Implementing Change for Greater Learning, Readiness, and Lethality

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ABSTRACT

The United States Department of Defense (DoD) and the national security community can be certain that the future will continue to increase in complexity and pace, and that the availability of emerging science, technologies, and information will become more prevalent. Accordingly, organizational processes, practices, and concepts must continue to evolve. In the Summary of the 2018 National Defense Strategy, the United States Secretary of Defense stated that "Cultivating a lethal, agile force requires more than just new technologies and posture changes; it depends on the ability of our warfighters and the Department workforce to integrate new capabilities, adapt warfighting approaches, and change business practices to achieve mission success." Without sustained and focused efforts to cultivate agility and innovation, the military Services risk decreasing readiness and lethality.

To address these challenges, Services within the DoD are transitioning from an industrial age learning model to a more agile learning model that better leverages innovative methods, emerging learning science, and technology. Previous research (Raybourne et al., 2017; Vierling et al., 2018) identified recommended changes to enhance learning within the national security community, including enhancing instructional quality, competency-based learning, personalization, learning on demand, obtaining frequent end user feedback, exploring best practices to create integrated learning capabilities, and incentivizing innovation and performance. However, implementing a new learning model and the above recommendations within DoD has proven challenging.

This paper provides a flexible framework and specific examples from the Marine Corps Training and Education Command (TECOM) to explain how to implement changes to create a more student-focused, integrated, and agile learning environment. Training and education practitioners provided insights regarding obstacles and opportunities to enhance student learning. Finally, this paper discusses current limitations, challenges, future directions, and recommendations to enhance learning, readiness, and lethality.

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"Recruiting, developing, and retaining a high-quality military and civilian workforce is essential for warfighting success. Cultivating a lethal, agile force requires more than just new technologies and posture changes; it depends on the ability of our warfighters and the Department workforce to integrate new capabilities, adapt warfighting approaches, and change business practices to achieve mission success. The creativity and talent of the American warfighter is our greatest enduring strength, and one we do not take for granted."

James Mattis, 26th U.S. Secretary of Defense
Summary of the 2018 National Defense Strategy

INTRODUCTION

Organizations across the Department of Defense (DoD) and national security community are contemplating how to prepare students to thrive in an increasingly complex, interconnected, volatile, and ever-changing world. Organizations charged with preparing their students to thrive in the future world are seeking better ways to cultivate learning cultures, leaders, and environments. In previous centuries, it was a luxury for educational systems to develop people who could think critically and reason, to express themselves clearly, to solve complex problems, and to adapt their learning to new challenges. However, current and future environments *require* that organizations and students learn these higher order cognitive skills and competencies to be able to thrive in complex environments. Although the ways and means of implementing instructional programs may be different, the common end goal of these organizations are to better enable students to develop an intellectual edge so that they will be more prepared to address future challenges and opportunities. The DoD and the national security community can be certain that the future will continue to increase in complexity and pace, and that the availability of emerging science, technologies, and information will become more prevalent. Without sustained and focused efforts to cultivate agility and innovation across DoD, the military Services risk decreasing readiness and lethality.

Accordingly, organizational processes, practices, and concepts must continue to evolve. Simply stated, continuous learning is required to solve future complex problems and address new challenges. However, in the absence of goal clarity and an understanding of how to modify methods to obtain needed changes, organizations often just repeat previous practices and processes. Knowledge without accompanying changes in organizational behaviors creates only the potential for organizational improvement. Therefore, learning organizations need a framework of actionable, practical methods and recommendations to more effectively identify, integrate, adapt, and anticipate changes to better support learning. There are numerous initiatives across the military Services to transition learning environments from traditional "brick and mortar" school settings to delivering learning at end-users' points of need leveraging new distributed instructional technologies and instructional methods, however, these efforts are not typically coordinated, synchronized, or similarly assessed due to the lack of an integrated framework (Hodges, 2015).

