The Changing Face of Military Learning

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ABSTRACT

Globalization, social media, ever-increasing computing power, and the proliferation of low-cost advanced technologies have created a level of worldwide complexity and rapid change never before seen. To remain competitive in this environment, the US Department of Defense and our coalition allies must identify new ways to empower our forces. In this paper, we assert that part of that solution includes increased investments in our Human Dimension. Specifically, we argue that military personnel require an expanded set of competencies, higher levels of nuanced skills such as critical thinking and emotional intelligence, and more efficient and agile pathways to expertise, and that achieving these outcomes depends, at least in part, on revising the military learning enterprise.

Towards this end, we outline a vision for the future of military learning, painting a picture of the “art of the possible” and proposing a roadmap that outlines five enabling conditions needed to achieve this future vision. The conditions include: (1) Cultivate ubiquitous learner-centric, technology-enabled instruction; (2) Build upon the foundations of data-driven learning; (3) Foster a learning culture at the organizational level; (4) Encourage and empower social learning; and (5) Draw upon deliberate practices and the evidence-based body-of-knowledge from learning science. Enacting any one of these conditions will pose significant challenges, and particular science or technology gaps associated with each condition create additional hurdles. Nonetheless, we argue that the time is right, in terms of understanding and demand, to take action. One major step in that direction is to agree upon a shared grand strategy, that is a vision for our Human Dimension and the military learning system that empowers it. That is the professional dialog this paper attempts to help inform and encourage.

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The essential nature of war remains unchanging, although both its features and the world, in general, continue to evolve at an increasingly rapid pace. Globalization, ever-increasing computing power, and the proliferation of low-cost advanced technologies have created a level of worldwide complexity never before seen. Added to that, the democratization of communication, the rise of social collaborative technology, and an increasingly fluid notion of "nation" and "identity" enable widespread volatility. Digital communities form and take action around an idea, globally, before it even appears on the mainstream radar. The voices of government, national media, and conventional news outlets now compete with the voices of these multitudinous communities, many of whom provide greater appeal than the alternative formal channels. In short, the ways we learn, live, and collaborate are all shifting. To remain competitive, the US Department of Defense and our coalition allies must identify new, high-value targets that give our forces overmatch and allow us to thrive under volatile, uncertain, complex, and ambiguous (VUCA) circumstances. In this paper, we assert that investments in our Human Dimension are part of that solution.

The Human Dimension comprises the people, their skills, and the performance-enabling technologies that directly enhance their abilities, such as decision-support systems (US Army, 2008). Our personnel, or "human capital," carry a heavy burden in the evolving global military environment. They must be prepared to perform a broader range of missions, across all phases of war (from initial deferring activities through post-conflict stabilization and rebuilding), and across an expanded set of missions (including cybersecurity, expanded intelligence analysis, space, civil military affairs, and humanitarian assistance/disaster relief). They must possess the independent decision-making skills to operate without clear *a priori* task direction, because so many challenges they face are novel. They must have the capacity to operate on intent, balance their tactical actions against strategic goals, and integrate multiple domains of sophisticated skills (e.g., soldiering skills, sociocultural understanding, emotional intelligence, resilience, and self-reflection) all within a joint, interagency, intergovernmental, and multinational context. In other words, as Lt. Gen. Robert B. Brown, commanding general of the Army Combined Arms Center, recently remarked:

> For the last dozen years or so, the Army has said it needed people who are "comfortable" in conditions of "ambiguity and uncertainty… [but] If you want to win in a complex world, 'comfortable' isn't good enough. We need individuals who improve and thrive in conditions of uncertainty and chaos…" Needed to strengthen the human dimension are institutional agility, executing realistic training that replicates the complexity of the world, and the ability to out think the adversary and figure a way out of complex situations (Quoted from Ferdinando, 2014, at www.army.mil).

