higher levels of engagement during training. Carefully choosing the first cohort(s) of employees who are energized by participating technology-oriented training and reskilling can build momentum and provide useful peer support for other employees who are more hesitant about the changes occurring within the organization or within their role.

During Training

CHTIOC was an ILT course that relied upon a range of training methods for the technology-oriented portion of the course. The training program relied on several well-established training delivery methods that support the transfer of training, but there were opportunities to modify the training design to further improve training outcomes.

Training methods

The technology-oriented portion of DeliverFund's course instructs trainees on a variety of tools used to search, gather, store, and link intelligence and evidence used in human trafficking investigations. Instructors at DeliverFund employed a variety of active learning techniques during the ILT course. Some instructors used modelling in which the instructor would present a case study and demonstrate how to use the technology in the context of the case. During other technology-oriented training sessions, students watched the instructor use the technology and mirrored her use of the technology. The students also used the technology during classroom exercises to work through their own (current) investigations or example cases provided by instructors. Instructors answered questions during these practice sessions and provided feedback during this process as needed. Other instructors used short capture-the-flag exercises to engage trainees in applying new technologies and techniques to gather intelligence and evidence. The trainees used the technology throughout the week in progressively more challenging activities and were encouraged to work with fellow trainees as they investigated human trafficking cases using the technology taught during training. Other functional or contextual knowledge components of training also incorporated hands-on approaches, when possible. For example, trainees learned how to engage with victims of human trafficking as part of CHTIOC. A human trafficking survivor shared her experience as a victim and engaged in role-play with trainees to teach them how to apply the contextual knowledge taught during training.

Transfer of training is more likely to occur when the training experience is identical or closely resembles the trainee's tasks at work. The technical training provided at DeliverFund very closely resembled its application in law enforcement. The similarity in training and real-world application allows for near transfer. For example, we observed trainees using the technology and techniques they learned in class to build cases against traffickers in their respective jurisdictions. Thus, transferring concepts learned in the classroom was easier to apply to the trainee's current work environment than concepts without a direct, clear application.

While DeliverFund's training techniques were effective, instructors of CHTIOC identified some aspects of training for improvement. Although instructors provided feedback on many exercises, there were still times when trainees expressed, "I am not sure if I am doing this correctly or if there is a better way." Most trainees could complete the tasks, but some were unsure if they were conducting the tasks correctly, efficiently, and in line with best practices. Other trainees struggled with identifying whether or not they were making mistakes when using the technology. As such, DeliverFund could incorporate error management training to help trainees increase their self-efficacy with the new technology during and post-training.

Attendees also discussed a lack of reference materials during training. Providing training materials during training offers visual cues and instructions for trainees to refer to while experimenting and practicing the skills taught, increasing the trainees' self-efficacy with the new technology. Training materials are especially helpful for tasks that are sequential or tasks performed infrequently. Some officers attending training investigated many crimes in addition to human trafficking cases. For those who perform a range of investigations and are likely to use the technology less frequently, training materials are a useful resource when returning to a task that has not been performed in a while.

Community building
The mode of delivery for CHTIOC was face-to-face with most training courses conducted at DeliverFund's headquarters in Dallas, Texas. The in-person training provided a notable positive experience for attendees to engage in networking opportunities. The trainees spent their downtime, such as breaks and meals, sharing investigation experiences and various approaches to human trafficking cases. These conversations with other law enforcement officials provided insight for investigating human trafficking cases beyond the content learned in the course. For example, trainees would ask technology-oriented questions during this time to learn more about relevant social media sites for human trafficking investigations, best practices to subpoena technology sites, or techniques for sorting and sifting through data returned from social media sites. Other trainees would discuss relevant content, which may or may not be related to the technology-oriented portion of the training course, such as sharing best practices for investigative techniques or other challenges associated with investigating human trafficking cases. Moreover, the face-to-face mode allowed trainees to help each other easily during training by looking at each other's screens and assisting each other with various tasks as needed. The peer support offered during training enabled trainees to gain value above and beyond the content taught during the ILT sessions. Attendees identified networking as a strong motivation for attending training and as a positive outcome of training.

Lessons learned during training
When choosing a training course for technology-oriented training for the purpose of reskilling, the desired outcome is for the employee to gain new skills that can be transferred to the work environment. During training, many attendees may perceive the technical, functional, or contextual knowledge as easy-to-use or straightforward to apply to their work environment. However, upon returning to their workplace, the employees may struggle with applying and transferring the knowledge taught during training. When selecting or designing a training pro-

22

gram, certain course elements can be particularly useful to support the transfer of training. Ideal training programs will:

- Incorporate a range of training methods that allow participants to practice the new technology skills in a context similar to their current work practices.

- Provide training materials that can serve as a reference while learning complex, technical tasks and when trying to apply the newly developed technology-oriented skills within the workplace.

- Encourage networking opportunities to enable collaborative learning and support among attendees during and post training.

These elements provide support for trainees during and post-training and increase the likelihood of the employee's ability to transfer their training to the workplace. By having a range of training methods that are applicable to their work context, employees are more likely to experience scenarios more consistent with their day-to-day work. Ideally, during training, employees will experience successfully completing tasks with the technology as well as making mistakes and learning how to recover from those errors. Having reference material (e.g., electronic documents, physical training manuals, help functionality within software) provides support when learning the new technology to lower the learning curve. Furthermore, upon returning to the workplace, training materials can help employees recall different training activities and elements from training that can support employees' efforts to transfer their skills to the workplace.

Post-training

After training, the trainees' work environment highly affected their ability to transfer their training. The post-training work environment includes organizational support, peer support, technology support, and the opportunity to utilize training in the workplace.[22] We followed up with trainees who attended the CHTIOC four to eight weeks post-training to assess their level of training transfer. In line with current research on transfer of training, we found that most attendees only transferred small amounts of training to their agency. In this section, we discuss some factors that impacted the transfer of training from the CHTIOC course post-training.

Technology access

DeliverFund provides all attendees with licenses for the software taught during CHTIOC. However, these licenses are only temporary (i.e., three-month or twelve-month licenses) with the idea that agencies would include the expense for software licenses in their budgets post-training. Although some trainees used the software, many trainees shared that their agencies were unlikely to renew the software license once it expired. If the officer did not expect that the agency would pay for the license after it expired, the trainees had less motivation to use the technology and apply their knowledge related to the technology after training. Many of the trainees were excited to use the technology and lamented losing access. One person shared that the technology was "fun while it lasted."

Some trainees were not anticipating using the technology until well after training because they were not conducting human trafficking investigations yet. One participant was unable to use the technology until several weeks post-training due to other job requirements. When

---

22.   Khahan Na-nan, Kanokporn Chaiprasit, and Peerapong Pukkeeree, "Influences of Workplace Environment Factors on Employees' Training Transfer," *Industrial and Commercial Training* 49, no. 6 (January 1, 2017): 303–14, https://doi.org/10.1108/ICT-02-2017-0010.

attempting to use some of the technology learned during training, the individual struggled with remembering some of the basics of logging into the system and getting started. Not quite sure how to proceed, the individual chose not to use the technology post-training. The lag time between training and the trainee's use of technology contributed to skill loss and a failure to transfer training. Trainees need the opportunity to perform and use the technical knowledge learned during training quickly to retain and transfer their skills. Trainees without access to the necessary technology were able to apply some of the functional and contextual knowledge post-training; however, those unable to access technology post-training were unable to fully embrace all of the instruction taught during the training course. Supervisory support to provide access to the associated technology from training is critical to achieve the desired outcomes post-training when reskilling employees.

