10

Preparing for the Future of Work and the Development of Expertise

Jason Moats

Throughout this volume, expertise has largely been defined for the world as it is today. We can see that the central themes of expertise are plentiful and varied, but indicate that it is a process resulting in a display of mastery of the highest skills, knowledge, and abilities of a given domain. In his book *Outliers: The Story of Success*, Malcolm Gladwell (2008) tackles the phenomenon of "men and women who do things that are out of the ordinary" (p. 17) by telling stories of people far exceeding normal levels of performance. Gladwell uses the stories to explore the science of how experts are developed. He does this through the work of Ericsson (2008), Levitin (2006), and M. J. Howe (1999). These scholars have laid the foundation to our understanding of how expertise is developed. Collectively, their work tells us that an individual becomes an expert by engaging in an extraordinary amount of targeted efforts resulting in specific experiences. It is a *process* that requires thousands of hours of acquired experience and *deliberate practice*.

J. Moats (✉)
Texas A&M Engineering Extension Service, College Station, TX, USA
e-mail: jason.moats@teex.tamu.edu

M.-L. Germain, R. S. Grenier (eds.), *Expertise at Work*,
https://doi.org/10.1007/978-3-030-64371-3_10

As this volume concludes and our minds turn to what's next, it is imperative that the discussion moves to how expertise might be developed for organizations in the future. The modern competitive landscape is too volatile to allow organizations to remain sustainable by continuing to consume thousands of hours of focused effort to develop expertise beyond a pedestrian level. It calls for exploring ways in which expertise can be rapidly developed without compromising the requisite level of mastery. Additionally, there is a need for more competent and viable ways to equip humans to perform well in a digitally transformed workplace; a workplace that will most certainly include symbiotic relationships with machines to establish and sustain an organization's competitive advantage.

This chapter begins by briefly contemplating what serves as a catalyst rapid for expertise development in organizations. From there, we look at the need for workplaces to be both adaptable and agile if they are to effectively respond to the need for rapid expertise development. Next, some of the anticipated challenges facing workplaces of the future are presented. Then, to better envision what rapid expertise development might look like in an agile and adaptive organization a case of a national manufacturing facility is present. Finally, the chapter concludes with strategies and techniques that could (and should) be employed to lay the foundation for developing expertise in organizations including implementing adaptive learning, upskilling and re-skilling, and ensuring technology adoption.

Catalyst for Rapid Expertise Development

The amount of time and effort needed to develop individuals' expertise provides a daunting conundrum for workers and organizations alike**,** especially as we consider the amount of change expected to organizations in the near future. In particular, unexpected, world-wide events and the influence of innovation will require quick responses and create changes in organizations as they identify new needs for survival or for attaining a competitive advantage in the marketplace. For instance, as organizations sought to continue working in the face of the COVID-19 pandemic, employees were in great need of timely re-skilling to collaborate in the now virtual or hybrid settings. Employees were often required to work

from home or isolated in an office, sometimes in different time zones, and even different countries. Sasangohar, Moats, Mehta, & Peres (2020) provide an example of the impacts created by COVID-19 for disaster managers. Disaster managers are, by definition, required to rapidly and efficiently adapt to the unique demands of each disaster in high stress complex environments. Disaster managers typically maintain close contact to establish and sustain shared mental models for rapid decision making—a key aspect of their work. However, social distancing requirements made the processes these individuals used in previous disasters inadequate. New processes were required to provide the same levels of performance. Unforunately, developing theses needed models to enable better decision making is "time consuming, inefficient, perilous, and in some cases, not possible" (Sasangohar, et al., 2020, p. 1064). Organizations responsible for disaster management quickly realized that there was a need for a new mindset created by the new ecosystem in which their work occurred.

Another catalyst driving expertise development is the desire to push the boundaries defined by the limitations of human performance through gains in technology and innovation. Technologists are often inspired by opportunities to improve and enhance human health and well-being (Simone, Zenobia, & Richard, 2018) as well as the performance of the individual, team, and organization. For example, within the field of healthcare, invasive abdominal surgical procedures often resulted in prolonged recovery times and greater risks of complications, including infection. However, technologists, specifically roboticists, created the DaVinci robot, which enables surgeons to operate through small holes in the skin with high levels of dexterity and near perfect accuracy. Consequently, patients have a reduced risk of surgical complications, less pain, and they heal faster (Kwartowitz, Herrell, & Galloway, 2007). As organizations continue to push the envelope of human performance, workers are constantly being exposed to new tools that are touted to improve performance at a seemingly frenetic pace. However, this rapid and relentless pace demands correlating changes in the knowledge, skills, and abilities of the workforce. As technology continues to emerge in the ever-transforming workplace it will require workers to develop and implement

new knowledge and skills (i.e., expertise) at a higher frequency than ever before; and in some cases even before mastery is attained.

As large-scale, unprecedented events disrupt organizational or employment practices or technology such as artificial intelligence (AI) becomes more prevalent in the workplace and unknown human augmentation technologies continue to emerge, workers and organizations must be prepared for rapid re-skilling to stay competitive. Unfortunately, the unyielding pace of change presents an immediate challenge to developing expertise. This is because of the lengthy amount of time and dedication it takes to develop expertise in tension with rapidly changing conditions. In addition, the high operational tempo of top organizations provides little time for the development of expertise while on the job, requiring workers to often cross over the work-life boundaries. Ultimately, this crossing of boundaries often leads some workers to leave the organization for greener pastures. Therefore, the need for rapidly developing expertise to adequately prepare the workforce to perform beyond a pedestrian level of operational proficiency while keeping pace with the evolving workplace is critical.

Organizational Response for Rapid Expertise Development

Organizations are in the midst of a digital transformation. Kaplan and Haenlein (2019) propose that organizations and societies across the globe continue to engage in "novel use[s] of technology to solve traditional problems" (p. 679). For example, work is being transformed into *digital work,* a reconfiguration of practices and operations that adapt to emerging technology being employed into the workplace (Dittes, Richter, Richter, & Smolnik, 2019). To be competitive, the workplaces of the future will need to be adaptable and agile (Gerwitz, 2016; Holbeche, 2019) in response to the catalysts described previously. This is because the consequences of maintaining the status quo are dire: either the organization is replaced or the workers are. Processes are needed that enable workers to seize strategic opportunities as they arise, mitigate threats to their

learning, and ensure that changes are sustainable over the longer term. This means the standard of 10,000 hours of deliberate practice (Ericsson, Krampe, & Tesch-Römer, 1993) to build a master level of expertise must be challenged in a way that doesn't compromise rigor. The workplace will need to be adaptable, with the capacity to effectively implement change, and also agile. This will require organizations to go beyond being adaptable to gaining a competitive advantage by strategically capturing opportunities, mitigating threats, and making *sustainable* changes (Holbeche, 2019, p. 669).