Table 1. Desired Leader Attributes (CJCS, 2013)

(1) The ability to understand the environment and the effect of all instruments of national power
(2) The ability to anticipate and adapt to surprise and uncertainty
(3) The ability to recognize change and lead transitions
(4) The ability to operate on intent through trust, empowerment, and understanding (Mission Command)
(5) The ability to make ethical decisions based on the shared values of the Profession of Arms
(6) The ability to think critically and strategically in applying joint warfighting principles and concepts to joint operations

Representatives from other services have issued similar statements. For instance, the *Marine Corps Vision and Strategy 2025* calls on the community to "prepare Marines for complex conditions and to counter the unexpected" and to help small unit leaders develop their abilities to "make sound decisions... in an increasingly complex environment while potentially operating in a decentralized manner" (MCV&S 2025; p.14). And the Chairman, Joint Chief of Staff's (CJCS) recently published his six "Desired Leader Attributes" [CJCS, 2013]) that centered on cognitive readiness–type skills, such as anticipation, adaptability, and critical thinking (see Table 1).

Despite the urgency and high-level support for Human Dimension efforts, it seems unlikely that significantly more time will be available to create increased capacity. Therefore, it stands to reason our personnel will need to achieve an expanded set of more sophisticated skills, behaviors, and attitudes within the same (or even less) amount of time. Further, given the VUCA milieu around us, personnel should expect to continuously learn, adapt, and grow across their entire careers. In other words, three fundamental reasons encourage reexamination of the status quo:

1. **Breadth:** Personnel require an expanded set of competencies
2. **Depth:** Personnel require higher levels of nuanced skills, e.g., critical thinking, anticipation, and empathy
3. **Velocity:** Personnel must gain these competencies more efficiently and have mechanisms for maintaining their relevance in an ever-changing environment

The remainder of our discussion will focus on personnel development as one part of the solution to meeting these issues. (Complementary approaches might include personnel selection, talent management, performance-enhancing technologies, and other external technological or system supports, but these fall outside the scope of this paper.) The following sections outline a vision for the future of learning within the Department of Defense and related coalition military agencies, painting a picture of the "art of the possible" and proposing a roadmap that, we believe, may help address the challenges outlined above and release the untapped potential of our Human Dimension.

VISION FOR THE FUTURE OF LEARNING

We envision a military learning environment that produces savvy, agile, and operationally adept individuals, teams, and organizational structures. In this future, our Human Dimension approaches each new challenge with reflection and creativity, the adaptability to notice and react quickly to evolving conditions, and a strategic understanding of the larger system and far-reaching effects of actions taken within it. This future force is not only comfortable in these conditions—but it thrives in them. Personnel develop deep understanding, across a range of cognitive, affective, interpersonal, and physical competences, and they refresh and adapt their knowledge and skills as situations evolve. The organization, too, shifts and grows easily with evolving needs, rapidly capturing and integrating lessons learned and disseminating new ideas painlessly across the enterprise.

To achieve this vision, we need to profoundly redesign the integrated continuum of formal and informal training, education, and operational experience. Hence we use the term "military learning" to more generically refer this integrated spectrum. We believe that five enabling conditions (defined below) will help bring this vision to life. If effectively realized, these conditions will construct a pervasive learning context—i.e., an intentional, interdependent learning environment composed of processes, technologies, and cultural practices. In other words, these conditions do not represent technologies nor specific modalities of delivery, per se. These conditions instead define the enabling context, including interaction types, desired outcomes, and delivery approaches that create the conditions for effective future learning. (For an expanded discussion on the nature and need to reform military education, training, and learning *cf.* Johnson-Freese, 2011, and Dempsey, 2012a, 2012b.)

ROADMAP TO THE FUTURE VISION

Condition #1: Cultivate ubiquitous learner-centric, technology-enabled instruction

The roadmap begins with the idea of *fully blended* learning or what someone might call *ubiquitous learning*. This concept expands (substantially) upon the traditional definition of blended learning, which generally comprises some classroom delivery plus online elements. The expanded version proposed here parallels the idea of *ubiquitous computing*, i.e., where computing power exists everywhere, fills an essential role in our everyday lives, but—enabled by smart, transparent technology—fades into the landscape, below active notice.

Stated more plainly, "ubiquitous learning" defines a learning context that is pervasive, omnipresent, and transparent. This necessarily means that formal and informal learning (including just-in-time learning and on-the-job learning) become seamlessly integrated with more formal modes of instruction. This also means that distinctions between training and education—and even between personal development and operational duties—blur. Operational decision-support systems become learning and assessment systems (and vice versa), and all of these technologies also become sensors for detecting context, performance, and tracking lessons learned.