The task of affecting change to evolve an organization's current learning model and methods to become more future-oriented may initially seem monumental and daunting. However, the recommendations that follow are based upon learning science research and organizational best practices that can help those at the enterprise level to form a flexible framework that enables policy makers, management, learning engineers, technologists, and learning facilitators to better develop a robust, supportive, technology-enabled, distributed learning organization. The abundance of data, information, new technologies, and social learning opportunities can enable so many more new approaches in the design and delivery of learning curriculum, instruction, and assessment than previously possible. Additionally, the growth of interdisciplinary and multidisciplinary learning programs can encourage collaborations and real-world learning opportunities that stimulate innovative approaches to problem-solving. However, simply providing increased

technologies and opportunities for collaboration cannot guarantee that learning programs will effectively prepare the DoD military and civilian workforces for future challenges. Organizations need to develop an integrated framework to evolve their learning model and methods.

Learning Environment

To address these challenges, Services within the DoD are transitioning from an industrial age learning model to a more agile 21st century learning model that better leverages innovative methods, emerging learning science, and technology. A variety of work in the social and cognitive sciences has established that the learning environment strongly affects individual and collective learning in many ways, such as the influence of social norms and motivation (Paris, Olson, & Stevenson, 1983), instructor expectations and feedback (Dweck, 2016), and even non-feedback related instructor comments to students (Smith, Brumskill, Johnson, & Zimmer, 2018). Studies of the design and evaluation of learning environments are providing new insights regarding the impact of learners' ubiquitous access to information on learning and instruction (Pimmer, Mateescu, & Gröhbiel, 2016). In addition, a wealth of lessons learned can be gained from observing successful organizations and practitioners who share their experiences and best practices to enhance the learning environment. These examples from DoD, industry, academia, and other partner organizations demonstrate how to implement changes to enable the learning environment to become more learner-centered and aligned with the skills that warfighters will need to be successful in future operating environments.

The learners, instructors, team leaders, and organizational leaders all also influence the environment through social interactions and the establishment of learning expectations. Learning technologies provide learners and instructors with a "toolkit" of a variety of flexible tools, such as mobile technologies or simulations, at the learner's point of need. These technologies support increasingly challenging learning opportunities, accelerated learning, and enhanced assessments along a learning continuum in the learner's path to mastery. Ideally, the learning environment provides a variety of immediate, specific, positive, and constructive feedback that enables multiple ways for the learner to better understand the concepts and remediate to demonstrate enhanced understanding and competence. A best practice is for organizations to leverage data and analysis to provide instructors, students, and leaders with enhanced feedback that will enable them to actively seek opportunities to improve. These learning opportunities integrate experiential instructional methods and technologies that promote a tailored, learner-centered approach. Practitioners creating a framework for a future-oriented distributed learning environment need to take into consideration the organization's unique culture, challenges, resources, and needs. An actionable and effective framework defines the phenomenon of interest, the relationship of its key factors, describes what works and why, and explains how the framework could be applied. Additionally, the premises or assumptions underlying the framework need to be clearly stated (Bacharach, 1989; Crossan, Lane, & White, 1999).

Continuous organizational, group, and individual improvements to be ready for future challenges requires an active commitment to learning. Organizational theorists have studied learning structures for a long time; however, a clear and concise definition of a learning organization often proves to be surprisingly elusive, or open to subjective interpretation. Academic discussions of learning organizations usually identify abstract concepts and themes, rather than providing actionable details for practice and implementation. "A learning organization is an organization skilled at creating, acquiring, and transferring knowledge, and at modifying its behavior to reflect new knowledge and insights" (Garvin, 1993). A learning organization is committed to continuous learning, seeking new insights, and improving.

Organizational Learning

Although organizational learning is not a new domain, all too often organizations continue to solely focus on near-term tasks and fail to take a replicable, systemic approach to gathering data to inform their understanding of key factors that can improve learning. Effective organizational learning can occur through applying the scientific method over time: observe, ask a question, form a hypothesis or testable explanation, make a prediction based on the hypothesis, test the prediction, and then iterate by using the results to inform new hypotheses, predictions, decisions, and learning methods. Organizations can do this by observing what is going on in the organization or environment, forming a question about what they are observing, and identifying a testable idea that can help the organization be better positioned to address future challenges. Then, they can test the ideas, collect data, and interpret the data to form information (i.e., orienting or sense-making). Based upon the test (or pilot study) results, then organizations can decide which new components to integrate into their processes and take active steps to institutionalize the learning.