Applying skills post-training

The trainees who attended CHTIOC had varying amounts of time to use and apply the skills acquired during training at their respective agencies post-training. Integrating the skills and technology learned at training takes time since using new technology can change established workflows and processes. For example, officers who attended training use case management systems mandated by their department. Investigative technologies taught at CHTIOC often duplicates processes such as entering evidence or case notes into a system. Consequently, trainees wanting to use the new technology must create new workflows that incorporate the new technology and skills learned during training with existing work routines. Most trainees did not have designated time after training to work through these issues and adapt or improve inefficient work processes to work with new technology (i.e., lack of opportunity to perform). The agency sending an employee to technology-oriented training needs to provide time for employees to integrate their newly developed technical, functional, and contextual knowledge with existing work processes. By failing to provide time for training transfer, agencies sending employees to training will not reap the benefits of the employees' new skills. Moreover, when trainees were not able to review, practice, and apply the skills they learned shortly after training, the skills they learned started to decay. Skill retention deteriorates at a higher rate for trainees who do not have significant time or opportunities to apply skills.[23] Skill decay further diminishes the returns organizations reap from investments in employee training.

Lessons learned post-training

DeliverFund discovered that successful transfer of training was impeded when trainees did not have support when they returned to their organizations. To reap the benefits from technology-oriented training, managers must be prepared to enable the employees to transfer their training effectively. Skill decay occurs quickly if employees are not able to apply and use their newly developed skills in their day-to-day tasks. Specifically, managers should:

- Ensure the technology used during training is available and accessible immediately (or as soon as possible post-training).

- Consider the need for new work processes and procedures if the new technology alters the current activities and flow of work.

- Recognize that some tasks may take additional time for employees to complete as they transfer their newly developed skills to the workplace.

23.   J. Kevin Ford, Timothy T. Baldwin, and Joshua Prasad, "Transfer of Training: The Known and the Unknown," *Annual Review of Organizational Psychology and Organizational Behavior* 5, no. 1 (2018): 201–25, https://doi.org/10.1146/annurev-org-psych-032117-104443.

Although DeliverFund made the software trainees used during training available to trainees at no cost to the organization after training, the availability of the software was not enough to ensure transfer of training. After investing in the reskilling of employees by sending employees to technology-based training, managers must continue to invest in employees post-training. Sending employees to learn technology that is not currently available or will not be available for weeks or months within the organization will negate much of the value of training. Since skills can decay quickly if they are not used, managers should ensure that the employee is coming back to an environment where these new skills can be put to use. As employees adjust to new work processes and procedures with the technology, their task output may be slower as they apply their skills from training in their environment. Giving employees additional time to complete tasks as they adjust to the new technology and processes is critical in the weeks immediately following training.

Case Study B—Federal Cyber Reskilling Academy

To address a shortage of federal government employees with skills in the domain of cybersecurity, the Federal CIO Council launched the Federal Cyber Reskilling Academy. This training program addresses concerns expressed by chief information officers (CIOs) over several years regarding the skills gap related to cybersecurity. As the number of positions increased related to cybersecurity and the number of qualified applicants remained minimal, agencies struggled to find qualified individuals to fill roles in cybersecurity. Frequently, these agencies found a shortage of talent with the credentials and skills required for cybersecurity positions. When the agency identified applicants with a strong skill set, these individuals would often find employment at another agency or private organization before the federal agency could complete the hiring process. Since cybersecurity talent is in short supply in both the public and private sector, another challenge was the lower salary levels and limited benefits that could be provided by federal agencies as compared to the private sector. For federal agencies who were able to hire cybersecurity talent, many found some of the hires did not have the full range of skills needed by the agency.

Consequently, the Federal CIO Council, with support from the Office of Management and Budget (OMB), developed a training program to reskill current federal workers to address the cybersecurity skills gap. This program focused their efforts on reskilling current employees who are already committed to government work and the mission of vision of their respective agency. Therefore, rather than recruiting and hiring new talent, the goal of the Federal Cyber Reskilling Academy was to identify current federal employees who have a desire to learn a new skill and an aptitude for cybersecurity and offer training to reskill workers with the cybersecurity skills needed to fulfill cybersecurity jobs within government.

CIOs across federal agencies recognized it could be more cost-productive to train existing employee skills in cybersecurity as opposed to finding new hires from the private sector. Hiring new employees can be quite onerous given the security clearances, drug clearances, and other checks that may take six months to a year to bring someone onboard. Furthermore, there was hope that employees who participated in reskilling training would continue to work within the federal government. OMB realized that the right people who are interested in performing cybersecurity roles are likely already working in a federal agency; the challenge was to find these individuals and provide them appropriate training to address their skills gap.

OMB created the Federal Cyber Reskilling Academy as a pilot program in 2019 to reskill current federal employees and transition them into cybersecurity roles. In this pilot reskilling program, OMB sought to develop a training program that could be reproduced in other agencies, thereby providing a model for agencies to utilize when reskilling their respective workforces for domains beyond cybersecurity. While the primary goal of the pilot program was to build cyber-

security capability, a broader tactical goal was to find approaches for agencies to expand the population of employees engaged in training to support federal workforce needs. Two different cohorts completed the Federal Cyber Reskilling Academy in 2019, and each cohort had similarities and differences that offer useful lessons learned to other agencies seeking to reskill employees using technology-oriented training programs.

Pre-training

Over 2,000 individuals applied to participate in the two Federal Cyber Reskilling Academy training programs offered in 2019. Given the large amount of interest generated in the program, there was a need to select which employees would participate in the highly selective training program.

Training selection procedures

OMB allowed any federal employee with an interest in pursuing training in cybersecurity to apply for the program. Applicants were not limited to employees with prior technology or cybersecurity experience. Those developing this program realized that many federal agency employees are likely to have an aptitude or cognitive ability suitable for cybersecurity roles, but these individuals may lack the experience that would allow them to transition into this newer field. There was a recognition within the creators of this program that the requirements associated with hiring individuals for certain roles at a federal level were quite complex and lengthy, which was preventing the ability to hire the talent needed in cybersecurity. By recruiting participants for the Federal Cyber Reskilling Academy across federal agencies and backgrounds, the goal was to enable those with a strong motivation and cognitive ability for cybersecurity roles to have an opportunity to reskill, regardless of their current role.