Let's return for a moment to the example of a disaster management organization during the COVID-19 pandemic. An *adaptive* organization meets the prescribed objective. In this case, the organization created a safe, socially distanced workplace by increasing the distance between work centers. Unfortunately, that adaptation required more space for the same number of employees resulting in increased long-term costs, challenges to the interactions of working teams, and even a change to operations. However, by also being an *agile* organization, they can go beyond the prescriptive and focus on a performance-based objective that adapts to the changing environment by creating a safe, social distanced workplace with solutions that do not significantly increase costs or team interaction. For example, the organization not only erected safe screens that reconfigured the space, but also provided an aesthetically pleasing environment that allowed teams to interact with few limitations. Most importantly, the organization strove to communicate the rationale behind the changes and employed the workforce in a collaborative relationship that ensured cooperation. Similarly, the workforce embraced the changes and looked for and communicated innovative implementation of the changes back to the organization. The workers adopted attitudes that supported the changes, thus aiding in the efficient and rapid development of new expertise.

Adaptive organizations are those organizations able to effectively and efficiently adjust to the changes in their ecosystem (Fulmer, 2000; Takahashi, 1987). These organizations are intentional in building their adaptiveness. They focus on strategic planning processes that build corporate culture and an enhanced sense of community within the organization. Adaptive organizations build community by placing high emphasis

on the individuals' personal satisfaction and happiness, integrity, and a clear understanding of the meaningful contribution of their work (Tanklevska, Kyrylov, & Zaitseva, 2017).

Agile organizations are those organizations able to proactively and rapidly transform to seize opportunities, mitigate potential threats to create a competitive edge (Holbeche, 2019). Agile organizations are adaptive by nature. These organizations anticipate changes in the ecosystem by watching for and reacting responsibly to trends, anomalies, changes in the behavior of customers and competitors. The reaction time of agile organizations is faster than the competition because there is a willingness and ability to implement changes, even when it is not a sure thing (Holbeche, 2019). Agile organizations are focused on innovation and finding the "right balance between standardizing operations and pursuing (sometimes risky) *sic.* innovations" (Rigby, Elk, & Berez, 2020, p. 67). Agile organizations can be interdisciplinary meaning they are created when two or more disciplines blur their boundaries, join forces, and interweave their knowledge to create a product or service. However, agile organizations are best when they are transdisciplinary. Transdisciplinary organizations are interdisciplinary, but the organizations transcend the traditional discipline structure resulting in a wholly new organizational structure absent of the pretense of boundaries (Choi & Pak, 2006). Transdisciplinarity enables and empowers organizations to react swiftly and intentionally without the encumbrances of alternate identities or loyalties that can undermine the change processes (i.e., transformation) (Gromb & Martimort, 2007). Ultimately, transdisciplinary organizations are the ultimate agile organizations because they are wholly focused on the mission and equipped with the *right* expertise yet lack the extraneous baggage of being mired in the *home discipline*.

Challenges to the Future of Work

One significant challenge is the enhanced risk of failure that is present when an organization does not prepare their workforce for success in the transformed environment (Moore, 2018; SHRM, 2016). The workforce is the foundation of an organization's growth and success (Grenier &

Germain, 2014) and training and development are foundational to creating and maintaining that workforce. Despite these facts, a survey of HR professionals conducted by the Society for Human Resource Management SHRM (2016) revealed that 31% of responding organizations did not have a training budget in the 12 months prior to the study. Moreover, an additional 11% reported their training budgets decreased in the same 12 months. Not having a skilled workforce is clearly a concern for CEOs around the globe. A 2019 global survey of 3200 CEOs revealed that nearly 80% are concerned about the availability (or lack thereof) of workers with key skills for their organizations (Stubbings, Sethi, & Brown, 2019). Additionally, more than half of these respondents understand the derogatory impact that a lack of workers with the *right* skills has on their organization's growth. It is most perplexing that despite the recognized impact on organizational growth, only 46% of these CEOs have made re-skilling/upskilling a top priority for their organization. Upskilling is enhancing and refining current skills to keep one in the same job. Re-skilling is developing new skills and abilities for a different job (Gratton, 2019).

A second challenge occurs as new technology is integrated into the workplace resulting in some employees fearing that they will lose their jobs (Peters, 2017; Pol & Reveley, 2017). As the transformation of the workplace unfolds, many observe that the technology provides a clear advantage for the organization by providing greater accuracy and improved consistency in operational performance. As machines and automation are utilized to do more in the transforming workplace, the need for employees with certain skills decreases, as organizational efficiency and profitability increase (Pol & Reveley, 2017). As employees observe the changing nature of the work required, they may deduce that the skills they possess are no longer relevant to their organization (Peters, 2017; Pol & Reveley, 2017) and that they need to change if they are to remain in the workforce (Schwab, 2016).

Inevitably, some of the workforce will be among the *technologically unemployed* (Frey & Osborne, 2016; McCarthy, 2014; Pol & Reveley, 2017). Technological unemployment is not a new concept. The term dates back to the early nineteenth century and refers to when the increase in the number of jobs assumed by technology in a given time is more

than the number of jobs taken by humans in the same time (Pol & Reveley, 2017). The challenge for the organization is to best determine who needs re-skilling versus upskilling and how to do it without disrupting the competitive advantage. In other words, the organization must not only transform the *workplace*—but also the *workforce*—by determining the expertise needed, how to develop it, maintain, and sustain it. This is important since, although 18% of the CEOs feel they can hire the expertise needed from the outside, recruiting costs about six to nine months of an employee's salary and the organization has little productivity impact to show for the effort and expense (Tah, 2018).

A third challenge, labeled by one scholar as "the Luddite strategy" (Peters, 2017), occurs when employees reject using the technology. Korn Ferry's Global Technology President, Werner Penk**,** describes the organizational impact of this phenomenon**:** "No value will be created from technology unless people embrace it" (Moore, 2018, p. 9) which is a challenge when employees harbor resentment toward the use of technology for one reason or another (Moats, 2013). For example, many workers struggle to adapt to new, innovative tools because they struggle to understand the usefulness of the technology when they compare it to what is already in place. Or, some employees may feel the technology is too intrusive, too demanding, or even unethical (Schwab, 2016).