Most view organizational learning as a process that unfolds over time and is associated with acquiring knowledge, behavioral change, and improved performance. Unfortunately, DoD and the national security community do not have the luxury of extended time and unlimited resources to continuously collect and analyze student and organizational learning data, tailor instruction, observe changes, and assess effectiveness. However, one can prioritize and take actionable steps to modify factors in the organization's learning environment through enhanced organizational and instructional methods, and integrating learning technologies to increase feedback quality, quantity, and frequency. Additionally, organizations can continuously collect and analyze learning data to arrive at insights (i.e., "lessons learned"), that are then efficiently disseminated throughout the organization. For example, two key questions to ask your organization are:

How do you know if the organization is making progress?
What policies, practices, and programs need to be in place to enable better learning?

Each organization has its own unique challenges and specific metrics for determining progress. However, it is important to continuously consider these questions in the context of your own organization's learning evolution. Organizations should strive to explicitly identify and prioritize assessment opportunities because they inform organizational knowledge and actions that can then influence policy, practices, and programs. Continuously exploring methods and disseminating knowledge are important actions to support organizational learning. It is this dissemination of knowledge, lessons learned, and best practices throughout the organization paired with a framework of processes and methods that can enable learning enhancements to achieve organizational transformation and improved student learning outcomes.

Implementing Change for Future Learning

Leveraging research results from emerging science and technology (S&T) program developments seems to be a simple task considering the abundance of information that practitioners could obtain from a simple Internet search. However, much of this information, unfortunately, does not often reach practitioners due to the research-practice gap. The research to practice gap affects every scientific domain, defining the division between theorists and researchers on one side, and policymakers and practitioners on the other. Neal and colleagues (2015) described the gap as "a lack of reciprocal communication between the research and practice communities and limited implementation of evidence-based interventions in practice settings." There are many likely causes for the gap, including different cultures, values, goals, skills, and structural factors between the two communities – and these are particularly prevalent in the defense and national security domains. Learning scientists lament that training and education practitioners ignore their findings, and practitioners counter that the research is irrelevant to their real-world challenges and experiences. Practitioners readily point out that academic learning studies are often conducted in controlled settings that do not reflect the complexity and range of real-life conditions and learning challenges, while scientists complain about their lack of practitioner willingness to support experimentation or application of new methods. The impact of the research-practice gap is that practitioners fail to fully recognize and leverage learning S&T that could create a more effective learning environment.

Any successful implementation of learning S&T needs to address both the common and context specific factors contributing to the research–practice gap (Vierling, Schatz, LaFleur, and Lyons, 2018). Research findings need to be provided as practical recommendations that practitioners can address, and practitioner challenges need to be translated into issues that researchers can help address. We need to ensure that organizations:

1. Promote an evidence-informed learning environment and identify the most influential barriers.
2. Identify the problem(s), end-user needs, motivations, current challenges, friction points, and what would make a substantial difference.
3. Obtain tools that are interoperable and extensible to support the environment.
4. Open opportunities to stimulate the exchange of information and ideas.

The future-focused distributed learning environment, or "future learning ecosystem," supports increased opportunities and tailored learning content for continuous learning that will form a foundation for life-long learning behaviors. This distributed and ubiquitous learning system of systems will necessarily enable individuals, groups, and organizations to easily and readily obtain, identify, learn, and integrate the most relevant information and skills for success. The

foundation for the future learning organization is based upon supporting learners in many ways to better learn *how* to think to address problems and opportunities in an ever-changing complex world, rather than instructing specifically *what* to think. The ability to thrive in the future environment will increasingly depend not on what students already know, but on how well that they are able to *learn and adapt* to the changing needs. With the pervasiveness of information, learners must be encouraged to develop critical thinking, reasoning, and other cognitive skills such as metacognition to recognize when they understand and trust the reliability of information, and when they should search for additional information or evidence. Instructional methods and practices that support a metacognitive approach to learning include those that focus on individuals' sensemaking, self-assessment, self-regulation, and reflection on what worked - and what needs to be improved.