OMB utilized a two-pronged, innovative approach for selecting trainees. As employees applied for the programs (i.e., approximately 1,500 applicants in the first cohort and 800 applicants for the second cohort), applicants were screened for two key qualities: attitude and aptitude. In terms of attitude, it was important to identify individuals who were motivated and willing to change their career trajectories by participating in this training program. Since many individuals applying for the position were not currently in technology-oriented roles, applicants had to be willing to spend the time and effort to gain new skills. They wanted to find applicants that had an excitement or enthusiasm about learning something new pivoting to a new career in cybersecurity within a federal agency.

The aptitude element considered if the applicant had cognitive skills that were consistent with or similar to the types of skills related to cybersecurity. These may not be skills or experiences that would be documented on a resume, per se, but these are qualities that would identify if a person were likely to have skills consistent with those working in cybersecurity roles.

Trainee attributes

Individuals who were selected to participate in the Federal Cyber Reskilling Academy had a strong motivation for participating. Applicants had a range of personal motivations and reasons to participate in this program. Federal Cyber Reskilling Academy participants were not required to have experience or a role in information technology. This program sought applicants with the ability to learn technical, functional, and contextual knowledge consistent with cybersecurity roles. The aptitude tests identified applicants with high levels of problem-solving and critical thinking skills. This program sought out applicants who would not rest until they found a solution when faced with a problem.

One OMB official discussed the range of reasons many federal employees applied to this program:

> *We had people at basically every stage of their career who were interested in reskilling for a lot of different reasons. . . .Maybe they had a physically demanding job, and they were reaching the point when they were not capable of doing it anymore. So, they were looking for something that would allow them to continue to deliver on that federal mission. . . .Then, we had people who were in careers that weren't seeing the challenge or the growth opportunities that they were looking for, and they wanted to make a transition into something that they knew would have tremendous growth potential and they had a lot of new things to learn. Then, we had people who had always had the interest. They were hobbyists at home but had never done the cybersecurity work professionally and wanted to find a way in through this training program. It's really across the spectrum. We were really surprised at the number of reasons that people came to a program like this to grow their own career. I think it would be limiting to say that there is any kind of one primary reason. It was really a constellation.*

Although the reasons for participating in a competitive and intense reskilling program varied among applicants, each of the participants was highly interested and motivated to learn a new technology-oriented skill and discipline. For many, they were willing to embrace new skills and knowledge to participate in this opportunity. The designers of the Federal Cyber Reskilling Academy were pleased when their broad-focused recruiting approach and focus on aptitude and attitude represented a diverse group of training participants. Trainees were from a range of agencies with varying degrees of experience. Participants ranged across the entire federal pay grade (i.e., GS1 – GS15).

Lessons learned pre-training

The Federal Cyber Reskilling Academy program recruited trainees across many federal agencies and roles. Unlike DeliverFund, which seeks to help law enforcement officers use new and existing technologies for a different purpose in their current role (i.e., human trafficking), the Federal Cyber Reskilling Academy sought to teach any federal employee with the right attitude and aptitude skills needed to work in the area of cybersecurity. The lessons learned from DeliverFund were applicable in the Federal Cyber Reskilling Academy context. Employees had to be highly motivated and demonstrate their interest by participating in a highly competitive process.

However, those who developed the Federal Cyber Reskilling Academy learned some additional lessons relevant to technology-oriented reskilling training programs. The selection process for the Federal Cyber Reskilling Academy proved to be very successful as those who entered the program performed well. Thus, managers should:

- Broaden participation by encouraging people from a range of roles to participate in technology-oriented training.

- Select participants based on potential ability to learn new skills as opposed to current or prior experience.

The Federal Cyber Reskilling Academy demonstrates that there does not necessarily need to be a bias to select only those with prior or current experience or job roles within information technology to participate in technology-oriented training. By inviting federal employees to apply, regardless of the current role within the organization, it expanded the number of people interested and willing to participate in the program. This program further demonstrates the interest from the

existing workforce in learning new skills to allow them to persist in their respective industry. By selecting employees based on their aptitude to learn cybersecurity skills through assessments that focus on things like pattern recognition or attention to detail, strong training candidates were not dismissed because of their current role within the organization.

During Training

For the first cohort of the Federal Cyber Reskilling Academy, OMB partnered with the SANS Institute to provide in-depth training for trainees to learn a range of cyber defense analysis skills. Much of the content was delivered virtually, which eliminated the need for employees to travel to participate in the program. The first cohort included thirty participants who completed a three-month training program and the Certified Information Systems Security Professional (CISSP) exam.

The second Federal Cyber Reskilling Academy cohort in 2019 implemented many strategies from the pilot with some adjustments. A different training provider, ComTech Telecommunications Corp, provided training to the second cohort. The second cohort had a larger in-person classroom component within the Washington, D.C. area. This required trainees to participate in the program away from their worksite during the training periods. Twenty individuals participated in this eight-week training program spanning several months.

Training methods

Because not all trainees had a background in information technology, there were specific aspects of coursework developed to help trainees learn functional knowledge related to information technology terminology and concepts prior to learning cybersecurity skills. For this content and the cybersecurity content, both cohorts had a combination of direct instruction, hands-on learning, and assessments for trainees to track their progress. Additional opportunities were available for many participants beyond training that included cyber competitions and mentoring opportunities. However, the modality for training varied for each cohort, with the first cohort receiving training virtually and the second cohort receiving training face-to-face in the Washington, D.C. area.

While there were advantages of both virtual and face-to-face training, there were many positives of having virtual training opportunities. Some individuals were unable to travel due to personal or professional reasons; therefore, the virtual aspect of training enabled a different set of individuals to apply and participate in the program. Participants were not limited to only those who live or could travel to the Washington, D.C. area and enabled participants across agencies and across the countries to participate.

Regardless of the modality of training, virtual or face-to-face, it was important that each cohort had dedicated time to focus on training. There was a recognition that if trainees were trying to attend to both training and tasks in their day-to-day work, it would limit the ability of the trainee to learn the new material. Therefore, there was a desire to ensure that employees had specific time focused on training and studying the skills learned during coursework.

Learning assessments

Learning was assessed differently for each cohort of the Federal Cyber Reskilling Academy. Trainees in the first cohort were required to take multiple certification exams to demonstrate their functional knowledge, including the CISSP (Certified Information Systems Security Professional) exam. Since many individuals participating in the Federal Cyber Reskilling Academy did not have an information technology or cybersecurity background, the CISSP credential provided a third-party verification through a well-recognized credential that the trainee had the necessary knowledge and skills for a position. By requiring all participants to obtain

the credential of a CISSP, it provided a clear signal to agencies that the trainee had obtained critical functional knowledge related to cybersecurity.

After discussing the certification requirements with participants in the first cohort and others interested in the program, the OMB changed the requirements for the second cohort of the Federal Cyber Reskilling Academy. The second cohort did not require certification exams, such as the CISSP, after the completion of certain course elements or at the conclusion of the training program. Instead, individuals completed pre-tests and post-tests throughout the training program. This provided a means to offer a lower-stakes approach to review the level of learning among participants. Through this series of pre-tests and post-tests, OMB realized that trainees were improving their technical, functional, and contextual skills as they completed each portion of the training program. Between this form of assessment and other hands-on, informal assessments throughout training, OMB was able to gauge the level of learning among participants in the cohort, even without a formal certification exam.