A final challenge will be how organizations adapt to the needs of employees as the transformation unfolds. For example, some workers will be very comfortable in a less structured environment, where work-life boundaries are blurred or removed. On the other hand, other workers will need or want the structure provided by an office and the nine to five work day (Dittes et al., 2019). Failing to adapt to changing workforce needs could result in the inability to recruit and/or retain the expertise needed to maintain a competitive advantage (Schwab, 2015).

Envisioning the Future: The Workplace Transformed

Workplaces of the future will reveal a very different landscape compared to the ones we work in today. De Bruyne and Gerritse (2018) tap into the future forum study to provide insights into what might be expected in future workplaces. They note that workplaces will be highly digitized, collaborative, and agile. Many futurists describe empowering and encouraging environments where cross-functional teams are enabled to be adaptable and autonomous (De Bruyne & Gerritse, 2018; Guinan, Parise, & Langowitz, 2019); places where access to knowledge, the ability to store data, and the power to process that data will be unprecedented (Schwab, 2015).

Workers in these transformed workplaces will be expected to be more innovative, creative, and entrepreneurial than in any previous time, as they work within reconceptualized structures that see the current eight–five workday replaced by a focus "… on the efficient completion of work" (Dittes et al., 2019, p. 650). This new structure will enhance the ability of teams to collaborate, even when they are miles—or even continents apart. This also means the potential for the boundaries of work and personal times to become increasingly blurred (De Bruyne & Gerritse, 2018; Dittes et al., 2019; Kaplan & Haenlein, 2019).

The tools that workers will use in the future will be different as well. Guinan et al. (2019) explains that the continued development of digital applications provides a powerful energy to the ongoing digital transformation. The speed of the expansion of the Internet of Things (IoT); the widespread implementation of neural interfaces to join human and machine; and integration of artificial intelligence will be used to make the organization's performance faster, more efficient, and to improve accuracy. The use of collaborative robots, powered exoskeletons, and other to-be-determined technologies will augment human capacity and improve workers' individual performance beyond the current limitations of human capability. Furthermore, the future will likely see machines learning from humans, who are learning from machines to create a symbiotic relationship. What follows is an imaginative case study. It sees how

the workplace of the future responds in the face of catalysts to expertise development in an adaptive and agile environment and provides a means of considering the anticipated challenges facing the transformed workplace of the future, along with strategies to mitigate their effects.

Expertise on a Manufacturing Floor

Imagine for a moment that you work in a durable goods (e.g., air conditioner, home appliance, etc.) manufacturing facility. You applied for the job four years ago after graduating from college with a bachelors in history. The opportunity appealed to you because the organization was known to be a proactive corporate citizen in their communities and had an outstanding reputation as a company that cares about their employees and families. You had no manufacturing experience, so in addition to the attractive starting salary and benefits package, you were drawn to a career development path that enabled advancement in a low-tech industry using high-tech tools that would transfer to other parts of the organization. Once hired, you took part in a one-day classroom-based course addressing administrative issues and basic safety and from there you were placed in an onboarding program to prepare you for working on the manufacturing floor. From that point on, you advanced through the organization's development program with its blend of coaching, mentoring, counseling, and training. Although over the last four years you have been constantly learning, you have not been in a classroom training session since your first day with the company. Today you are considered a master technician, performing with the highest level of expertise within the organization.

Currently, your position on the line is responsible for creating a housing component by fabricating a large box from six 750-pound steel panels. More specifically, you work as a manufacturing technician responsible for overseeing the manufacturing processes, including maintaining the fabrication machines (i.e., robots) and ensuring the quality of the assembled components. Carrying out this job means that you will interact with the artificial intelligence system, use powered human augmentation technologies (e.g., augmented reality, powered and non-powered exoskeletons

etc.) and collaborative robots, as well as many other technologies. Training and professional development happen in many forms, but always on the job. More importantly, the training you receive is often created by an AI training module that is observing your performance, identifying your strengths and deficiencies, and then creating and scheduling learning opportunities through an array of media that are tailored to your needs and learning styles.

On any given day as you and your colleagues enter the building, facial recognition automatically identifies you and checks you in to officially start your workday. At the entrance you are greeted by a personalized virtual dashboard. It displays your schedule for the day and other critical information specific to you (e.g., leave balance, days worked, etc.), as well as the performance metrics from the previous shift and organization-wide reminders such as available development opportunities. After reading it and moving ahead, the display screen changes for the next employee. Walking through another entryway, your equipment bag arrives via a chute. The bag contains your personal protective equipment and the tools you will need to complete the scheduled tasks for the shift**.** This includes your biometric wrist sensor and safety glasses with integrated eye-tracking, augmented reality (AR) and your personal assistant interface that is connected to the company's artificial intelligence (AI) system. As you don the safety glasses, the system automatically activates and in the lens you see a display confirming that you are connected, and your equipment is functioning properly. You are also greeted by your personal assistant, an audio-based, AI-driven system that communicates through your headset with a professional, yet relaxed voice. The personal assistant recaps the performance metrics from the previous shift and throughout the day it provides important personalized messages needed to complete your work. The personal assistant and the augmented reality function of your safety glasses have eliminated the need for emails and going to most meetings. These tools now enable the meeting to come to you wherever you are.

As you arrive in the physical space of your workstation, you and every employee in the area are provided a virtual *employee roll call*. When you look around the manufacturing floor, a yellow symbol highlights an empty workstation. The system recognizes where you are looking and

provides information indicating that the absent employee checked into the company infirmary after his wrist sensor detected an elevated body temperature. The system provides everyone on the manufacturing floor a short list of signs and symptoms that may indicate the spread of an illness with suggested protective actions to minimize it. The system also confirms that all employees present in the work area have normal body temperatures.

The work area is clean, but cavernous, and is maintained by a small fleet of automated sweepers (similar to industrial "Rumbas"). As you walk to your personal workstation, you notice a line of robots adjacent to the main thoroughfare moving as it fabricates steel panels into a large box weighing approximately 1500 pounds. The system senses welding slag as it flies into the pathway and immediately identifies a hazard you should avoid. You and others walking with you are guided away from the hazard with a series of green arrows superimposed on an adjacent walkway. You safely arrive at your workstation.

Your personal assistant announces that the collaborative robots are ready to start shift. As the massive robots begin to move, the system constantly updates the status of each machine and you see the startup process checklist in your AR display. As your eyes move to each item on the checklist, a blue circle highlights the specific area of the machine you must inspect, and if needed, also calibrate. As you complete each step of the startup procedure the AI evaluates the accuracy of the assessment and if completed to pre-set standards, a green check is displayed and the next item on the list appears.