LEARNING FRAMEWORK

The following basic organizational learning framework in Figure 1 makes high-level connections for wider generalizability to different organizations. Practitioners should not only examine the applicability of this framework for their own organizations, but also seek to modify it for their own specific organizational cultures and needs. Four key premises form the underpinnings of this framework, and support one central proposition:

- Premise 1: Effective organizational learning involves assimilating new learning (exploration) and leveraging previous learning that remains relevant (e.g., best practices and lessons learned).
- Premise 2: Organizational learning is multilevel and interconnected, involving the individual, group, and organization levels.
- Premise 3: The three levels of organizational learning influence, and are influenced by, psychological, social, and environmental factors.
- Premise 4: Effective evidence-informed organizational learning occurs through gathering and analyzing data to examine these factors across the levels.
- Proposition: Organizations can take actionable steps to learn in order to prepare for future challenges and opportunities.

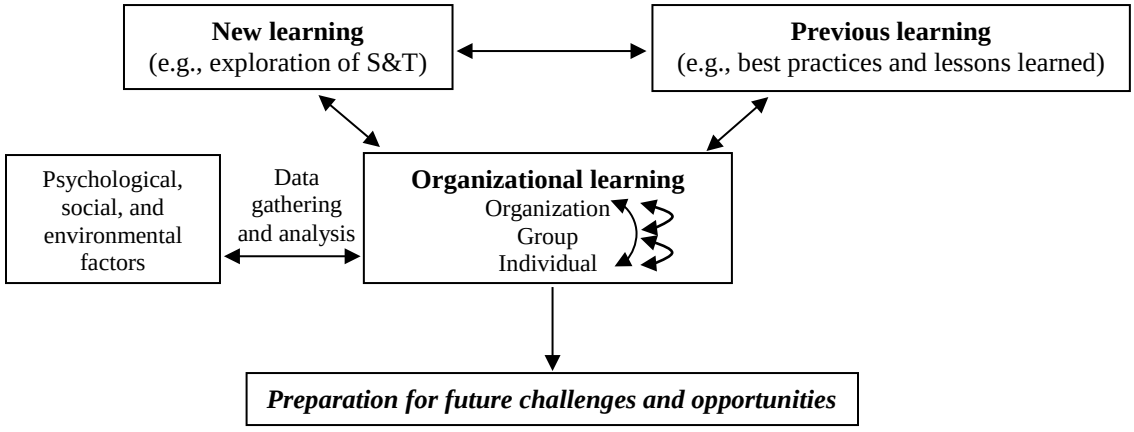

Figure 1. Proposed learning organization framework

Effective organizational learning involves assimilating new learning (exploration) and leveraging previous learning that remains relevant (e.g., feedback processes and lessons learned) across the individual, group, and organization levels. Learning exploration pertains to the process of assessing new methods and technology prototypes that could enhance learning for individuals, groups, or the organization levels. This assessment can also include system, structure, procedural, and process changes. Organizational learning is multilevel, and the individual, group (i.e., collective), and organization levels can each impact the others. Observations, assessments, analysis, understanding, decisions, and actions can be developed at each level. There are bottom-up and top-down effects: individual and

group learning can affect changes within the organization, and institutional learning can affect individual and group changes in behaviors.

Key Considerations for Planning

Organizations can take actionable steps to learn in order to prepare for future challenges and opportunities, such as to create an implementation plan. The above flexible framework for future learning organizations leverages best practices, science, and technologies to create an adaptive, effective, future-oriented, and technology-enabled learning environment. When paired with enhanced organizational awareness achieved through the described learning process, this framework helps to identify and remove obstacles that can impede learning, provides clarity regarding the structure of future organizations, and informs necessary process and policy modifications.