The first cohort's training provider noted that the pass rate and scores for the certification exams for Federal Cyber Reskilling Academy participants were among the highest they had seen across organizations. This affirmative feedback from the training provider offered a sense of validation that the approach used for this reskilling program had the potential to be effective. While some participants valued their CISSP and other certifications, others viewed this requirement as a constraint within the program.

Community building

When trainees are engaged in technology-oriented training for the purpose of reskilling, they experience high levels of change. The employee is learning new content and skills to perform a new role, often in a different department or agency. Knowing that others are experiencing similar changes can offer a sense of support.

During the first cohort of the Federal Cyber Reskilling Academy, trainees expressed uncertainty at many points in the program. This was the first group of people within the federal government that were selected from a range of backgrounds who were expected to learn an entirely new role and skillset (i.e., cybersecurity), pass a challenging certification exam (i.e., CISSP, among others), secure a new position in cybersecurity, and transfer these newly developed skills to a different role. OMB received feedback from trainees indicating that having a community of professionals in the same training program provided a vital support system the trainees relied on to be successful. One OMB official described the sentiment of trainees in this manner:

> *The thing that got them through was knowing that they had a community of other people going through the same challenges and having the same successes that they did that they could look back to. They could ask questions. They could say, "What should I do in this situation? Oh, could you help me with this," or even just, "I'm really stressed. Is anyone else feeling this way?" Over and over again that community came together and supported each other and helped each other through those challenging components of the program.*

OMB recognized that this cohort established its own community when participating in the Federal Cyber Reskilling Academy. It became evident that this sense of community was a critical component of any training effort, particularly for technology-oriented training programs, and contributed to the success of the trainees. After the first cohort, OMB acknowledged the

importance of community building and sought to continue this in other training programs, such as the Data Science Training program.

Lessons learned during training

OMB learned that the training should have flexible delivery modes to accommodate the varying needs of potential participants. When choosing among technology-oriented training programs for the purpose of reskilling, managers may have many solutions from which to choose. Instructor-led training, which may be in-person or virtual, or student-led training, which is often virtual, offer different strengths and weaknesses. In addition to the lessons learned from DeliverFund, when considering technology-oriented training programs, managers should also:

- Identify the most appropriate training program approach based on the needs of the participants.

- Provide dedicated time for employees to focus on training activities, with limited distractions from their day-to-day role.

- Consider encouraging employees to complete third-party certification exams or other credentials to demonstrate their knowledge and skills.

- Encourage employees to use networking opportunities during training to offer support when learning new and challenging material or transitioning to new roles within or across organizations.

The Federal Cyber Reskilling Academy successfully trained employees using in-person and virtual modes of instruction. Some participants preferred the dedicated, face-to-face interaction of training, while others appreciated the flexibility and fewer travel needs required for virtual learning. Nearly every technology-oriented training program can be adapted to be instructor-led or student led, virtual or in-person; however, the different needs of employees during training can affect which modalities are most appropriate to use. Specifying the modality of the training program may affect who volunteers to apply to participate in training; therefore, selecting the modality early in the process can affect the applicant pool. It is also important for managers who are sending employees to training to ensure there is dedicated time for employees to focus on training, regardless if the training is in-person or virtual. When employees feel the need to continue their day-to-day work assignments during training, it creates distractions and lessens their involvement and potential to learn.

Certain types of technology-oriented training have third-party credentials, such as certifications, to enable the employee to demonstrate their knowledge of a certain topic (e.g., cybersecurity, networking, programming languages). These credentials can be useful in some circumstances, such as when demonstrating that the employee is capable to move to a new role within the organization or is eligible for a promotion or raise. However, the credential may not be necessary depending on the goals of the employee. One lesson learned by OMB was to offer certification exams as an option, as opposed to a requirement, which was performed in the second cohort.

Both DeliverFund and the Federal Cyber Reskilling Academy noted the importance of networking and community building as part of training. Participants in both training programs found value in sharing their experiences with their peers. In the scenario in which employees are making dramatic shifts in their knowledge and role, creating a personal network through training programs can be particularly helpful. As employees navigate changing roles (or even careers), having a network of people experiencing similar changes can be a source of support.

Post-training

After completing the Federal Cyber Reskilling Academy, trainees had obtained a high level of technical, functional, and contextual knowledge related to cybersecurity. Since most of these individuals did not have prior experience or roles related to cybersecurity, they needed to find a new position to leverage their newly learned skills.
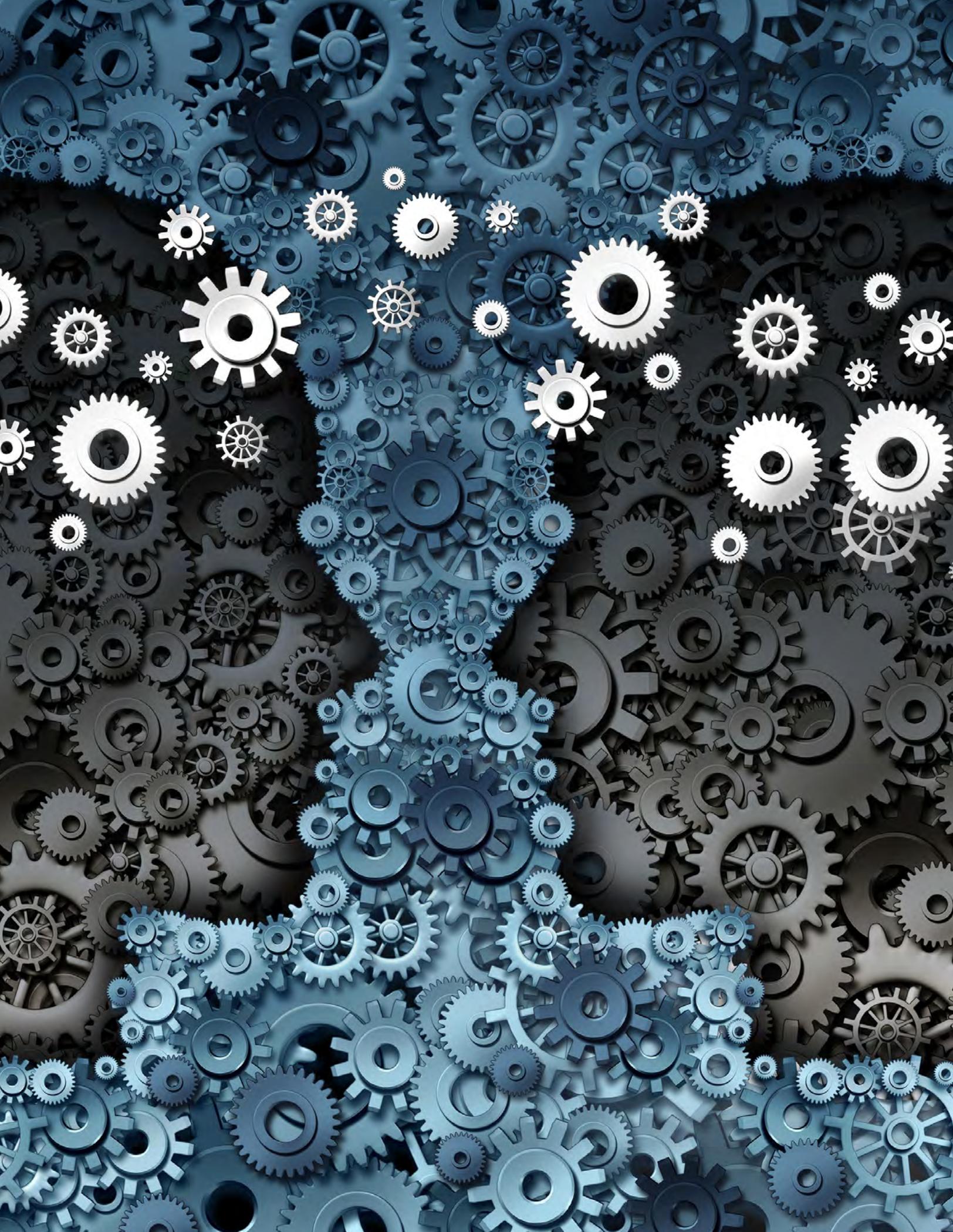
Credentialed without experience