This notion shifts key portions of learning away from something formally bound by time and place, into something continuous, timely, and expressly relevant to each learner's tasks, state, and situation. As the classic study by Benjamin Bloom (1984) exemplifies, personalized learning, such as between a tutor and a student, achieves better learning outcomes than more homogenized instruction. Of course, providing individual tutors for students is cost prohibitive, but technologies can help fill this gap. Traditionally, this has been the rallying cry of the intelligent tutoring systems (ITSs) community. Today, that goal of automated, personalized learning has matured to include a more diverse set of formal and informal technologies that, like conventional ITSs, provide intelligent and adaptive learning experiences but across the broad military learning continuum as described above. This what we mean by the phrase "learner-centric, technology-enabled."

Many decades of research—often funded by the US Department of Defense—has helped to mature the field of adaptive learning technologies and science. Most, if not all, of the raw materials exist to implement the complete vision, but more efforts and integrative work will be required in several key areas. From our perspective, those areas include the following:

Blending of Learning Activities and Operations: Although not a technology, nor even a science per se, achieving the ubiquitous learning capability will require new processes and an evolved organizational culture that accepts the notion of "fully blended learning." Trainers, educators, instructional technologists, and operational systems designers (to name a few) will need to demolish the boundaries that separate their disciplines (and domains of ownership). Data, learning content, and even resources will need to be shared across organizational boundaries. Negotiating the processes to achieve this will likely prove just as challenging as developing the actual technologies that facilitate it.

Personal Assistant for Learning (PAL): Ubiquitous learning must be supported by a variety of systems, starting with a cluster of enabling technologies associated with a Personal Assistant for Learning (PAL). The PAL concept begins with an integrated learner model that captures a person's full range of attributes and formal and informal developmental experiences. Based on this data, it recommends new learning opportunities (macro-adaptation) and can inform micro-adaptation within a given learning context. The PAL must be context-aware (to enable recommendation of just-in-time or opportunistic learning) and incorporate open learner models that enable the individual learner (and, possibly, teachers and supervisors) to view his/her learning trajectory (e.g., Raybourn, Mills, & Weeks, 2013; Regan, Raybourn, & Durlach, 2013; Fletcher, 2011).

More learner-driven options (for both time and delivery): In a ubiquitous learning environment, learners necessarily take more ownership of their own development. This offers several benefits. First, learner-driven growth is often more effective than learning that is "done to" a student. Learner-driven content fosters metacognition (i.e., individuals thinking about their own thinking) and encourages greater personal accountability for growth. It helps students learn not only the content, but also how that content fits within the larger development context (e.g., because they directly see the trajectory of learning) and objectively how they are performing within that context. Technologies that enable learner-driven development promote generative learning processes (London, 2012), encouraging personnel to explore new ideas, try new ways of interacting, and actively apply their learning.

Second, from a practical perspective, learner-driven development is more flexible to the individual. Previously, we've written about "the paradox of the white space" (Fautua & Schatz, 2012); that is, any given training schedule is already densely filled with no time for more content; however, if personnel can complete a learning task on their own (e.g., an online course accessible anytime/anywhere) then they can most likely find "white space" in their own schedules to meet that requirement. Increasing learner-driven options creates more flexibility. Even unsophisticated delivery of self-paced learning has been shown to be at least equally as effective as other, traditional methods (e.g., classroom-based presentation), while also creating an efficient, more satisfying, and less frustrating learning environment for participants (Tatum & Lenel, 2012).

To achieve this increase in learner-driven development, we need to leverage enabling capabilities, such as:

- <u>Transmedia learning</u>, which enables nonlinear learning across a variety of media modalities and where students can start and stop their learning, shift between different tools and contexts, and gain additional insights from the contrasting delivery styles.

- Live/virtual/constructive (LVC) modeling and simulation, that is, the technology that directly enables the blending of training content or educational overlays into real-world contexts (and vice versa).
- Mobile learning, where "anytime, anywhere" becomes a reality, only constrained by available bandwidth, as learning management systems can flexibly serve content across a multitude of mobile learning access points.