Key considerations and second-order consequences of implementing methods that accelerate student learning and allow students to progress at their own individual rates are that they will impact other associated processes within the larger system. The different rates of learning will potentially create a backlog in students waiting to participate in other courses, activities, or impact subsequent assignments. For example, in DoD, the manpower models are tied to operational requirements for certain military jobs that are much needed for the mission, and funding is provided by lawmakers for these billets. If a student finishes training early, he or she may be able to move into a position in the operating forces or elsewhere if the manpower model allows, or they may have to wait in place until a position opens.

Although military service members may have some input regarding their preferences for assignments, ultimately, they are directed to go where the Service needs them most to accomplish the mission. Resources would need to be applied to enhance the military manpower models to make them more agile and dynamic to temporal changes that result from students moving through the learning pipeline system at different paces. But even with enhanced manpower models, it would be challenging to move students through the system without significant friction due to the other logistics associated with the training, such as the amount of required equipment, billeting, travel, and instructor support. For example, this situation is quite different than K-12 education where a 12-year-old who reaches all competency goals for high school may be able to graduate years earlier than anticipated - and move on to higher education at his or her own preferred pace and location. The operating forces are depending upon a steady stream of fully trained service members arriving to accomplish the mission. Any unplanned disruption to this model can create a significant, undesired impact upon the operating forces.

Understanding these current challenges, the goal is to support practitioners in implementing effective methods to accelerate student learning and to enable them to learn at their own pace anywhere, and at any time. Each implementation plan of this learning organization framework will differ depending upon your organization's unique needs. However, there are some common components that each plan should include to increase the probability of successfully implementing a learning organization framework. For example, your plan should describe what actions need to occur to translate your organization's specific vision of a learning organization into a reality. The plan should include:

- Individual, group (i.e., collective or team), and organizational learning goals.
- The competencies needed to achieve those goals.
- Learning methods and technologies creating the learning environment to support those goals.
- The ways in which you intend to gather data to determine effectiveness and evaluate learning.

The goals in your learning plan provide targets of what the organization would aim to accomplish within specific time frames. These goals and initiatives should clearly align with your organization's vision, mission, values, and strategic plans. The goals should be broken out to include individual learning goals, group goals, and organization goals that are aligned with the organization's mission. To enhance motivation and ensure that the goals are clearly articulated, each of the three levels of goals should be specific, measurable, adjustable, realistic, and time-based (i.e., target dates for completion). Goals at each of the three levels help to keep everyone in the organization focused on *why* they are learning (i.e., to support the mission) and headed in the same positive direction.

It is important to clearly identify and develop competencies to achieve these goals. Competencies describe what the individuals in your organization need to know and do for the organization to achieve its goals. Keep in mind that the individuals in your organization may need new competencies when the organization's needs or the environment changes. Therefore, the learning organization implementation plan needs to address any identified gaps between

current competencies and the competencies that your organization really needs to be ready for current and future challenges.

The learning methods and technologies are the means to help your organization create a supportive learning environment to achieve the competencies. Therefore, your plan should describe the specific methods that the organization will use to help individuals and groups close the specific competency gaps. For example, these methods may include group discussion forums, cloud-based team concept maps, augmented reality land navigation simulation training, interactive tactical decision games, mentoring, or adaptive digital flashcards that enable learners to recognize important symbols. Ideally, an organizational learning plan would include a variety of learning methods and opportunities that will support the learners' individual differences and the organizational goals.

Finally, the plan should identify how the organization intends to gather data to determine effectiveness and evaluate learning. Unfortunately, many organizations do not have a plan with a replicable process that explains how they intend to gather data to determine whether their plan or new method is effective. Successful learning organizations include a variety of assessment measures in their implementation plan so that they can obtain a wealth of information and continuously evaluate progress towards their goals.