As the first of several components passes your workstation, the system announces that you will need to lubricate several joints on the machines. In previous years, this task would have been performed by a technician and production would have stopped for three to four hours. However, the maintenance schedule is optimized by the cloud-based AI system to avoid disruptions in the production flow. Although you have never performed this maintenance task and it is scheduled for a very tight window, you are confident that you will be able to complete the task in the time given. About 90 minutes later, you receive a notification to start a short two-minute video that demonstrates the procedure. The video plays in your lenses and you complete a summative evaluation called a knowledge

check by correctly answering five questions. The training advances from a knowledge component to the psychomotor skills development module. The safety gloves you donned as you entered the facility are equipped with haptic devices. The next part of the video plays in your AR headset and you are now able to imitate the motions shown in the video. As the AR superimposes a *virtual* grease gun in your hands, the haptic feedback gives you the sensation of holding it. To the passerby, your training looks like a form of Tai Chi; however, to you, it feels like you are doing the actual task with the tools.

The system initiates a timer. As you acknowledge the timer by looking at it, a small wheeled robot arrives at the workstation with a grease gun identical to the one in the training video. When you grab the grease gun, a sensor activates the display of the greasing procedures in your AR display. The first grease port is highlighted in red, indicating it is not yet safe to start the procedure. As a few seconds pass, the highlight changes to yellow and then green indicating it is safe to begin the maintenance. Your personal assistant provides reminders from the training video ensuring that you have accurately and adequately completed the task. The system also provides verbal reinforcement by indicating common problems associated with the task. As each grease application is completed, the AR directs you to the next grease port. Simultaneously, the small camera in the frame of the safety glasses snaps a photo of the completed work and archives the picture. The system is autonomously assessing your performance based on a set of parameters, including time, accuracy, and visual evidence from the photos. This information is used to adapt your training and will be used in your personal performance evaluation.

Six hours into your workday, the system announces that a robot is malfunctioning and requires emergency maintenance. To complete the task, the procedure will require a passive upper body exoskeleton. This is needed to prevent strain injuries that can result from extending your arms as you use a 20-pound motorized driver for more than 30 minutes. Ten minutes before the task is to begin, a wheeled robot, about the size of a vending machine stops next to you and opens automatically to reveal the exoskeleton. After suiting up, the procedure, as before, is displayed in the AR glasses. Ten minutes before your workday ends you complete the task. Sensing the task is over, the vending machine reappears at your

workstation to collect the tools. As you and your co-workers exit the building, you drop your personal safety equipment in a tray to be disinfected for the next day, and you are automatically clocked out for the day.

A Way Forward

Ericsson and others have noted that developing someone to an expert level in the modern workplace requires a significant investment of time and effort (Ericsson, 2008; Ericsson et al., 1993; Gladwell, 2008; Levitin, 2006). However, as we can see, the workplace is going to change in significant ways in response to technology and the types of knowledge and skills needed by the workforce changes. These factors conspire to challenge the validity of the current views of expertise. As the workplace continues to transform, so should the ways in which expertise is defined and developed.

Take for instance the learning that happens in organizations. The massively inefficient classroom methods used by many of today's training departments must yield to in-situ learning that integrates emerging and innovative technologies in meaningful activities. The need for rapid expertise development means that pedagogical methods of instruction should instead be andragogical approaches (Knowles & Associates, 1984). This means that instructional design methods which produce one-size-fits-all curricula must instead offer personalized curricula capable of being adapted to the specific learner in real time. Moreover, long classroom sessions with limited and / or iterative application activities will need to transform to short bursts of just-in-time learning using techniques such as microlearning (Kapp & Defelice, 2019; Zhang & West, 2020) and simulation-supported learning experiences (Cabanero-Johnson & Berge, 2009; Marlow, Lacerenza, Reyes, & Salas, 2017; Oblinger, 2003). In addition, as the case illustrates, learning experiences will be less formal and include repeated, but purposeful interactions with technologies such as AI, Augmented Reality (AR), and Virtual Reality (VR) (Merriam & Bierema, 2014; Messmann, Segers, & Dochy, 2018). Although the integration of informal learning into work is not a new concept (Marsick & Watkins, 1997; Marsick, Watkins, Callahan, &

Volpe, 2006), it has not been used significantly by organizations as a primary means of developing occupational expertise.

Current training is typically designed as a one-size-fits-all solution for building skills, increasing knowledge, and refining abilities. The significant investments of time and effort to gain mastery will, in the future, render this approach grossly inefficient**.** Yet, it is efficient and, more important, cost-effective for the organization as they develop learning opportunities. It is also well accepted that people start their respective learning journeys from different points, with different levels of knowledge and different skills mastered (Knowles & Associates, 1984). Moreover, research has shown that one-on-one instruction is the most effective learning style (Howe & Barrow, 2020). However, creating tailored learning experiences scaled for an organization's workforce is costly and time-consuming. HRD professionals need to identify and develop solutions that balance the power of customization with the speed of mass production of learning, including implementing adaptive learning, upskilling and re-skilling, and ensuring technology adoption.

Adaptive Learning

The pace of changes in technology necessitates developing and implementing learning opportunities within days not weeks or months. HRD professionals will need to understand and expand the value of enhancing the knowledge, skills, and abilities of the organization's workforce, especially since recruiting can take longer as the competition for attracting the *right* expertise can take months. A likely strategy to address this involves implementing *adaptive learning*. Adaptive learning can be explained as a data-driven learning tool that tailors the content and interactions to the individual's specific needs (Cavanagh, Chen, Lahcen, & Paradiso, 2020). There are several ways in which this customization can occur, including the use of a machine-learning system. In machine-learning systems, the computer observes and records interactions with the learner and adapts the content and delivery based on algorithms. Perhaps the most important factor in adaptive learning is detecting and identifying essential data points about the individual learner to

determine what content he or she requires (Mwambe, Tan, & Kamioka, 2020).

There are many delivery platforms for this kind of learning opportunity, including web-based, video-streaming, and face-to-face instruction (Cavanagh et al., 2020). However, augmented reality, virtual reality, and other immersive technologies provide opportunities to engross participants in the learning moment through adaptable scenarios where he or she can *play* through the learning experience (Chandramouli, Zahraee, & Winer, 2014). Scenario-based learning has long been a tool used to develop expertise (Chermack, 2003; Chermack & Walton, 2006; Moats, Chermack, & Dooley, 2008). The learning focus of immersive platforms such as virtual reality, combined with the customized content tailored by adaptive learning algorithms can provide a powerful tool to rapidly develop expertise.

