Enterprise Digital Learning Modernization: What, Why, and Who Says So?

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ABSTRACT

In FY18, in response to Executive Order 13781, DoD established the IT and Business Systems Reform, one of several reforms undertaken by the newly established DoD Chief Management Officer (CMO). The Deputy Secretary of Defense directed this series of reforms in October 2017, and in that same memo, he also encouraged a shift toward Defense-wide enterprise services, IT consolidation, and more efficient DoD business systems. One of the subareas under larger reform addresses is digital learning.

In July 2018, the Reform Management Group (senior Pentagon committee) approved the Enterprise Digital Learning Modernization initiative, which includes three distinct lines of effort focused on education and training. These include: (1) implement DoD-wide assisted acquisition and category management (i.e., centralized spending oversight) leveraging the Office of Personnel Management's (OPM) USALearning program, (2) develop an enterprise course catalog capability, and (3) develop an enterprise learner record repository capacity.

Work on this reform has gradually progressed over the last two years. In April 2019, OPM and DoD signed a memorandum of agreement outlining responsibilities and desired outcomes for the reform. At the same time, the DoD CMO issued a memo directing all DoD Components to participate in the three lines of effort. In 2019, stakeholders from the Pentagon, Air Force, and OPM began defining technical requirements for the course catalog and learner record repository. Senior executives representing training and education perspectives from the military, civilian, and DoD intel communities (along with a CMO representative) agreed to serve as an executive steering committee to oversee the reforms and ensure unity of effort across functional communities in April 2020.

In this paper, we summarize the Enterprise Digital Learning Modernization reform, including the antecedent directives and polices driving it. We also discuss current and forthcoming guidance about the reform stemming from the Pentagon, and we provide a general update on its implementation progress.

ABOUT THE AUTHORS

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INTRODUCTION

In July 2018, the Pentagon's Reform Management Group (the most senior review group in DoD) approved a Department-wide reform to comprehensively improve the efficiency and integration of DoD's technology-enabled training and education systems.

In broad strokes, the reform first seeks to get a handle on DoD's education and training spending—reducing duplications of effort, encouraging the use of shared services, and streamlining acquisition processes. Second, the reform seeks to encourage interoperability at the DoD-wide level. This starts by building an enterprise course catalog and an enterprise learning record repository (discussed in detail later), but the ultimate vision is to have a Department-wide federated digital learning ecosystem.

This sweeping reform affects every DoD organization and, potentially, all unclassified learning and development systems. That means a wide-ranging community—including training professionals, educators, acquisitions specialists, and IT administrators—all have a stake in it. This paper summarizes the reform's history as well as its goals and lines of effort. Most importantly, this paper explains some of the rationale behind the reform, including the DoD enterprise-wide expected results.

RATIONALE: WHY?

There's a "perfect storm" of reasons to modernize DoD's digital learning systems. Below is a brief highlight of some of the motivating factors, and the table at the end of this section further summarizes the rationale for this reform.

From a **business perspective (efficiency)**, the ways DoD purchases and manages its digital learning systems leaves room for improvement. Training and education technologies are typically considered to be "Human Resources" (HR) IT systems, and an internal review in 2015 by the DoD Deputy Chief Management Officer found DoD spends 870% more per fulltime employee on HR management than the next costliest commercial entity. Under this reform, DoD intends to strengthen its digital learning infrastructure, increase efficiencies related to training and education, and get better buying power for its education and training tools such as licenses and applications. This is accomplished, in part, by making that spending more transparent at an enterprise level, reducing duplications, and leveraging shared services such as shared IT/cloud management and enterprise-wide Platform/Software as a Service (P/SaaS).

From a **technology perspective (readiness)**, new learning delivery platforms, artificial intelligence (AI), and other data-centric capabilities have created countless opportunities to improve training and education outcomes—and, ultimately, to impact DoD's personnel readiness. But to realize those much-desired benefits, DoD must integrate its personnel-focused IT systems so that they share meaningful data across the enterprise. To establish that infrastructure, the Department requires modern technologies, technical interoperability, and sophisticated data handling processes. This problem is larger than training and education, but digital learning systems are an important part of the solution.