Improved Andragogical Models: To support this future learning vision, in general, as well as the ubiquitous learning capability, specifically, improved instructional models will be needed. These need to have a more robust level of detail versus current broad-based solutions while offering greater scalability versus today's ITSs. The frameworks need to tell us how to best design the open learner models, when to recommend certain learning opportunities or make specific adaptations, and how to best integrate transmedia, LVC, and mobile learning into students' personalized development trajectories.

Condition #2: Build upon the foundations of data-driven learning

The concept of ubiquitous learning requires much more effective and extensive performance measurements and evaluations. (Where "measurement" or "test" refers to the quality of the data collection and "evaluation" refers to the quality of the interpretation and response to that data.) Without measurement, we cannot be agile, we lose efficiency with reinforcing known principles to advanced personnel, and we lose effectiveness by pushing unprepared individuals ahead. Measurement is the lynchpin to the future learning vision. Data-driven learning enables real-time adaptations, whether in an instructional or operational context (which are blended together seamlessly anyhow in the future learning vision), and it will enable organizational adaptability at higher levels. In a world where learning is constant, data in the form of measurements and evaluations will be more pervasive and must be woven into the learning experience (e.g., see Freeman et al., 2014).

To mature the idea of data-driven learning, we need to further develop, operationalize, and integrate several core capabilities including the following:

Massive human performance data: Douglas Hubbard, author of *How to Measure Anything*, remarked (during a special event panel at I/ITSEC 2014): "The best way to spend 1% of a budget is to use it to optimize the other 99%." Testing and evaluation enables this, and it offers a high return-on-investment because it provides insight, enables adjustments, and allows us to make better decisions by removing some uncertainty around them. Presently, the manpower, personnel, and training system within the military does a relatively poor job testing and evaluating personnel beyond their initial entry (e.g., ASFAB) or their physical factors (e.g., pace of a mile). As Brad Carson, acting undersecretary of defense for personnel and readiness, wrote in a recent memo (quoted from *Military Times*, see Tilghman, 2015): "In managing personnel, we use only a narrow slice of information about service members and, as a result, we cannot optimize assignment, training, development or utilization of the available talent pool. In short, we have a one-size-fits-all model of production, in which people are not seen as uniquely valuable so much as almost interchangeable inputs into an industrial machine." Measuring other attributes, as well as managing and analyzing a greatly expanded set of more demanding data, is challenging. Current technologies enable the capture, management, integration, storage, sharing, access, and protection of such big data, but work is needed to integrate the available capabilities and apply them towards the military human performance system, broadly defined.

Performance sensing technologies: Capturing this data will require a range of ancillary technologies, including environmentally based Internet of Things sensors, operational neurophysiological sensors, and other wearable devices (e.g., Riggi & Wamba, 2015). Together these technologies will support more realistic measures *in situ*. They will be noninvasive, blending into the background (e.g., stealth assessments; see Shute, 2011 or Shute & Kim, 2014). These capabilities will provide a basis for collecting data to inform the next item, expanded measures.

Expanded measures: In order to support the sort of learning outcomes described in the introduction, agencies will need an expanded set of metrics that can accurately capture and diagnose complex, unobservable, and latent knowledge, skills, and attitudes. To be most effective, this expanded set of measures will need to be multidimensional, collected in realistic contexts, and address all levels of assessment (from Kirkpatrick's level-

1 satisfaction to level-4 organizational outcomes). Further, the measures must address foundational attributes (e.g., competencies) versus highly context-specific task achievements (e.g., Mission Essential Task Lists). With the expanded scope of measures, assessments require improved psychometrics, such as greater reliability, sensitivity, repeatability, and integration into a larger assessment schema. With greater fidelity of learning and skill advancement, it would be a disservice for the assessments to remain basic go/no go summaries of performance.

Competency-based learning: Competency-based learning means focusing development interventions on the underlying human performance capacities (e.g., critical thinking and sensemaking) versus the context-specific tasks those capacities support. Competency-based learning offers two important benefits. First, focusing on underlying competencies directly supports preparation for the VUCA operational environment, where we are increasingly less able to fully define the exact tasks someone will need to complete (Voorhees, 2002). Second, we need a standardized set of competencies so that different systems can share human performance data; that is, by agreeing upon standardized competencies, their ontological relationships, and definitions of their internal steps (or stages of learning), different databases and instructional technologies can share content and learner performance (e.g., Sampson, & Fytros, 2008).