The transformation of the workforce is a *process* that must be planned, implemented, evaluated, and constantly adjusted based on the environment. Swanson (2007) notes, "Developing expertise is not an event. It is a purposeful journey" (p.126). Moving forward on this journey, organizations must accept that developing expertise means developing learning opportunities that simultaneously demonstrate *valuable* impact to the organization and individual learner and is *tailored* to the individual's specific learning needs. However, the learning needs will vary based on each person's knowledge, skills, and abilities. Some will be general and permeate the entire organization, while other expertise will be highly technical and specialized, and needed by only a few. Learning opportunities based on pedagogical approaches to teaching that unfold in iterative, stepwise progressions in which all attendees get the same information, regardless of their existing experiences and cognitive abilities, is often the practice, regardless of the expertise needed. Learning that ignores the need for basic knowledge or complex cognitive system-based decision-making skills cannot remain in the future. Expertise development must adapt and be tailored not only to the learner, but also to the expertise that is needed for any given work scenario. For example, building the expertise to manage complex situations may best be accomplished with immersive, virtual reality supported, scenario-based experiential learning. However, building the expertise to perform a routine maintenance procedure, such as in

the greasing task described in the case study is more suited for just-in-time microlearning.

Upskilling and Re-skilling

Upskilling, defined earlier as enhancing the *current* skills and abilities so there is a greater depth, is a vastly underutilized human resource development strategy. Failing to incorporate this as part of the workforce transformation of the future will be costly in terms of time and financial resources (Carnevale, Ridley, Cheah, Strohl, & Peltier Campbell, 2019; Modestino, Shoag, & Ballance, 2015). Providing for the employees' continued development as the organization changes can engender loyalty. Researchers (J. Y. Lee, Rocco, & Shuck, 2020; Shuck, Adelson, & Reio, 2017) have shown that when organizations invest in developing their employees, employees are likely to be more engaged in the organization. Consequently, upskilling can have a positive impact on the company's ability to recruit and retain the best and brightest employees (Marquardt, 2011).

Upskilling is rife with opportunities to provide micro-duration, high impact interventions delivered through a variety of modalities, including through an individual's mobile devices using video sharing platforms (e.g., YouTube), podcasts, and video games instead of the traditional face-to-face classroom (Gratton, 2019). Upskilling builds on an individual's existing expertise, or redevelop expertise, and helps them adapt to new technology (Tah, 2018). However, understanding the need for upskilling and more importantly, providing the motivation and support to incorporate it into the organization is a shared burden by both the employee and employer (Gratton, 2019).

Where upskilling is enhancing skills for the current job, re-skilling is developing new knowledge and skills for a different job (Gratton, 2019). Weber (2019) suggests that both re-skilling and upskilling are underutilized strategies for most organizations. Weber explains why organizations are reticent if not outright against re-skilling:

> Sometimes the required skills aren't easily taught to existing employees, experts say. It's also often because companies have only a hazy sense of what their internal talent is capable of, and migrating large numbers of employees into new positions requires time, money and commitment. (p. 1)

V. E. Davis and Minnis (2017) make a similar point about veterans who are transitioning from the military to the civilian workforce. Employers misjudge what the existing workforce is capable of when given an opportunity. Therefore, as with upskilling, re-skilling must be inextricably embedded within the core strategies of the organization. In doing this, organizations can effectively plan for the expertise they will need in the future and create strategic plans to plot a course for strengthening the workforce, developing the needed expertise, and retaining people. Attending to re-skilling means organizations are able to maintain their competitive advantage through a strong, viable, tenured workforce with organizational expertise. In other words, the organization that strategically plans and implements re-skilling for employees is closer to realizing true self-sufficiency. Failing to include re-skilling as part of the organization's transformation strategy is taking a great risk that will ultimately result in the organization's failure (Moore, 2018) and the loss of employee expertise.

Adoption and Acceptance of Technology

However, for any of this to be successful, organizations of the future must ensure that steps are taken to facilitate the adoption of innovation (Rogers, 2003) and technology (McGurn & Prevou, 2012; Pavera, Walkera, & Hunga, 2014). Research (Davis, F. D., 1989; Lee, Kozar, & Larsen, 2003; Moats, 2015; Venkatesh, Morris, Davis, & Davis, 2003; Yen, Wu, Cheng, & Huang, 2010; Yousafzai, Foxall, & Pallister, 2007) has shown that technology is more likely to be accepted by users when several criteria are met. First, one must understand how the technology will help him or her perform the job better. Second, he or she needs to realize that the technology is relatively easy to use (Davis, F. D., 1986, 1989; Lee et al., 2003; Yen et al., 2010). Third, the user needs to sense

that others want them to use the technology**.** This is especially important when the opinions are from those who are important to the user (e.g., the boss, a trusted colleague, etc.) (Moats, 2015; Venkatesh et al., 2003). A final, but important criterion is that the user believes that the organization can support the implementation and the sustained use of the technology (Venkatesh et al., 2003). This final criterion is of great concern given the rapid pace of the evolving technology. Many business leaders openly question whether technology developers will be able to keep up with the demand as the digital transformation continues to permeate the workplace (De Bruyne & Gerritse, 2018; Schwab, 2015).

Rogers (2003) defines a four-component strategy that is essential for integrating an innovation throughout an organization and ensuring learning and development of employees; chief among these components is a social system. In technology adoption literature, the power of this component is strongly reinforced (Moats, 2015; Venkatesh et al., 2003). To that end, organizations must be ready to go beyond teaching individuals how to use the technology. Although this is vitally important, it is not enough. Organizations must also create, communicate, and explicitly support technology implementation strategies (Moats, 2015). Simply throwing technologies at workers with little or no guidance of how the technology will integrate into the organizational operation is likely to fail and hinder the application of employee expertise.