From a **bureaucratic perspective (policy)**, various authoritative government publications urge this sort of reform. Those policy and strategy papers tend to focus on IT modernization, data modernization, and/or talent management improvements. *DoD's Digital Modernization Strategy* (DoD, 2019) is a good example of the first category. It outlines a roadmap that embraces contemporary IT best practices, such as moving from legacy systems to more federated and enterprise-wide infrastructures as well as leveraging cloud computing, AI, and service-oriented architectures (SOAs). The *Foundations for Evidence-Based Policymaking Act of 2018* (USG, 2019) and the *Federal Data Strategy* exemplify

the second category. They describe methods and directives for creating data-driven work across the government. Finally, the *President's Management Agenda* (USG, 2018) exemplifies all three categories with its three lines of effort: (a) IT modernization, (b) data, accountability and transparency, and (c) people—workforce for the twenty-first century. (For a summary of these policies, see Briefel, Madsen, & Schatz, 2019. Also, refer to Raybourn, Schatz, Vogel-Walcutt, & Vierling, 2017, for a summary of Defense publications urging the modernization of learning.)

Table 1. Summary of Key Motivating Factors for Enterprise Digital Learning Modernization

Efficiency: Resources can be saved by reducing IT/license costs, reducing unnecessary duplications, and using more time-efficient processes:	**Readiness:** Improved personnel readiness can be found through better, more responsive, and more accessible training/education (T/E):	**Policy:** A small library of DoD and Federal strategy and policy documents direct the EDLM reform's approach, addressing components such as:
• Reduce duplicate IT systems ($) • Shift to shared P/SaaS ($) • Reduce duplicate e-courses ($) • Reduce course re-dos (🕑) • Streamline/speed acquisition (🕑)	• T/E more accessible at point of need • Connect learning in a continuum • Enable data-driven learning mgmt. • Data to validate T/E ⇆ Operations • Personalize talent interventions (AI)	• Modernization of data systems • Modernization of IT (cloud, SOA) • Improved use of shared services • Federated enterprise architecture • Modernization of talent mgmt.

BACKGROUND: WHO SAYS SO?

More than two decades ago, the Government Accountability Office (GAO) first added "DoD Business Systems Modernization" to its high-risk list, and the Defense Department has maintained that dubious title ever since. The latest GAO report in its biennial *High-Risk Series* explains (GAO, 2019, p. 159):

> DoD spends billions of dollars each year to acquire modernized systems, including ones that address key areas such as personnel, financial management, health care, and logistics. While DoD's capacity for modernizing its business systems has improved over time, significant challenges remain…(1) improving business system acquisition management, (2) improving business system investment management, and (3) leveraging DoD's federated business enterprise architecture.

Even though DoD IT and business systems made the list again in 2019, there's hope. This latest GAO report acknowledges, "Since our 2017 High-Risk Report, DoD has made improvements" (GAO, 2019, p. 159; see also GAO, 2020). In particular, DoD has made progress toward its federated business enterprise architecture, which is "a coherent family of parent and subsidiary architectures, to help modernize its nonintegrated and duplicative business operations and the systems that support them" (Senate Committee on Armed Services, 2012, p. 34).

In a federated business enterprise architecture, the "member architectures (e.g., Air Force, Army, and Navy) conform to an overarching corporate or parent architecture and utilize a common vocabulary…[and] governance across all business systems, functions, and activities" (GAO, 2013, p. 10). Among other things this approach includes "data standards, policies, procedures, and performance measures that are to be applied throughout the Department" (p. 15). This sort of integrated, enterprise approach reflects modern best practices for IT systems. It helps DoD provide better functionality while avoiding unnecessary duplicative investments.

Although DoD and other agencies have been working to improve their business systems for years, let's fast-forward to the current administration. In March 2017, President Trump signed Executive Order 13781 ("Comprehensive Plan for Reorganizing the Executive Branch," March 13, 2017). Among other things, the order directed federal agencies to submit plans for reforming their respective organizations to improve efficiency, effectiveness, and accountability.

Secretary of Defense James Mattis submitted DoD's plan, which identified several areas ripe for improvement, including (you guessed it) DoD's IT and business systems. Secretary Mattis directed DoD leaders to reduce the costs, improve the quality, and enhance the speed of delivering new capabilities (e.g., see Garamone, 2018). These sentiments were later echoed in the 2018 *National Defense Strategy*, which included "reforming the Department's business practices" as one of three lines of efforts (DoD, 2018). But even before the *National Defense Strategy* was released, Pentagon leaders were already working on the latest round of business system reforms.