Unfortunately, many trainees from the Federal Cyber Reskilling Academy were unable to secure positions in cybersecurity post-training. Although the trainees had obtained the necessary credentials (such as a CISSP certification) and skills, the trainees did not have the necessary length of experience required for many cybersecurity positions in federal agencies. Many positions require at least one year of specialized experience to qualify for paygrades consistent with cybersecurity positions or to qualify for the role itself. Since trainees in the Federal Cyber Reskilling Academy were from a range of paygrades with diverse backgrounds, many found that they had the necessary skills and credentials, but not the length of experience required for the position.

OMB has identified multiple approaches to address this problem for future reskilling training program participants. The first idea is to create rotational job opportunities to supplement a reskilling training program. After completing a three-month training program, the trainee would complete a series of assignments across agencies or divisions to allow an individual without the necessary one year of experience to gain related, specialized experience. Coupling the training and experience would allow the trainee to transition into new roles associated with the reskilled area (e.g., cybersecurity). A second opportunity is to rethink the hiring requirements for specific positions and allow individuals who have participated in training to gain experience on the job. There are obstacles to this approach, such as requirements that exist for jobs at certain pay grades. This idea requires rethinking the human resources and personnel management requirements for federal workers, particularly for positions in which there are critical talent shortages, such as cybersecurity. A third approach is to partner with agencies to develop positions that are suitable for graduates of the Federal Cyber Reskilling Academy. In March 2020, a series of jobs from specific federal agencies were created on the Open Opportunities site that fit the skills and experience of graduates from the Federal Cyber Reskilling Academy. The opportunities were open to all federal employees, but these positions were created for underemployed Federal Cyber Reskilling Academy trainees to gain the experience needed to move into cybersecurity roles. A range of creative solutions are required when reskilling employees for new roles in which the individual has knowledge and credentials, but not necessarily the experience level expected for the position.

Lessons learned post-training

OMB quickly learned that just providing training for employees was insufficient for trainees to move into new positions after a technology-oriented reskilling training program. It was also essential to provide opportunities for experience. The Federal Cyber Reskilling Academy is different from many technology-oriented training programs in that it was preparing individuals for new types of jobs and roles in the same or different organizations. This program sought to address a critical shortage of people with the necessary cybersecurity skills within the federal government. If a technology-oriented reskilling training program dramatically changes and improves the skill set of the employee, managers should be prepared to:

- Identify new roles or positions to allow employees to apply and use their newly developed skills.

- Create employee development plans to enable employees to transition to roles more fitting of the technology-oriented skills learned during training.

Because the Federal Cyber Reskilling Academy was a program targeting federal workers, some of the challenges associated with placing trainees in positions that leveraged their training are more specific to the federal government. When employees engage in training to gain skills that will allow them to change roles, managers need to be prepared to develop employee development plans to support the employee to make the needed transition. This may require identifying new tasks and roles for the employee to gain experience in certain areas (e.g., cybersecurity) to allow the employee to have the necessary credentials to transition into roles consistent with their interests and skills.

Recommendations

The following are recommendations to enable agencies to achieve effective technology-oriented training outcomes when reskilling employees. Each recommendation supports one of the three practices identified based on our case study:

- **Selecting Individuals for Technology-Oriented Training Readiness:** Choosing the right employees to engage in technology-oriented training programs for the purpose of reskilling.

- **Designing or Choosing Technology-Oriented Training Programs Appropriately:** Selecting or creating technology-oriented training programs with essential elements that are needed for successful outcomes.

- **Providing Agency Support for Employees Post-Training:** Sending employees for training is a critical step for reskilling; however, the agency must support the employee to use the skills learned post-training to benefit from the investment in the employee.

Selecting Individuals for Technology-Oriented Training

Sending the right employees for training is critical to achieve the desired outcomes. Employees who are unprepared or unwilling to embrace the skills taught during training will not effectively apply their skills within the government agency upon their return. It is crucial that trainees have adequate motivation to learn new skills and apply those skills after training.

1. Choose employees who exhibit technology engagement.

Employees attending technology-oriented training that demonstrate an interest in technology are more likely to be engaged during training, apply the lessons learned in their day-to-day work, and will find innovative uses for technology to transform the organization. Individuals who naturally find pleasure in learning, engaging, and innovating with technology are more likely to have positive outcomes in technology-oriented reskilling training programs, particularly because they are likely to have a higher level of openness to learning the technical knowledge components taught during training.

When selecting employees to participate in technology-oriented reskilling programs, managers can identify an individual's comfort level related to technology by asking the employee directly or considering how others perceive the employee's engagement with technology. For example, managers can use existing measurement scales to identify employees with high levels of spontaneity, flexible, creative, and playful interactions with technology.[24] Employees with higher ratings on these items are more likely to be engaged in the technical knowledge portions of the reskilling training program, which increases their potential to transfer and apply their knowledge toward evolving or new roles within the organization.

2. Identify employees that have an expressed need or motivation for technology-oriented training.

Employees who are interested in participating in reskilling training programs, particularly because the training program is aligned with the employees' goals, are more likely to result in applying the knowledge and skills gained during training within the workplace.[25] Employees who want to learn new technical and/or functional skills to achieve personal or professional goals will have higher levels of intrinsic, or internal motivation, to transfer their skills learned in technology-oriented training programs. As highly motivated employees learn technical and

24. Jane Webster and Joseph J. Martocchio, "Microcomputer Playfulness: Development of a Measure with Workplace Implications," *MIS Quarterly,* 16, no. 2 (1992): 201-226.