Building an adaptive capability within organizations will require the agility to innovate creative approaches to identifying the needs of the organization *and* the learners. As was the scenario in the case, processes will be completed in a small fraction of time compared to those used now (Moore, 2018; Schwab, 2015), which means the speed of designing and developing learning opportunities must be greatly improved. Plus, there needs to be a culture that welcomes change. All of which necessitates OD strategies and techniques that foster the adoption and acceptance of the new and innovative technology as it continues to appear in response to the ever-changing landscape (Moore, 2018). By doing this, new approaches to developing expertise are opened, allowing for the eventual reduction of the prolonged timeframes currently needed to create mastery. In other words, the development of expertise must be as agile and adaptable as the organizations (De Bruyne & Gerritse, 2018). However,

keeping pace with transformation may not be adequate given the advancement of technological change. What is required is disruption (Christensen, Raynor, & McDonald, 2015) to the current training and development processes to rethink how individuals gain expertise and how the workforce is equipped for success. To create new ways of developing expertise, HRD professionals will need to expand their repertoire of training and development techniques and go beyond the *usual suspects* (i.e., instructional designers, content specific subject matter professionals, technical writers, and graphic designers). As Schwab (2015) writes, "The response to it [transformation] must be integrated and comprehensive, involving all stakeholders of the global polity, from the public and private sectors to academia and civil society" (p. 1). For expertise development this means having a transdisciplinary approach. Without this, organizations will struggle to be competitive (Moore, 2018).

Given the discussions in this chapter around and about technology, it is important that an individual's perceptions and decisions about the technology's value and the perceived investment of time and effort they will expend to learn it be given some attention. The decision to accept technology can potentially provide organizations the single greatest risk of failure with reference to developing expertise. For example, if an individual decides to not accept a technology**,** a couple of things could unfold that would cost the organization time, money, and other resources. First, the organization could possibly lose the employee and the expertise that employee possesses. Second, the organization's investment in the technology goes unreturned, or returned on a much lesser scale than expected. Or both could occur, resulting in incomplete staff and investments that go unrecovered. In a competitive environment in which minor adjustments often result in major impact, these losses are likely to be critical to maintaining a competitive advantage. Ultimately, if an individual rejects (i.e., does not accept) the technology, they are unable to develop the expertise needed to do the job. For example, in the case of the floor worker, the acceptance of augmented reality is vital. There would be risks to their safety as they moved around the manufacturing floor and repairs and maintenance would likely take hours or days, instead of a few minutes.

In the future, HRD professionals should consider a few points as they plot the course for engendering technology acceptance among employees to endure rapid development of expertise. First, an individual's perception of the innovative technology in context influences the decision to accept (or not accept) the technology. Often, an individual experiences a feeling of awe and amazement as they initially encounter the technology. However, this quickly changes to anxiety as they realize that their performance would be, at least in part, contingent on how well they used the unfamiliar, innovative technology. Yet, as the individual's exposure to the technology increased and they experienced successes with the technology in context, the anxiety typically wanes, and the individual's confidence grows, and they become more comfortable with the technology.

Second, anxiety is created and can be counter to a decision to accept the technology. Moats (2013) has shown that an individual's anxiety is intensified when using an unfamiliar technology. Therefore, organizations should anticipate the anxiety and employ OD strategies and learning opportunities that are specifically designed to mitigate anxiety that can slow expertise development.

Third, exposure to, and early success in using, an innovative technology is essential to the individual's continued use of it. An individual's first-hand experience with innovative technology is powerful in discovering the technology's ease of use since individuals are able to gauge difficulty. They can then weigh that against the level of investment they are willing to make to learn the technology, instead of relying on others' interpretations and explanations. Opportunities to use the technology in context and experiencing successes will continue to build comfort with it. These successes, although comparatively small, will serve as motivators for the individuals as they continue to use innovative technology and develop expertise. Experiencing the utility of innovative technology is also important for ensuring continued use. Therefore, the previously mentioned scenario-based opportunities are important. While some learning opportunities can be constructed around mastery of tasks, intrinsic motivation to engage in these is often absent, especially among the competing interests of the working environment and work-life balance. However, when the learning opportunity is built to provide a

perception of a forward direction, it is meaningful and often more palatable for the individual to justify spending the time and effort to participate.

Finally, role models, whether formal or informal leaders within an organization, are influential to the acceptance and use of technology. These personnel are uniquely positioned to facilitate change, mitigate, and even alleviate anxiety, and help individuals identify the ease of use and utility of the innovative technology. This is a very powerful position and makes them critical to bolstering the probability of technology acceptance. Given this, organizations must ensure that role models are identified, and well prepared to use the technology.

Conclusion

This chapter asked you to take a journey into the future. From the outset, I have asserted that current methods used to develop expertise are inefficient, costly, and incongruent with the volatile environment of organizations found in the future. We must reconsider how we think about expertise and how we develop expertise. We must prepare for a very different workplace and ensure that we have the *right* expertise within an organization to provide a powerful competitive advantage (Grenier & Germain, 2014; Lee et al., 2020; Marquardt, 2011). This means that in workplaces that are continuously transforming and innovations continue to emerge, an investment of 10,000 hours of deliberate practice will likely be untenable and how we prepare and develop expertise now will be incompatible for establishing and maintaining competitive advantage in the future. HRD professionals must do more than push the boundaries to ensure expertise development. They must be disruptive by introducing learning as part of operations and push the organization to go beyond being an organization that learns when it needs to, to being a "learning organization", an organization "that learns effectively and collectively and continually transforms itself for better management and use of knowledge; empowers people within and outside of the organization to learn as they work; utilizes technology to maximize learning and production" (Marquardt, 2011, p. 209).

The quick glimpse into the future that was provided in this chapter was an example of what that push can lead to, and it might be quite disorienting as it seems to bring science fiction to reality. Innovations such as artificial intelligence, exoskeletons, collaborative robots, and those yet to be discovered will continue to evolve, emerge, and transform the workplace and work processes. The result is a workplace that changes the requirements of *what* expertise *is needed* and *how* expertise *is implemented*. Likewise, the innovations in technology and processes and the speed at which they emerge will demand changes in *how* expertise *is developed*. The ubiquitous nature and the rapid evolution of workplace technology, as well as unforeseen world-wide events, such as the COVID-19 pandemic will continue to disrupt the competitive landscape, subsequently challenging organizations' performance in the future. As the global pandemic created by COVID-19 demonstrates, a disruptive event serves as a catalyst for furthering transformation and the need for rapid expertise development. It is very likely that many organizations who are unable to adapt will fail over the long term and employees too who do not redevelop their expertise may be made redundant. This illustrates the need for organizations to be adaptable and agile, and create and implement innovative approaches to develop and maintain occupational expertise.

References

Allen, B. (2018). How Structured Use Cases Can Drive the Adoption of Artificial Intelligence Tools in Clinical Practice. *Journal of the American College of Radiology, 15*(12), 1758–1760. https://doi.org/10.1016/j.jacr.2018.09.002.

Cabanero-Johnson, P. S., & Berge, Z. (2009). Digital natives: Back to the future of microworlds in a corporate learning organization. *The Learning Organization, 16*(4), 290–297.