In the most recent reform cycle, DoD identified nine priority areas: information technology, human resources, community services, contracts, real property, testing and evaluation, medical services, logistics and supply, and financial management (e.g., see Mehta, 2018). And in October 2017, the Deputy Secretary of Defense appointed a reform leader for the "Information Technology and Business Systems" portfolio, originally tapping John Bergin from DoD's Office of the Deputy Chief Management Officer (CMO) for the job (Shanahan, 2017). The Deputy's memo also encouraged DoD to examine enterprise-wide services, and it requested a time-phase roadmap of reforms—especially for the consolidation of IT systems.

In early 2018, the Pentagon formed the Reform Management Group, a cross-functional panel of senior leaders, focused on overseeing and aligning the assorted reform efforts. The group generally operates at the three-star or equivalent executive level, and it's chaired by the Chief Management Officer. The Deputy Secretary of Defense and the Director of DoD's Cost Assessment and Program Evaluation also participate, with the Deputy having ultimate responsibility for the group and for the reform outcomes.

After his appointment in 2017, John Bergin had identified around two dozen targets for IT optimization, and he grouped them into several functional areas. In January 2018, he appointed a team to review the "Human Resources Management" IT portfolio, which included "Learning Management Systems" (LMS; Bergin, 2018). That effort kicked-off around March 2018 and originally had a simple goal: Reduce the number of LMSs used across the DoD. The initial concept was to move all DoD e-learning to a single, or at least a small handful, of enterprise-wide LMS software applications. However, it soon became clear that this wouldn't satisfy the business reform's intent.

As Jay Gibson, DoD's first-ever CMO, said at the time:

> One thing I don't want to overlook is we're looking for operational efficiencies. Sometimes that simply yields financial benefit. Sometimes that yields what I'll call an operational readiness benefit, but not financial. But it's still good and still incredibly important. If we're able to simplify the process, reduce the number of man hours, sometimes that's hard to quantify, but there is still a tremendous benefit to readiness. Then sometimes we find the projects that have a nice blend of both. So it's not just money. (As quoted in an interview by Aaron Mehta, 2018.)

While simply reducing the number of LMS applications *might* have reduced DoD's LMS license and maintenance costs, it wouldn't have yielded the kind of true efficiencies or readiness improvements the CMO wanted. Transitioning the existing e-learning courseware (scattered across hundreds of existing LMSs) would have proven prohibitively time- and labor-intensive. Additionally, traditional LMS applications are inching toward obsolescence. Although still broadly applicable today, they're being replaced by more diverse digital learning delivery platforms (e.g., smartphones, virtual and augmented reality, e-books) and by disaggregated software services, like separate software apps for content, quizzes, and records. Suffice it to say, simply creating one big LMS for all of DoD wouldn't work.

In April 2018, the CMO's LMS reform lead approached the Advanced Distributed Learning (ADL) Initiative for help. Established in 1997, the ADL Initiative is DoD's "principal steward for researching and facilitating the implementation of DL [Distributed Learning] standards, specifications, and emerging technologies," and the program chairs the Defense ADL Advisory Committee, a DoD-wide working group of distributed learning stakeholders (DoDI 1322.26, 2017).

Pulling from the Defense ADL community, the ADL Initiative and OCMO assembled a working group, including representatives from across DoD military and civilian digital learning organizations, the Office of Personnel Management (OPM) USALearning program, and even the Canadian Forces' ADL program, who are pursuing similar modernization goals for their own learning systems. The group named themselves the "Learning Technology Working Group" or LTech WG for short. They examined DoD's digital learning portfolio and looked for ways to optimize it, in the CMO's true spirit of reform.

In May 2018, the LTech WG held a sort of "war game" to hash out different courses of action (Figure 1). Twenty-nine attendees, representing fifteen different Defense and government organizations, participated. This also included two members of the Canadian Forces as well as representatives from OPM's USALearning. The war game participants ultimately developed four courses of action (COAs), each with additional internal variants. Ultimately, the LTech WG

rejected the outdated and inefficient status quo. They also rejected ideas to move to a single or small number of DoD digital learning applications or to outsource to a single corporate provider. Instead, the LTech WG experts recommended a "Learning Ecosystem" COA.