25. Irene Nikandrou, Vassiliki Brinia, and Elissavet Bereri, "Trainee Perceptions of Training Transfer: An Empirical Analysis," *Journal of European Industrial Training* 33, no. 3 (January 1, 2009): 255–70, https://doi.org/10.1108/03090590910950604.

functional knowledge during training, they are more likely to seek opportunities to contextualize their skills for their current and future roles. This effort to apply generic knowledge and skills to one's organization increases the potential for transfer of training. Employees attending technology-oriented training for reskilling because they perceive it is compulsory are more likely to struggle to identify the benefits of the technical and functional skills learned during training. As a result, they are more likely to find difficulty in understanding how to apply their new knowledge within their organizational context because the employee does not understand or value the need for the technology-oriented training within their role.

When presenting technology-oriented training opportunities to employees, managers should explain how the technology and skills learned during training will impact employees' current or future roles within the organization. Law enforcement officers participating in DeliverFund's training that could articulate the value of participating in technology-oriented training for reskilling were more likely to transfer their training. In addition to asking potential participants to identify the possible impact of training, managers should encourage attendees to document their goals related to learning the knowledge taught during training. As demonstrated in the DeliverFund case, employees who understand the value of technology-oriented training for reskilling prior to attending training are more likely to stay engaged during training and transfer their training post-training.

3. Prioritize aptitude over experience.
It is vital for government agencies to reskill employees for positions in new roles and disciplines as the workforce evolves in the twenty-first century. Identifying individuals with a cognitive ability suitable for the role also improves the potential for effective training outcomes. Rather than limiting technology-oriented training only to employees who have pre-existing technical knowledge, creating pathways for employees with an interest and cognitive ability for the training broadens participation in technology-oriented reskilling training programs. This is especially critical for technology-oriented reskilling programs since employees may not have been exposed to certain technologies or had opportunities to engage in certain technologies. It was clear that the Federal Cyber Reskilling Program found individuals with a high aptitude for cybersecurity in unexpected job roles that were not technology related. To screen for aptitude related to the reskilling program, organizations should utilize a screening protocol to identify those who have the aptitude to learn new technical, functional, and contextual skills.

It is important that managers widen the net when considering who should attend reskilling programs. The Federal Cyber Reskilling Academy had an influx of professionals who identified interest in the program. Although many did not have cyber experience, or even information technology experience, they had the aptitude to be successful in the Federal Cyber Reskilling academy. Thus, managers should identify aptitude through a means other than previous experience in similar work roles. Managers seeking to embrace these lessons learned should look beyond their "usual suspects" for technology-oriented training. Rather than only considering those in technology-oriented roles, encouraging individuals who are strongly motivated and have an interest in the training topic should be considered for participation in the technology-oriented training program.

www.businessofgovernment.org

Designing or Choosing Technology-Oriented Training Programs

Effective technology-oriented training programs for reskilling employees should include the following elements.

4. Enable opportunities for community building.

Training provides an opportunity to network and meet counterparts at similar or different agencies. Increasing a participant's social support network can help employees learn new techniques and share not only technical knowledge, but also functional and contextual knowledge, with others who support the efforts of the government agency. For in-person courses, DeliverFund provided frequent breaks and adequate time for lunch that allowed time for participants to interact with one another. Additionally, trainees worked in small teams during portions of training that allowed participants to engage with one another. For organizations providing online training, managers should ensure training programs have a social aspect embedded in the program to allow participants to interact in an online setting. For example, the training program could include a virtual meals or virtual happy hour. The training might also include break-out sessions to discuss course material with other trainees. Finally, for both online and face-to-face training, having a contact list or social networking site whereby participants can post questions or communicate with fellow attendees provides a central location for trainees to continue to interact and share insights into training, including best practices.

Having a support network during and after training can increase attendees' level of confidence with learning new technology skills. Some training programs may have more formal networking programs in which participants are purposefully paired or placed into teams to allow for collaborative learning. Other programs may encourage informal networking opportunities (i.e., during breaks or meals) for attendees to share their insights and knowledge with one another. Both formal and informal networking during and post training can be useful if attendees take advantage of these opportunities.

5. Provide reference resources during training that can be used post-training.

Training programs should provide accompanying course materials to trainees during training for reference while performing technology exercises. Providing training materials during training offers visual cues and instructions for trainees to refer to while experimenting and practicing the skills. Training materials also provide a reference for trainees using technology post-training.

When technical, functional, or contextual knowledge is not immediately used after training, the skills learned quickly decay. This is especially true for technical knowledge. Employees who are learning knowledge for the purpose of reskilling may not be able to immediately apply the knowledge from training. Training materials related to technical knowledge can provide step-by-step guidance related to the mechanics of using the related software. Functional knowledge training materials available post-training offers descriptions of key concepts, terminology, and best practices related to the knowledge gained during training. Contextual knowledge training materials may include examples of specific applications of technical and functional knowledge that is documented by the training provider and/or the trainee. Ideally, training programs should provide access to digital copies of training materials that are available pre-, during, and post-training. Training programs that include training videos, how-to guides, and other relevant course materials for trainees after the conclusion of the program allows trainees to access materials on-demand when needs arise.

6. Incorporate feedback using learning assessments appropriate for the training need.

Participants should use and apply the technical and functional knowledge taught during training in the context of their day-to-day tasks during training to develop contextual knowledge. Furthermore, when learning technical skills during training, trainees need to learn how to use the technology successfully as well as recover from errors to gain self-confidence with using the technology. Providing a range of feedback opportunities related to the trainee's development of technical, functional, and contextual knowledge allows trainees to activate recall and reflect on their learning. The choice of assessments within a technology-oriented training program can vary based on the needs of the agency and employee. Formal learning assessments, such as certification exams can provide third-party verification of the skills learned by trainees. However, other forms of learning assessments, such as short quizzes, case studies, and role-playing enable trainees to receive feedback as they develop knowledge required for reskilling.

The Federal Cyber Reskilling Academy relied on formal learning assessments, particularly when evaluating the technical and functional knowledge obtained by trainees during the program. These learning assessments included certification exams or pre-tests and post-tests to measure trainees' progress through the training program. DeliverFund relied heavily on more informal assessments, such as role-playing and example cases. Through role-play sessions, trainees immediately applied what they learned in the session and received real-time feedback from instructors as they developed technical, functional, and contextual knowledge. Learning assessments, whether formal or informal, allow trainees to apply what they are learning in a safe environment and obtain feedback as they improve their skills and knowledge during training.

Providing Agency Support for Employees Post-training

Government agencies making the investment to send employees to training must provide appropriate support to enable trainees to use and apply lessons learned from training in the organization.

7. Ensure technology availability for those attending training.

The technology taught during training should be available for employees to immediately use and apply upon their return to achieve more benefits from attending training. Sending employees to training too far in advance of when the technology will be made available or when the trainee can apply the skills, can limit the value of training programs.

Managers should consider the timing of reskilling efforts to ensure the training coincides with the acquisition of new technology within the organization. DeliverFund attendees were disappointed to have only short-term access to the technology taught during training. Many attendees returned from training to their organizations and their information technology department did not provide supporting hardware or supporting computing environment to support using technology in the workplace. Furthermore, some attendees reported that their law enforcement organization would not remove filters to allow investigators to access sites with explicit material where traffickers and potential victims were being advertised. The lack of access to technology prevented the trainees from using the technical knowledge they gained during training. Technology policies within the organization prevented employees from engaging their functional or technical knowledge obtained throughout the training program. Therefore, managers should ensure attendees have access to technology and ensure computing policies support technology use post-training.