The United States Marine Corps (USMC) Training and Education Command (TECOM) Future Learning Group is a specific example of how an organization has implemented an evidence-informed organizational learning process to integrate new learning innovations, science, and technologies. Established in 2017, the TECOM Future Learning Group is a special staff unit that advises the Commanding General of TECOM and has the mission to seek and assess innovative methods and technologies in order to enhance Marine learning (USMC TECOM 2017, Policy Letter 1-17). The Future Learning Group leads TECOM's S&T initiatives to enable the Marine Corps to better capitalize on emerging opportunities to improve Marine Corps training and education. Collaborating with S&T partners such as the Office of Naval Research and the Defense Advanced Research Projects Agency, the Future Learning Group scans over the horizon for emerging S&T that could significantly improve training and education. The TECOM Future Learning Group has evaluated emerging S&T prototypes such as augmented and virtual reality simulation technologies for small unit decision-making, adaptive mobile learning application technologies, and new instructional methodologies to enhance Marine Corps instructor development. The Future Learning Group is assisting TECOM to overcome the research-practice gap, navigate DoD S&T processes to more rapidly integrate learning S&T into Marine Corps programs, and facilitate organizational culture changes to encourage more innovative learning methods that will the transform the Marine Corps training and education model.

Future Learning Group uses an evidence-informed organizational learning process to provide recommendations regarding changes to Marine Corps organizational learning methods, policies, procedures, systems, and processes. For example, in March 2019, the Future Learning Group organized the Transforming the Training and Education Continuum Advisory Workshop in Quantico, Virginia to obtain TECOM stakeholders' input to develop specific recommendations addressing the TECOM Commander's Guidance (Mullen, 2018) priority task to transform the Marine Corps' training and education continuum from an industrial age learning model to a modern 21st century model. Instead of focusing primarily on teaching Marines *what* to think and do, a modern 21st century learning model teaches Marines higher order cognitive skills so that they understand *how* to better think, decide, and act. The workshop's problem-framing activities enabled TECOM to better understand why, when, and where the Marine Corps could make changes to the training and education continuum to enable Marines to be better prepared for future challenges. The 68 participants (37 military, 31 civilians) provided a range of recommendations, including advocating that the Marine Corps adopt a learning model that focuses on active, student-centered learning that fosters problem-solving and a drive for Marines to take intelligent action – concepts that were also later reflected in the *38th Commandant of the Marine Corps Commandant's Planning Guidance* (Berger, 2019). The Marine Corps requested that many of the specific workshop recommendations currently remain internal. However, the participants generally recommended that the learning continuum focus on building competencies that enable Marines to think critically, recognize when changes are needed, and increase adaptability so that Marines can better respond to changing conditions. Additionally, a key recommendation was that the Marine Corps' policies and resources better focus on leveraging modern technologies to create an integrated learning ecosystem.

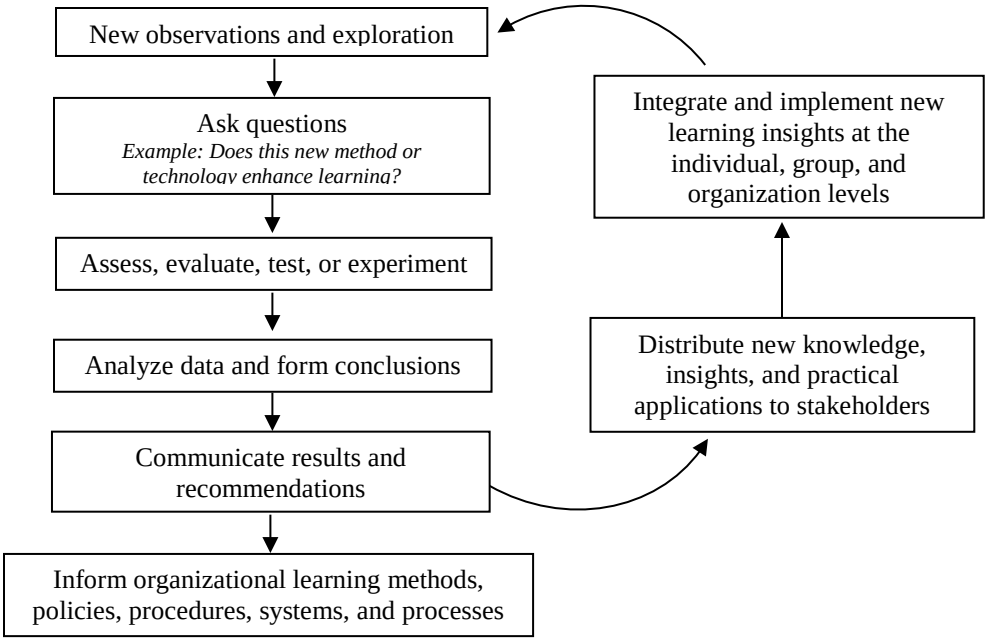

Figure 2. The evidence-informed organizational learning process implemented by the USMC TECOM Future Learning Group.