Figure 1. In May 2018, the LTech WG held a "war game" to develop COAs for the reform

The Learning Ecosystem approach doesn't directly consolidate DoD's software applications, nor does it attempt to dictate, from the top down, what applications each DoD organization requires. Instead, in the spirit of a federated enterprise architecture, it encourages DoD organizations to implement standards-based, open-architecture, data-centric systems. (We will unpack that jargon a little later.) This approach also consolidates the acquisition and routine maintenance of those digital learning systems, leveraging OPM's USALearning program for support.

In June 2018, the IT/Business Systems reform lead, John Bergin, took those COAs to the Reform Management Group (DCMO Memo, June 27, 2018), and they selected the recommended Learning Ecosystem option. A month later, as requested, Bergin returned with more details on the implementation plan. He discussed the need for "DoD-enterprise level" digital learning management, and he reiterated the "integrated framework" approach. The CMO approved those plans, specifically agreeing to (DCMO Memo, July 25, 2018):

(1) Direct DoD to use OPM USALearning for **assisted acquisition** for training and education

(2) Direct the use of an **Enterprise Course Catalog**

(3) Direct the use of an **Enterprise Learner Record Repository**

For the next eight months, CMO personnel and the LTech WG developed more detailed implementation plans, and by the next spring, OPM and DoD had come to an arrangement on the way ahead. The acting OPM director, Margaret M. Weichert, and the acting DoD CMO, Lisa W. Hershman, signed a Memorandum of Agreement (MOA) defining their mutual plans on March 26, 2019 (Figure 2). The MOA reiterated the Reform Management Group's direction:

> Training and Education capabilities (formerly Learning Management Systems)…includes learning hardware, software, courseware, and other training and associated services typically procured from external sources.
>
> [The DoD Reform Management Group]…agreed to reform DoD's Training and Education capabilities via an enterprise approach that leverages USALearning for assisted acquisition, operation and maintenance of a DoD-wide Common Course Catalog and associated web portal, and operation and maintenance of a DoD-wide Common Learning Record Repository.

OPM's USALearning further agreed to provide:

> Rapid, agile, and responsive assisted acquisition and related technical support services that enable the acquisition of learning hardware, software, courseware, and other externally procured training and associated services at a speed and quality that meets or exceeds status quo DoD contracting.

A month later, Lisa Hershman issued a DoD memo directing Defense Components to first consider USALearning as a source for assisted acquisition of all relevant education and training products and services. It also directed DoD organizations to begin actively participating in the phased implementations of (a) "automated, interoperable course catalog(s) that will make available descriptions of unclassified courses into a common online portal" and (b) "a mechanism to digitally aggregate learning outcome data into a 'Common Learning Record Repository'" (Hershman, April 26, 2019). However, details on just what those two technical capabilities (i.e., the course catalog and records repository) would look like were still vague at that time.

Figure 2. In March 2019, senior government executives Margaret Weichert (left) and Lisa Hershman (right) sign an OPM-DoD MOA for DoD enterprise digital learning reform

Over the next year, DoD and OPM staff undertook the challenging tactical and technical work needed to realize the reform's vision. The OCMO set benchmarks for the reform's success. USALearning began expanding its staff, and DoD organizations started learning the new business processes. Meanwhile, the ADL Initiative (that DoD program for distributed learning research and development) was examining how to build the enterprise-wide course catalog and learning record capabilities. Along the way, the name of the reform finally changed—shedding the anachronistic "Learning Management Systems" moniker for the more contemporary "Enterprise Digital Learning Modernization" or EDLM.

During 2019, an implementation oversight council also gradually formed, originally through a coalition of the willing, with representation from military, civilian, and DoD intel training and education leaders as well as the OCMO's Director of Defense Business Systems and Enterprise Operations (who has the delegated responsibility for overseeing the reform's enactment). In April 2020, this group signed a charter, formalizing their collaboration as the EDLM Executive Steering Committee, with the following members:

- Director, Defense Business Systems and Enterprise Operations (chair)
- Deputy Assistant Secretary of Defense for Force Education and Training
- Director, Defense Civilian Personnel Advisory Service
- Director, Human Capital Management Office, DoD (Intel and Security)

The executives agreed to oversee the EDLM implementation plan, monitor progress toward the enterprise course catalog and enterprise learner record repository, establish operational and governance processes for the long-term initiative, and oversee full-scale implementation of the reform.