8. Offer the needed time to apply insights from training.

It takes time after learning a new technology at training to adapt the lessons learned from training to the day-to-day work within the organization. The agency should ensure there is adequate time for employees to apply skills learned from training in their current or new roles within the organization. It is unrealistic for managers to expect to see the benefits of training in a short amount of time. In fact, productivity will likely decrease while employees endeavor to transfer training to their new environment. After transferring training knowledge, organizations will reap the benefits of reskilling employees.

When employees are reskilling to roles within or across organizations that are highly different from their current role, managers should consider their expectations to obtain the desired outcomes from training. Training participants in the Federal Cyber Reskilling Academy who are shifting from nontechnical roles to security-oriented roles within an organization need time to adapt. Not only are these employees learning how to adapt their knowledge learned during training to a new context, but also these individuals are learning the culture, practices, and processes within new roles and organizations. In contrast, many officers participating in DeliverFund's training were currently in roles that perform human trafficking investigations. Officers needed some time to transfer the knowledge gained from training to their real-world context. The time required for these officers to transfer their training knowledge to the workplace, however, was shorter than officers who were moving into new roles as human trafficking investigators post-training. The time needed to apply insights from training vary based on the level of change in the employee's role before and after training. Therefore, managers should discuss with trainees' timelines for transferring training based on the changes in skills and roles that occur post-training.

9. Protect against skill decay with designated time for skill refreshers.

When employees are unable to practice or apply their knowledge from training in the work environment, skills begin to decay.[26] Additionally, technical skills tend to lose relevance quickly and need to be updated continuously. As such, agencies should have a plan to provide employees with skill refreshers and enhancers on a regular basis for each of the type of knowledge gained during training: technical, functional, and contextual. These refreshers will reduce skill decay, encourage the transfer of training and protect the agency and employee training investment.

Organizations should provide designated time each week or month for employees to devote to training since transfer of training often requires exposure to the material more than once. Law enforcement officers who attended training at DeliverFund lamented the lack of time to refresh their skills after training. It is vital that managers keep in mind that training does not stop at training. Instead, training is a continuous activity that requires regular updates. Those who attended training in our case studies often had other demands on their time when returned to work such that they had to relearn the skills from training since they were away from the material for such a long period of time. Managers should encourage and reward those who continue to update their knowledge after training by having designated days or times devoted to refreshing their skills.

---

26. Ford, Baldwin, and Prasad, "Transfer of Training."

10. Couple training with related experience requirements.

Technology-oriented reskilling training is not sufficient for workers to transition into new roles post-training. Certain roles may require applicants to demonstrate both skills and experience. As experienced by many participants in the Federal Cyber Reskilling Academy, trainees were ready to apply their newly learned cybersecurity skills, but had no ability to transition into a new cybersecurity role within the federal government.

Many government agencies and managers may need to consider altering the experience requirements for positions. For those with demonstrated competence through the completion of training programs or credentialing exams, employees could participate in experiential programs that provide the necessary experience for higher level roles within the organization. Examples of experiential programs include rotational assignments, apprenticeship programs, and internship programs. Rotational assignments to help employees gain experience and apply their knowledge from training. Employees hold short-term assignments (one to three months) in a range of roles within an organization after training. Rotational assignments enable trainees to deepen their contextual knowledge as they apply the technical and functional knowledge from training to a range of roles or areas with an organization. Another experiential opportunity to help employees gain experience include apprenticeship programs.

Apprenticeship programs allow current employees to work with mentors and receive experience to complement the skills learned in training. Coupling training with day-to-day work is an example of on-the-job training, which enables the employee to gain knowledge from training while also obtaining the necessary experience for new roles. Finally, internship programs offer another alternative to help trainees gain experience post-training. Although internships are typically used for new entrants into the workforce, organizations can adapt internship programs to fit employees with significant prior work experience by showing them areas for skill transfer. The future of work in agencies will provide multiple opportunities for their workforce to become lifelong learners.

Conclusion

As government agencies increasingly rely on technology to provide more services to citizens with fewer resources, technology-oriented training becomes particularly important and relevant. The rapid pace of technological changes requires agencies to have a skilled workforce that can use the technology required of their position and learn new skills for positions and tasks that have yet to be created. There is a myriad of ways organizations can offer technology-oriented training to improve or shift their employees' technology skills. Agencies seeking to increase their employees' technology-oriented skill sets can face challenges as they seek to achieve effective training outcomes. By carefully considering the choice of employees who are sent to training, ensuring appropriately designed training programs are offered, and providing post-training opportunities to apply the skills learned during training, organizations can achieve more positive outcomes from technology-oriented training when seeking to reskill their workforce.

APPENDIX—METHODOLOGY

This report documents two different organizations that engage technology-oriented training programs to address the technology skills gap by reskilling the workforce. The first case study displays a training program offered by a nonprofit, DeliverFund. This organization addresses the digital and technology skills gap within the law enforcement community by providing training and reskilling to law enforcement professionals investigating human trafficking. Certain crimes (including human trafficking) involve technology and require law enforcement to possess technology-oriented skills to investigate, address, and prosecute perpetrators of human trafficking. DeliverFund offers a Counter Human Trafficking Intelligence Operations Course (CHTIOC) to train local, state, and federal law enforcement officers on practices to counter domestic sex trafficking utilizing modern technology. This course includes technical training wherein officers learn to use new and existing technologies to identify trafficking victims, procure evidence, and arrest traffickers. The training also teaches modern investigative techniques (functional knowledge) and technology-driven investigation tactics specific to human trafficking cases (contextual knowledge). We observed three multiday training courses attended by law enforcement officers in 2019. When possible, we conducted interviews with attendees approximately one week prior to training, spoke with participants during training, and interviewed most participants eight to twelve weeks post-training. DeliverFund provided access to anonymous post-course evaluations, shared their training materials, and allowed us to interview their training staff.

The second case study is the Federal Cyber Reskilling Academy offered by the Office of Management and Budget (OMB). OMB seeks to reduce the critical technology skills gap related to cybersecurity knowledge within the federal government. This program exists to reskill current government employees to fill cybersecurity jobs. The Federal Cyber Reskilling Academy provides training on specific tools related to cybersecurity (technical knowledge), general information technology and information technology security concepts consistent with the Certified Information Systems Security Professional designation (functional knowledge) and specific knowledge and skills related to securing data in the context of the federal government (contextual knowledge). We interviewed federal employees from the OMB who were involved in the development of the Federal Cyber Reskilling Academy, which began in 2019. We supplemented our understanding of this program with news articles and reports that describe the program, the participants, and its impact.