Traceability through layers of the organization: Within the Defense enterprise, any data-driven learning system will necessarily seek to translate individual *performance* data into individual *readiness* data. More than that, the system also requires models that predict team, collective, or institution-level readiness based upon collected data. These more abstract readiness estimates are unlikely to be simple aggregates of their component parts. This means that different models will be needed, with an emphasis on shifting the goal of learning based in response to the measured outcomes, or double loop learning (Argyris & Schon, 1978).

Condition #3: Foster a learning culture at the organizational level

By definition, "learning organizations" are those companies or agencies that continuously transform themselves to maintain relevance within changing conditions, respond nimbly to the newest threats, and capitalize upon emerging opportunities. To support these collective outcomes, learning organizations necessarily promote continuous improvement at the individual levels; they possess a set of organizational values, conventions, processes, and practices that encourage individuals—and the organization as a whole—to increase knowledge, competence, and performance. As a result, learning organizations reap many benefits. For example, a 2010 industry study conducted by Bersin & Associates, found that those organizations with a strong learning foundation tend to significantly outperform their peers in areas, such as employee productivity (37% greater), response to customer needs (34% better), and possessing skills to meet future demands (58% more likely; Mallon, 2010; for additional support see also Otter, 2012).

While military leaders may be less concerned with business outcomes, the underlying drivers of those outcomes (e.g., efficiency, responsiveness, and anticipation) are universal. Those attributes that support business outcomes also support the effectiveness and adaptability of Defense institutions in the face of volatility and turbulence. Defense agencies already invest heavily in lessons learned systems as well as information and knowledge management technologies. The aspiration to foster a culture of learning also already exists, but the scale and complexity of this task create challenges in all phases of the process from collection, to integration, and eventual dissemination. Emerging technologies will be needed to achieve this; two examples are provided below:

Social computing to collect lessons and forecast trends: High-impact learning cultures capture lessons learned and notice meaningful leading indicators in a timely fashion. Now reaching a sufficient level of maturity, social computing can support such processes. Social computing combines collaborative social technologies (e.g., micro-blogging), large-scale data, and associated analyses (e.g., Hubbard, 2011). For instance, we can leverage social computing crowdsourcing to identify learning opportunities or meaningful problem solving approaches, or in a more passive modality, to collect data to inform forecasting and sensing for weak signals such as population outlooks or changes in attitude.

Automated knowledge resource creation: A particular challenge of lessons-learned systems involves efficiently processing the large quantities of input data, turning it not only into information or knowledge, but transforming it into situationally relevant education and training content. This transformation from raw-data to optimized-learning traditionally requires trained analysts and instructional designers (with necessarily limited bandwidth), but automated semantic analysis systems can now supplement this process. For instance, performers working with the Army have demonstrated the use of semantic analysis to create standardized machine-readable data with testable topic models from doctrine or raw reports via automated semantic analysis (e.g., Ray, Brawner, & Robson, 2014).

Condition #4: Encourage and empower social learning

Social collaborative technologies have given rise to the "Social Age," where individuals connect (often globally) in informal communities who share and access information outside of the scope of traditional governance. Organizations have conventionally "owned" the training and education messages pushed down to learners. Such organizationally designed (formal) instruction will continue to play important roles for the foreseeable future; nonetheless, formal learning content is inherently abstract. Top-down content, no matter how engaging or dynamic, is always one step away from learners' immediate reality. To augment formally created content, individuals need spaces and resources that enable them to engage with one another, to share knowledge peer-to-peer (or even from bottom-to-top), to co-create meaning, probe new ideas, and create shared narratives. That is, future learners require *social learning* (Stodd, 2012).

Social learning grows out of scaffolded environments that nurture and facilitate reflective, community-based, informal learning situated within participants' everyday reality. Social learning should not be confused with social media, although connective and collaborative technologies typically facilitate social learning, it is more accurately defined by the behavior, scaffolding, and community exchanges that occur.