REFORM DETAILS: WHAT?

As mentioned in the introduction, the overall reform has lofty goals. It promises to substantively transform the way DoD manages, acquires, and technologically supports training and education. Initially, though, the EDLM initiative focuses on three lines of effort, which this section describes.

Line of Effort 1: Assisted Acquisition via USALearning

LOE-1 Objective: Streamline and centralize the acquisition of new education and training capabilities through the OPM USALearning program, which provides shared services for contracting, licensing, and cloud hosting.

Rationale

DoD allocates billions of dollars every year to military education and training, and a significant portion of those resources goes toward infrastructure, products, and services—and a subset of that involves digital learning systems. However, because of the way DoD manages its education and training spending (e.g., those expenditures are typically nested under functional budgetary categories versus a dedicated "learning" line of business), it's not clear just how much the Department spends on digital learning. One estimate provided to the Reform Management Group in 2018 puts the figure at over $485 million annually, with hundreds of different training/education software systems and more than 30,000 courses that could be optimized through digital learning reform. However, this figure likely only scratches the surface. (See DCMO, July 2018, for estimates developed to originally inform the EDLM reform.)

Part of the challenge is that, historically, each DoD organization has independently acquired its digital learning systems, software licenses, courseware, and other services. Not only does this encourage unintended and unnecessary duplications (e.g., two different offices both acquiring the same software), but it also prevents the DoD enterprise from optimizing across the portfolio (e.g., negotiating for bulk licenses or capitalizing on economies of scale). When each local organization does its own acquisition and management, it creates a great deal of administrative overhead

across the Department. Further, each local organization lacks organic subject-matter expertise for every relevant topic, so some activities (say, license cost negotiation in one office and mobile-learning software know-how in another) are bound to be unilateral and suboptimal for some organizations.

Certainly, digital learning acquisition is just one (of many) places where the government could better coordinate across its components. So it shouldn't be surprising that the Office of Management and Budget (OMB) recently directed federal agencies to make better use of shared services. Specifically, OMB Memorandum M-19-13 ("Category Management: Making Smarter Use of Common Contract Solutions and Practices," 2019) provides guidance on category management, i.e., the practice of buying common goods and services as an enterprise to eliminate redundancies, increase efficiency, and deliver more value and savings for the government.

Approach

OPM's USALearning program is the government's "category management" hub for digital learning. As explained in the *GSA and OPM FY 2021 Congressional Justification* (2020, p. 113):

> USALearning is certified by the Human Resource Line of Business (HRLOB) as the government's "Preferred Provider" for all products and services related to e-learning. These products include, but are not limited to, the design, development, delivery and support of learning management systems, learning content management systems, custom e-learning courses, IT security services, and custom software engineering services…[including] customized learning management systems, online forums such as communities of practice and social media integration, executive coaching, access to online course libraries, custom course development, hosting and helpdesk support, technical support services, online assessments, virtual conferencing, and various online technical support tools.

Said another way, USALearning provides management support (i.e., P/SaaS support for open-source, commercial, and government off-the-shelf software and other configurable solutions) as well as "assisted acquisition" services for digital learning systems. That means the program has resident subject-matter experts and contracting personnel who help other government organizations with their requirements, contracting, purchasing, and maintenance processes. USALearning is recognized by OMB as a "Best in Class" organization for this work. That designation goes to government-wide contracts satisfy vetted, well-managed, and recommended for use. GSA runs an Acquisition Gateway with information on USALearning and other Best in Class solutions (GSA, 2020). Finally, as an OPM organization (per 5 USC § 4116), USALearning is formally permitted to "advise and assist in the establishment, operation, and maintenance of the training programs." And (per 5 USC § 1304(e)(1)), it may use "revolving fund without fiscal year limitation."

For all of these reasons, the DoD CMO directed all DoD organizations to use USALearning's assisted acquisition process for timely and cost-efficient digital learning acquisition and other shared services (Hershman, 2019, 2020).