Figure 2 shows the evidence-informed organizational learning process implemented by the USMC TECOM Future Learning Group (Vierling, 2019). Beginning with "new observations and exploration," the Future Learning Group contributes to TECOM organizational learning of S&T opportunities by identifying (i.e., observing) current and future Marine Corps learning needs, competencies, gaps, and goals – and how they relate to the individual, group, TECOM organization, and overall Marine Corps levels. Then, the Future Learning Group asks questions to explore the new learning prototype S&T, tests the new method or technology, gathers data, analyzes the data to form conclusions, and provides recommendations to TECOM leadership. These results and recommendations that we provide to leadership then inform organizational learning methods, policies, procedures, systems, and processes. The Future Learning Group quickly distributes the new knowledge, insights, and practical applications to stakeholders both within and (as appropriate) external to the command in a variety of ways, such as through the TECOM S&T Working Group and other venues. These new learning knowledge, insights, practical applications, and lessons learned are then integrated into current and future learning programs at the individual, group, and organization levels. The Future Learning Group continues to seek and assess innovative methods and technologies to enhance learning in accord with its mission, the TECOM mission, and Marine Corps needs. Therefore, the evidence-informed organizational learning process continues to build upon these previous and new learning insights at the individual, group, and organization levels. These learning insights inform the Future Learning Group's subsequent observations, planning, and the exploration of new learning S&T to enhance Marine Corps training and education.

Individuals, groups, and institutions are embracing distributed and ubiquitous learning technologies to create, communicate, collaborate, connect, and coordinate learning environments to enhance learning. However, there are still vast differences in learners' access to information technologies, cloud-based services, and even basic Wi-Fi across the DoD due to policy implementation, limited resources, and in some organizations - a lack of information technology infrastructure. These challenges impact the effective exploration, assessment, development, and adoption of innovative learning methods - and discourages organizational transformation from an industrial age model of learning to a more future-focused learning model. Organizations should take active steps to help practitioners to adopt innovative instructional methods by providing both formal and informal learning opportunities, encouraging them to experiment with new instructional methods and technology prototypes, and enabling them to easily share their results and best practices. As an example, Table 1 provides a few factors that could be included into your own organizational learning framework and implementation plan.

Table 1. Example factors for a learning organization implementation plan

Psychological, Social, and Environmental Factors	Explore S&T	Data Gathering and Analysis	Communication and Recommendations	Integrate and Implement
• Organization's mission and goals • Organization's learning culture • Organization's learning model • Identify the learners' needs, competencies, gaps, motivations, challenges, perceived barriers, and friction points • Social, collective, and team learning • Learning facilitators, instructors, coaches, and mentors • New and legacy systems • Information technology infrastructure (e.g., Wi-Fi) • Resource and policy constraints	• New methods to accelerate and enhance learning • Innovative methods to address the identified problem(s) • Human factors and human-system integration • Human-centered designs for technology interfaces • Interoperable and extensible software • Total learning architecture • Learning technologies, apps, games, sensors, collaboration tools, and simulations	• Policies and processes for human research and/or user assessments • Teams and tools to gather learning data • Information assurance • Cybersecurity • Privacy and personally identifiable information (PII) • Common data structures or translators • Interoperability specifications • Secure data and record storage • Assess learning at the individual, group, and organization levels • Analyze results	• Translate research results for stakeholders - avoid technical jargon whenever possible • Distribute results, best practices, and lessons learned • Results inform recommendations for organizational learning methods, policies, procedures, systems, and processes • Share specifications and standards • Create opportunities to exchange information and ideas • Communication methods (e.g., in-person, webinars, websites, and social media) • Actionable recommendations	• Evidence-informed organizational learning • Learner-centered instructional design • Easily accessible learning at the points of need • Tailored, relevant life-long learning • Personalized and updated learning plans • Updated learning materials and interactive delivery methods • Integrated learning ecosystem • Innovative S&T to enhance learning programs • Effective learning at the individual, group, and organization levels