Adopting a scaffolded social learning approach requires a certain bravery, because the organization relinquishes full control of the story. It retains ownership of the overall narrative, but the community fills it with lived experience and meaning. Under this approach, organizations work within and alongside the grassroots communities, providing access to both the formal learning resources and tacit collective knowledge. In other words, organizations develop formal elements and then surrounded them with social, co-creative ones where participants can bring their own experience, everyday realities, personal challenges, ideas, and resources into the learning space.

Collaborative learning approaches: Social learning communities often manifest on their own, on Twitter or Reddit, for instance. However, to create deliberate (and secure) social learning venues requires more intentionality and a greater understanding of the nature of social learning. How can we effectively leverage peer-to-peer and bottom-up learning within the military learning enterprise (which has been, and will continue to frequently include, top-down learning)? What are the most appropriate enabling technologies and facilitating techniques that will foster genuine social learning?

Condition #5: Draw upon learning science deliberate practices and its body-of-knowledge

None of the previous roadmap elements will be possible without applying a deliberate, evidence-based approach to their design and implementation. The application of learning science helps meet this demand. Learning science is an applied, ecological discipline as well as a resulting body-of-knowledge about how people learn and how to enhance that learning. It touches on many related fields, such as cognitive science, neuroscience, computer science, educational psychology, anthropology, applied linguistics, and design science; however, it principally emphasizes the combination of human cognition and learning plus educational theory and practice. The primary goals of learning science practitioners include creating and discovering learning innovations, continuously improving instructional methods, and applying learning science knowledge to create effective, efficient, and affordable instructional interventions (Hays, 2006).

Effective application of learning science can enhance any and all aspects of the previously outlined vision, and to be clear, the use of iterative, evidence-based learning science methodologies is a critical enabler of those elements. In addition to the previously mentioned items, learning science can help inform the development of the following:

Improved humans-in-the-loop: Despite the many benefits technology provides, humans will continue to support the design, delivery, and evaluation of learning in fundamental ways. We should work hard to enhance their skills and prepare them to most effectively use the supporting technologies. (As we previously found, simply providing the tools to military instructors does not necessarily enable those instructors to effectively employ the tools, see Fautua et al., 2014).

Ongoing improvement of instructional delivery: Learning scientists (often working in conjunction with technologists and emerging software capabilities) continue to advance the discipline each year. Recent and ongoing areas of progress include better understanding and application of neuroscience principles, increased understanding of the factors that affect optimal learning states (such as the interplay of fatigue, stress, and nutrition), how to foster implicit learning, how gamification can contribute to instructional outcomes, and how to best apply other emerging techniques and technologies, such as Massive Open Online Courses (MOOCs). Continued analysis of such techniques—as well as many other future methods not yet popularized—will directly support the future learning vision.

CONCLUSION: ENABLING THE FUTURE

This paper defined five enabling conditions of a future military learning environment that reliably produces savvy and operationally adept individuals across all echelons, promotes a culture of organizational learning, and expands the breadth, depth, and agility of our Human Dimension. Admittedly, it's a big idea.

By painting this high-level picture of the "art of the possible" we hope to promote a conversation about a collective strategy for the future of military learning. As constituents of the military learning enterprise, if we work in isolation and pursue diverse projects that individually achieve limited short-term goals, then we *might* arrive at the desired emergent outcome (after considerable investment). If we work towards a shared vision, however, we can achieve success with more surety and efficiency. This means *designing* the entire learning system with the strategic outcome in mind, optimizing the whole system (versus trying to optimize individual, siloed parts of it), and considering the human element throughout that design effort. We need to work in concert towards a shared vision—a grand strategy—and with a high level of coordination among agencies, industry, and research centers.

The building blocks of the five conditions outlined above already exist; yet, no one has operationalized, integrated, or collectively implemented them into real military learning environments. Individual projects and other examples showcase the possibilities of each concept described above. They are like the raw materials needed to build a house, and the future military learning strategy (which this paper contributes to) is the blueprint for the building. We still need to put the pieces together, which is no small task. More work is needed.

We have reached critical mass in terms of understanding and demand for the future learning capability. The timing is right to unleash the full potential of our Human Dimension. All the resources are here—science, technology, and the demand—all we need is a shared strategy and the will to pursue it.

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