Metrics

All CMO reforms are managed via key performance indicators, which are tracked weekly through an automated reporting system. For this line of effort, the metrics include the following:

- Increase the training and education spending under management by USALearning
- Increase LMS shared services for Defense-wide agencies by reducing the number of independent LMSs
- Reduce the average training and education acquisition cycle time (i.e., fewer days from need-to-acquisition)

Line of Effort 2: Enterprise Course Catalog

LOE-2 Objective: The Enterprise Course Catalog provides a globally searchable directory of DoD course listings and ancillary instructional resources by automatically pulling metadata from local sources/catalogs. More than just another static course catalog, the ECC federates across numerous local data sources, allowing DoD personnel to use a single interface to access information from across DoD.

Rationale

Across DoD, different education and training organizations use many different methods to describe and publish their available courses, learning activities, and other instructional resources with varying degrees of detail and capability. This results in hundreds of proprietary and unconnected catalog capabilities across the Department—which promotes inefficiency, duplication of efforts, and a lack of awareness about available learning opportunities.

Existing course catalogs lack interoperability and are not designed to easily transfer data about learning activities between the different DoD systems. For example, most catalogs are integrated into proprietary platforms and use pre-determined, point-to-point connections to transfer data between systems, which results in lengthy integration efforts for each and every connected system. Additionally, these systems rarely accommodate new or diverse types of learning activities, such as e-books, augmented reality, or even simulations. Current course catalogs also use sparse, non-standard metadata to describe each course which results in minimal sharing of catalog data across DoD and limits the ability to identify course duplicates, share resources, or maximize the opportunity for learning across DoD.

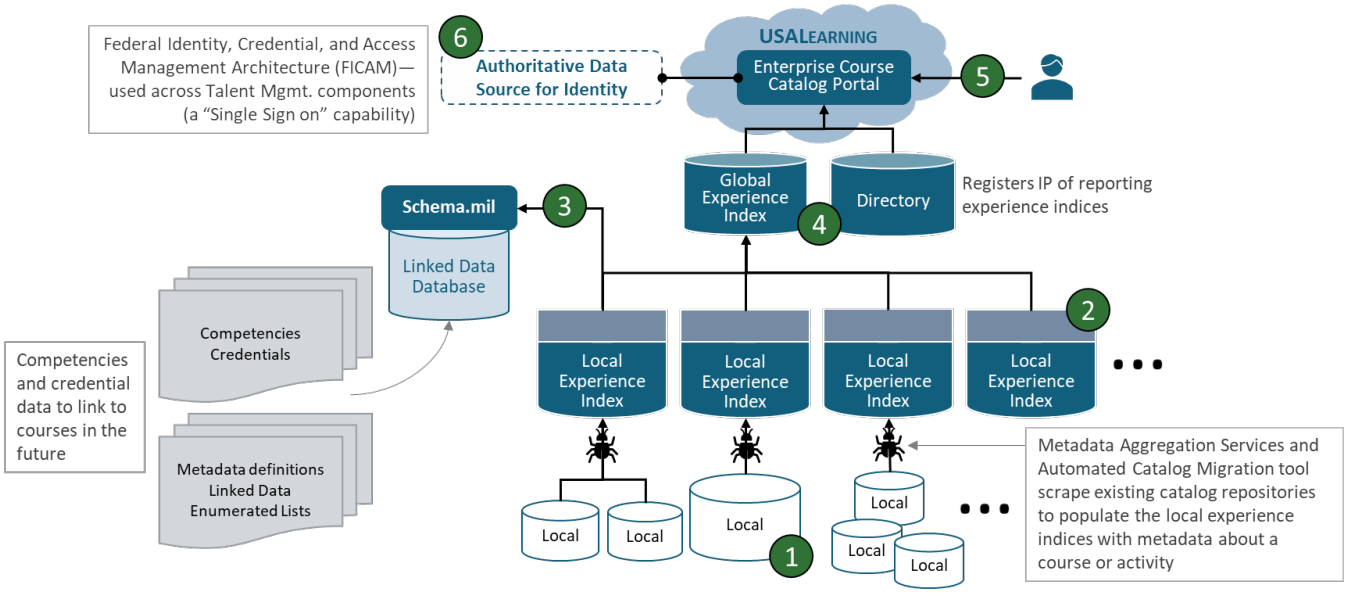

Figure 3. Diagram of the Enterprise Course Catalog capability. (1) Local course catalog databases remain the authoritative data sources. (2) A metadata aggregation service automatically generates descriptive information from the local data sources, and it stores the data within a local experience index, which interfaces across organizational boundaries to expose data to the enterprise-level system. (3) Linked data are stored in a schema server to provide shared vocabularies for competency definitions and other metadata attributes. (4) Local experience indices roll-up to the global experience index. (5) End-users can access the ECC capabilities through a single, online web portal. (6) Federated Identity, Credential, and Access Management (FICAM) allows end-users to click through the portal to any (allowable) course using a single sign-on capability.