Carnevale, A., Ridley, N., Cheah, B., Strohl, J., & Peltier Campbell, K. (2019). *Upskilling and downsizing in American manufacturing*. Washington, DC: Georgetown University Center on Education and the Workforce.

Cavanagh, T., Chen, B., Lahcen, R. A. M., & Paradiso, J. R. (2020). Constructing a design framework and pedagogical approach for adaptive learning in higher

education: A practitioner's perspective. *The International Review of Research in Open and Distance Learning, 21*(1), 172–196.

Chandramouli, M., Zahraee, M., & Winer, C. (2014, 5–7 June). *A fun-learning approach to programming: An adaptive Virtual Reality (VR) platform to teach programming to engineering students*. Paper presented at the IEEE International Conference on Electro/Information Technology.

Chermack, T. (2003). Decision-making expertise at the core of human resource development. *Advances in Developing Human Resources, 5*(4), 365–377.

Chermack, T., & Walton, J. S. (2006). Scenario planning as a development and change intervention. *International Journal of Agile Systems and Management, 1*(1), 46–59.

Choi, B. C. K., & Pak, A. W. P. (2006). Multidisciplinarity, interdisciplinarity and transdisciplinarity in health research, services, education and policy: 1. Definitions, objectives, and evidence of effectiveness. *Clinical & Investigative Medicine, 29*(6), 351–364.

Christensen, C. M., Raynor, M., & McDonald, R. (2015). What is disruptive innovation? *Harvard Business Review, 93*(12), 44–53.

Davis, F. D. (1986). A technology acceptance model for testing new end-user information systems: Theory and results (Unpublished Ph.D. dissertation). Massachusetts Institute of Technology, Cambridge, MA.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319–340.

Davis, V. E., & Minnis, S. E. (2017). Military veterans' transferable skills: An HRD practitioner dilemma. *Advances in Developing Human Resources, 19*(1), 6–13.

De Bruyne, E., & Gerritse, D. (2018). Exploring the future workplace: Results of the futures forum study. *Journal of Corporate Real Estate, 20*(3), 196–213.

Dittes, S., Richter, S., Richter, A., & Smolnik, S. (2019). Toward the workplace of the future: How organizations can facilitate digital work. *Business Horizons, 62*(5), 649–661.

Ericsson, K. A. (2008). Deliberate practice and acquisition of expert performance: A general overview. *Academic Emergency Medicine, 15*(11), 988–994.

Ericsson, K. A., Krampe, R. T., & Tesch-Römer, C. (1993). The role of deliberate practice in the acquisition of expert performance. *Psychological Review, 100*(3), 363–406.

Frey, C. B., & Osborne, M. A. (2016). The future of employment: How susceptible are jobs to computerisation? *Technological Forecasting and Social Change, 114*, 254–280.

Fulmer, W. E. (2000). *Shaping the adaptive organization: Landscapes, learning, and leadership in volatile times*. New York: AMACOM.

Gerwitz, R. J. (2016). Modern strategy for operational excellence: Building agile and adaptive organizations. *Journal of Healthcare Protection Management: Publication of the International Association for Hospital Security, 32*(2), 121–124.

Gladwell, M. (2008). *Outliers: The story of success*. New York: Hachette Audio.

Gratton, L. (2019). New frontiers in re-skilling and upskilling. *MITSloan Review*. Retrieved from https://sloanreview-mit-edu.srv-proxy1.library.tamu.edu/article/new-frontiers-in-re-skilling-and-upskilling/

Grenier, R. S., & Germain, M.-L. (2014). Expertise through the HRD lens: Research trends and implications. In N. F. Chalofsky, T. Rocco, & M. L. Morris (Eds.), *Handbook of human resource development* (pp. 183–200). New York: John Wiley & Sons, Inc.

Gromb, D., & Martimort, D. (2007). Collusion and the organization of delegated expertise. *Journal of Economic Theory, 137*(1), 271–299.

Guinan, P. J., Parise, S., & Langowitz, N. (2019). Creating an innovative digital project team: Levers to enable digital transformation. *Business Horizons, 62*(6), 717–727.

Harrington, S. G., & Johnson, M. K. (2019). The FDA and Artificial Intelligence in Radiology: Defining New Boundaries. *Journal of the American College of Radiology, 16*(5), 743–744. https://doi.org/10.1016/j.jacr.2018.09.057.

Holbeche, L. (2019). Designing sustainably agile and resilient organizations. *Systems Research and Behavioral Science, 36*(5), 668–677.

Howe, M. J. (1999). *Genius explained*. Cambridge, U.K.: Cambridge University Press.

Howe, N., & Barrow, J. (2020, March 27). *Adapting for adaptive learning with Area9 Lyceum* [Audio podcast]. https://www.learningsharks.com/ltt-blog/adapting-for-adaptive-learning

Howe, N., & Barrow, J. (Hosts). (2020, March 27). *Adapting for adaptive learning* [Audio Podcast].

Kaplan, A., & Haenlein, M. (2019). Digital transformation and disruption: On big data, blockchain, artificial intelligence, and other things. *Business Horizons, 62*(6), 679–681.

Kapp, K. M., & Defelice, R. A. (2019). *Microlearning: Short and sweet*. Alexandria, VA: American Society for Training and Development.

Knowles, M., & Associates. (1984). *Andragogy in action* (1st ed.). San Francisco: Jossey-Bass.

Kwartowitz, D. M., Herrell, S. D., & Galloway, R. L. (2007). Update: Toward image-guided robotic surgery: Determining the intrinsic accuracy of the

daVinci-S robot. *International Journal of Computer Assisted Radiology and Surgery, 1*(5), 301–304.

Lee, J. Y., Rocco, T. S., & Shuck, B. (2020). What is a resource: Toward a taxonomy of resources for employee engagement. *Human Resource Development Review, 19*(1), 5–38.

Lee, Y., Kozar, K. A., & Larsen, K. R. T. (2003). The technology acceptance model: Past, present, and future. *Communications of the Association for Information Systems, 12*, 752–780.

Levitin, D. J. (2006). *This is your brain on music: The science of a human obsession*. New York: Dutton.

Marlow, S. L., Lacerenza, C. N., Reyes, D., & Salas, E. (2017). The science and practice of simulation-based training in organizations. In K. G. Brown (Ed.), *The Cambridge handbook of workplace training and employee development* (pp. 256–277). Cambridge, UK: Cambridge University Press.

Marquardt, M. J. (2011). *Building the learning organization: Achieving strategic advantage through a commitment to learning*. Boston: Nicholas Brealey Publishing.