RECOMMENDATIONS

The future learning environment will enable learners to access learning opportunities, connect with peers and instructors, track their learning competencies and progress, and tailor their learning *at their points of need* through a pervasive, ubiquitous, and interactive system of learning systems. Four key foundational learning organizational changes are recommended:

1. View learning not as a single event or series of events, but rather as a connected, constantly updated streaming of experiences over the learner's career or lifespan, and the three levels (individual, group, and organization) to identify emerging learning needs based on dynamic real-world and operational demands.

2. Personalize the learning progression pathways to the individual, group, and organization's unique attributes, skills, competencies, culture, and needs.

3. Collect and rapidly analyze data on learning and human performance to improve learning content and presentation at all levels (individual, group, and organization).

4. Focus information and data visualization methods on ensuring deep learning that improves knowledge acquisition, application, and learning transfer to real-world operational environments.

CONCLUSION

Full development and implementation of the learning ecosystem has yet to be achieved due to a variety of infrastructure, resource, and policy related challenges. For example, DoD organizations are looking to not only explore and integrate innovative learning technologies into programs, but also to leverage legacy systems as much as possible due to resource constraints. Integrating systems that were not originally designed to interoperate or communicate can lead to a variety of technology challenges. Additionally, information technology security policies in some DoD organizations limit or prohibit learners' access to Wi-Fi, cloud, or streaming video technologies. Remarkably, there are DoD schoolhouses that do not have access to the above technologies, largely due to policy issues and cybersecurity concerns.

There are currently DoD modernization initiatives to consolidate learning technology software platforms, associated cloud server delivery platforms, licensing, and related training and education activities to achieve better economies of scale and integration across platforms (Lopez, 2019). Although these initiatives have yet to fully address the Services' challenges in modernizing learning environment infrastructure and digitizing schoolhouse content, they are good initial steps. DoD organizations can develop organizational learning frameworks to better take advantage of emerging opportunities to implement transformative changes to their learning environments. An organizational learning framework enabled TECOM to develop specific recommendations to evolve its learning continuum to better enable Marines to think critically, recognize when changes are needed, and increase adaptability so that Marines can be more ready to respond to changing conditions.

DoD's future learning environments will enable learners and instructors to not only communicate in real-time from anywhere, but also to automatically update the learning materials, view instructional videos, engage in collective instructional and interactive games, interact with increasingly challenging simulations, tailor the content to accelerate learning, and to gather data to track their competency development along a path to mastery – in a way that balances access with security. All of this is possible and within reach. However, it requires the support of leadership and policy makers to enable this learning transformation and culture change.

Ultimately, the provided framework is intended to help practitioners determine the methods, technologies, policies, practices, and programs that can enable better service member learning, which will lead to increased readiness and lethality. Specific examples and a learning organization implementation plan were provided to help practitioners better understand how they can adapt this organizational learning framework to their own organization's mission, goals, and needs. The framework leverages the relevant previous learning while integrating innovative S&T into learning programs, enabling the organization's processes, practices, policies, methods, and structure to evolve and be more adaptive. When paired with enhanced organizational awareness, the framework and implementation plan provide how to better explore S&T, identify best practices, and modify existing processes. These steps will support practitioners in implementing effective methods and technologies to accelerate learning, bridge the research-practice gap, and create the organizational changes needed to enable the learning ecosystem. Current and future environments require that organizations evolve by continuously integrating new learning insights and technologies to better foster higher order cognitive skills and competencies. These organizational learning changes will enable military service members to better develop an intellectual edge, greater readiness, and lethality to succeed in future complex environments.

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