Both case studies are examples of ILT programs in which trainees participated in a certain number of days or weeks of dedicated training sessions led by an instructor. In addition, both organizations utilize various approaches to reskill a large workforce with the technology-oriented skills needed to conduct their jobs effectively and/or fulfill new roles in their agency. We provide recommendations to government agencies regarding effective technology-oriented training based on the insights from these case studies and the transfer of training literature. The report identifies recommendations to improve the effectiveness of technology-oriented training in three key areas: individual readiness for training, training design, and agency support for training.

ABOUT THE AUTHORS

Stacie Petter is the Ben H. Williams professor of information systems and business analytics in the Hankamer School of Business at Baylor University. Her research examines how information systems and technology bring value and benefits, as well as harm or negative consequences, to organization and individuals. In particular, she is interested in the use and evaluation of information systems, gamification and online gaming, and software project management.

Her work appears in outlets including *MIS Quarterly, Journal of Management Information Systems, Journal of the Association for Information Systems, European Journal of Information Systems,* among others. Her research has been funded by the National Science Foundation. She has served as editor-in-chief of *The DATA BASE for Advances in Information Systems,* associate editor for *MIS Quarterly and Information Systems Journal,* and she is currently a senior editor for *AIS Transactions on Replication Research* and *AIS Transactions on Human-Computer Interaction* and a member of the editorial review board for the *Journal of the Association for Information Systems*.

STACIE PETTER, PHD

Laurie Giddens is an assistant professor in the Information Technology and Decisions Sciences Department in the G. Brint Ryan College of Business at the University of North Texas. Prior to earning her PhD, she worked for 10 years in the nonprofit sector in various information technology, management, and consulting roles. Her research explores how individuals and organizations utilize information systems to improve the well-being of the workforce and society. Specifically, her research investigates how technology impacts social inclusion, anti-human trafficking efforts, sustainable consumption, and a sustainable workforce. Her research is published in *Information Systems Journal, Computers and Security, The Journal of the Southern Association for Information Systems,* and *Cogent Business and Management* and has been presented at numerous international information systems conferences. Additionally, her research has been funded by The National Science Foundation.

LAURIE GIDDENS, PHD

KEY CONTACT INFORMATION

To contact the authors:

Stacie Petter, PhD

Ben H. Williams Professor of Information Systems
and Business Analytics
Hankamer School of Business
Baylor University
One Bear Place #98005
Waco, TX 76798-8004

(254) 710-4239
stacie_petter@baylor.edu
https://sites.baylor.edu/stacie_petter/

Laurie Giddens, PhD

Assistant Professor
Information Technology and Decision Sciences Dept.
G. Brint Ryan College of Business
University of North Texas
1155 Union Circle, #305249
Denton, TX 76203-5017

(940) 565-2848
Laurie.Giddens@unt.edu

RECENT REPORTS FROM THE IBM CENTER FOR THE BUSINESS OF GOVERNMENT

For a full listing of our publications, visit www.businessofgovernment.org

Agility

Adopting Agile in State and Local Governments by Sukumar Ganapati

The Road to Agile GOVERNMENT: Driving Change to Achieve Success by G. Edward DeSeve

Transforming How Government Operates: Four Methods of Change by Andrew B. Whitford

Agile Problem Solving in Government: A Case Study of The Opportunity Project by Joel Gurin, Katarina Rebello

Applying Design Thinking To Public Service Delivery by Jeanne Liedtka, Randall Salzman

Digital

Artificial Intelligence in the Public Sector: A Maturity Model by Kevin C. Desouza

Aligning Open Data, Open Source, and Hybrid Cloud Adoption in Government by Matt Rumsey, Joel Gurin

Innovation and Emerging Technologies in Government: Keys to Success by Dr. Alan R. Shark

Risk Management in the AI Era: Navigating the Opportunities and Challenges of AI Tools in the Public Sector by Justin B. Bullock, Matthew M. Young

Financial Management for The Future: How Government Can Evolve to Meet the Demands of a Digital World by Angela Carrington, Ira Gebler

Effectiveness

Managing The Next Crisis: Twelve Principles For Dealing With Viral Uncertainy by Katherine Barrett and Richard Greene, Donald F. Kettl

Other Transactions Authorities: After 60 Years, Hitting Their Stride or Hitting The Wall? by Stan Soloway, Jason Knudson, Vincent Wroble

Guidance on Regulatory Guidance: What the Government Needs to Know and Do to Engage the Public by Susan Webb Yackee

Federal Grants Management: Improving Outcomes by Shelley H. Metzenbaum

Government Reform: Lessons from the Past for Actions in the Future by Dan Chenok, John Kamensky

COVID-19 and its Impact: Seven Essays on Reframing Government Management and Operations by Richard C. Feiock, Gurdeep Gill, Laura Goddeeris, Zachary S. Huitink, Robert Handfield, Dr. Rodney Scott, Sherri Greenberg, Eleanor Merton, Maya McKenzie, Tad McGalliard

Insight

Using Technology and Analytics to Enhance Stakeholder Engagement in Environmental Decision-Making by Jenna Yeager

Making Federal Agencies Evidence-Based: The Key Role of Learning Agendas by Dr. Kathryn E. Newcomer, Karol Olejniczak, Nick Hart

Improving Outcomes in Government through Data and Intelligent Automation by The IBM Center for The Business of Government, Partnership for Public Service

Silo Busting: The Challenges and Successes of Intergovernmental Data Sharing by Jane Wiseman

Integrating Big Data and Thick Data to Transform Public Services Delivery by Yuen Yuen Ang

A Practitioner's Framework for Measuring Results: Using "C-Stat" at the Colorado Department of Human Services by Melissa Wavelet

People

Sustaining a Distant Vision: NASA, Mars, and Relay Leadership by JW. Henry Lambright

Distance Work Arrangements: The Workplace of the Future Is Now by John Kamensky, Emily G. Craig, Michaela Drust, Dr. Sheri I. Fields, Lawrence Tobin

Preparing the Next Generation of Federal Leaders: Agency-Based Leadership Development Programs by Gordon Abner, Jenny Knowles Morrison, James Perry, Bill Valdez

Risk

The Rise of the Sustainable Enterprise by Wayne S. Balta, Jacob Dencik, Daniel C. Esty, Scott Fulton

Managing Cybersecurity Risk in Government by Anupam Kumar, James Haddow, Rajni Goel

About the IBM Center for The Business of Government

Through research stipends and events, the IBM Center for The Business of Government stimulates research and facilitates discussion of new approaches to improving the effectiveness of government at the federal, state, local, and international levels.

About IBM Global Business Services

With consultants and professional staff in more than 160 countries globally, IBM Global Business Services is the world's largest consulting services organization. IBM Global Business Services provides clients with business process and industry expertise, a deep understanding of technology solutions that address specific industry issues, and the ability to design, build, and run those solutions in a way that delivers bottom-line value. To learn more visit ibm.com.

For more information:
Daniel J. Chenok
Executive Director
IBM Center for The Business of Government

600 14th Street NW
Second Floor
Washington, D.C. 20005
(202) 551-9342

website: www.businessofgovernment.org
e-mail: businessofgovernment@us.ibm.com

Stay connected with the IBM Center on:

or, send us your name and e-mail to receive our newsletters.

IBM Center for
The Business of Government