Marsick, V., Watkins, K., Callahan, M. W., & Volpe, M. (2006). *Reviewing theory and research on informal and incidental learning.* Paper presented at Academy of Human Resource Development International Conference, Columbus, OH. Retrieved from http://files.eric.ed.gov/fulltext/ED492754.pdf

Marsick, V. J., & Watkins, K. E. (1997). Lessons from informal and incidental learning. In J. Burgoyne & M. Reynolds (Eds.), *Management learning: Integrating perspectives in theory and practice* (pp. 295–311). London/Thousand Oaks, CA: Sage.

McCarthy, M. (2014). *Time to kill the tech job-killing myth*. Retrieved from https://thehill.com/blogs/congress-blog/technology/219224-time-to-kill-the-tech-job-killing-myth

McGurn, L., & Prevou, M. (2012). *Rethinking the role of the instructor: Teaching 21st century learners*. Paper presented at the Interservice/Industry Training, Simulation, and Education Conference (I/ITSEC) 2012, Orlando, FL.

Merriam, S. B., & Bierema, L. L. (2014). *Adult learning: Linking theory and practice*. San Francisco: Jossey-Bass.

Messmann, G., Segers, M., & Dochy, F. J. R. C. (2018). *Informal learning at work: Triggers, antecedents, and consequences*. Abingdon, UK: Routledge.

Moats, J. B. (2013). A close look at technology acceptance: A phenomenological study (Unpublished doctoral dissertation). Texas A&M University, College Station, TX.

Moats, J. B. (2015). Influences on the acceptance of innovative technologies used in learning opportunities: A theoretical perspective. In F. M. Nafukho & B. J. Irby (Eds.), *Innovative technology in higher education* (Vol. 1, 1st ed., p. 20). Hershey, PA: IGI Global.

Moats, J. B., Chermack, T., & Dooley, L. M. (2008). Using scenarios to develop crisis managers: Applications of scenario planning and scenario-based training. *Advances in Developing Human Resources, 10*(3), 397–424.

Modestino, A. S., Shoag, D., & Ballance, J. (2015). Upskilling: Do employers demand greater skill when skilled workers are plentiful? *Working Paper Series (Federal Reserve Bank of Boston), 14*(17), 1–39.

Moore, A. (2018). *The human focus: Organizations can prepare for the future by reskilling employees and updating their workforce designs(1)*. Retrieved from https://www.td.org/magazines/td-magazine/the-human-focus

Mwambe, O. O., Tan, P. X., & Kamioka, E. (2020). Bioinformatics-based adaptive system towards real-time dynamic e-learning content personalization. *Education Sciences, 10*. Retrieved from http://proxy.library.tamu.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=EJ1245599&site=eds-live

Oblinger, D. (2003). Boomers, gen-xers & millennials: Understanding the new students. *EDUCASE Review*, 37–47.

Pavera, J., Walkera, D. A., & Hunga, W.-C. (2014). Adjunct faculty characteristics that may predict intention to integrate technology into instruction. *Community College Journal of Research and Practice, 38*(10), 859–872.

Peters, M. A. (2017). Technological unemployment: Educating for the fourth industrial revolution. *Journal of Self-Governance & Management Economics, 5*(1), 25–33.

Pol, E., & Reveley, J. (2017). Robot induced technological unemployment: Towards a youth-focused coping strategy. *Psychosociological Issues in Human Resource Management, 5*(2), 169–186.

Rigby, D., Elk, S., & Berez, S. (2020). The Agile c-suite. *Harvard Business Review, 98*(3), 64–73.

Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). New York: Free Press.

Sasangohar, F., Moats, J., Mehta, R., & Peres, S. C. (2020). Disaster ergonomics: Human factors in COVID-19 pandemic emergency management. *Human Factors, 62*(7), 1061–1068.

Schneider, S., & Leyer, M. (2019). Me or information technology? Adoption of artificial intelligence in the delegation of personal strategic decisions. *Managerial and Decision Economics, 40*(3), 223–231. https://doi.org/10.1002/mde.2982.

Schwab, K. (2015). The fourth industrial revolution: What it means and how to respond. *Foreign Affairs*. Retrieved from https://www.foreignaffairs.com/articles/2015-12-12/fourth-industrial-revolution

Schwab, K. (2016). *The fourth industrial revolution: A Davos reader.* Council on Foreign Relations.

SHRM. (2016). *The new talent landscape: Recruiting difficulty and skills shortages*. Retrieved from Alexandria, VA.

Shuck, B., Adelson, J. L., & Reio, T. G. (2017). The employee engagement scale: Initial evidence for construct validity and implications for theory and practice. *Human Resource Management, 56*(6), 953–977.

Simone, P., Zenobia, T., & Richard, N. (2018). The health benefits of autonomous vehicles: Public awareness and receptivity in Australia. *Australian and New Zealand Journal of Public Health*, (5), 480.

Stubbings, C., Sethi, B., & Brown, J. (2019). *Talent Trends 2019*. Retrieved from https://www.pwc.com/gx/en/ceo-survey/2019/Theme-assets/reports/talent-trends-report.pdf

Swanson, R. (2007). *Analysis for improving performance: Tools for diagnosing organizations and documenting workplace expertise*. San Francisco: Berrett-Koehler Publishers.

Tah, S. (2018). Upskilling workforce for the digital age. *Dataquest, 36*(6), 87.

Takahashi, N. (1987). *Design of adaptive organizations: Models and empirical research*. Berlin, Germany: Springer-Verlag.

Tanklevska, N. S., Kyrylov, Y. Y., & Zaitseva, O. I. (2017). Management of conscious adaptive organizations in the context of socioeconomic changes and financial turbulence. *Scientific Bulletin of Polissia, 12*(4,Part1), 36–39.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly, 27*(3), 425–478.

Weber, L. (2019, April 22). Why Companies are Failing at Reskilling. *Wall Street Journal,* p. 1.

Yen, D. C., Wu, C.-S., Cheng, F.-F., & Huang, Y.-W. (2010). Determinants of users' intention to adopt wireless technology: An empirical study by integrating TTF with TAM. *Computers in Human Behavior, 26*(5), 906–915.

Yousafzai, S., Foxall, G. R., & Pallister, J. G. (2007). Technology acceptance: A meta-analysis of the TAM: Part 1. *Journal of Modeling in Management, 2*(3), 29.

Zhang, J., & West, R. E. (2020). Designing microlearning instruction for professional development through a competency based approach. *TechTrends, 64*(2), 310–318.