Approach

Currently in R&D, the ECC will provide a global search capability that pulls information from the myriad of decentralized local catalog listings and aggregates them into a single, Defense-wide catalog. The local system owners will still retain the ownership and maintenance responsibilities for their individual course catalogs and their respective instructional content, but the ECC capability will make information about those available courses (i.e., metadata) discoverable across the DoD enterprise via a single web-based portal.

In other words, the ECC will provides a common interface. It will tie together existing catalogs (databases), automatically generate metadata from those local systems, and aggregating the metadata within a single portal. The larger EDLM learning ecosystem, which the ECC capability plugs-in to, will also provide accessible information on

careers, competencies, and credentials, which the course metadata from the ECC will align with to enable semantic interoperability across course listings. (See Figure 3.)

Metrics

For this line of effort, the benchmarks first apply to a developmental capability, tested through experiments during the R&D phase. These same metrics apply, but are assessed differently, as the ECC matures into a full operational capability. Regardless of the phase, the general metrics for the ECC include the following:

- Number of courses listed in the Enterprise Course Catalog (i.e., a proxy for breadth of adoption)
- Reduce time to find desired courses (i.e., time saving as a measure for reducing barriers to course access)
- Cost avoidance from unnecessary and duplicative course development (i.e., by making available courses more visible, we believe DoD will be better able to reuse existing instructional materials across the enterprise)

Line of Effort 3: Enterprise Learner Record Repository

LOE-3 Objective: The Enterprise Learner Record Repository (ELRR) allows DoD to expose and usefully aggregate local and global learner data from across the Department, including all training and education records, conferred credentials, and personal attributes and preferences through a federated data strategy.

Rationale

Across DoD, training and education records are distributed across a variety of systems and locked into countless disparate data formats. At an enterprise level, coarse-grained data about personnel's learning and development activities are captured (e.g., attendance at a training exercise) but more granular data are lost. Additionally, enterprise-level data often lack semantic interoperability, such as what might be achieved through the use of shared competency definitions. And the transport, control, management, and governance of training/education data are not easily accomplished across DoD's technological and organizational boundaries.

As a result, DoD isn't able to fully leverage all of its rich personnel training and readiness data. At the most obvious level, this creates inefficient duplications (e.g., individuals are required to retake prior training because their records don't transfer between, say, a military service and an intel organization). Looking a little further ahead, the lack of detailed and interoperable data means DoD isn't fully benefiting from enterprise-level analytics, such as tailoring personnel's developmental trajectories to their individualized needs or using more sophisticated (AI-based) people analytics for talent management planning.

Approach

Creating an enterprise architecture is no mean feat, and integrating data about people creates even more complications. There are the obvious challenges with security, identity verification, and ethics (e.g., privacy, ownership). Plus, whenever humans are involved, it's impossible to truly standardize—so there is bound to be a lot of noisy, unstructured, and volatile data. Finally, the data needed at the local levels (e.g., within a single simulator or mobile-learning app) are likely to be much more granular and idiosyncratic than the data needed at the enterprise-level (which will likely need more coarse-grained descriptions, such as someone's proven competencies or active licenses). Yet those coarser data still need traceability back to their original data sources, like a "chain of evidence" (or more formally data lineage).

To build an enterprise-wide system for learner data, DoD will need to establish a data fabric that scales across the Department, allowing local applications and organizations to retain their authoritative data while still aggregating data at an enterprise-level with enough fidelity to enable artificial intelligence (machine learning via big data sets). This enterprise capability will also need to decouple the data service layer from the application layer, enforce standards for data exchange (syntactic interoperability), and enable semantic interoperability. (See Figure 4.)

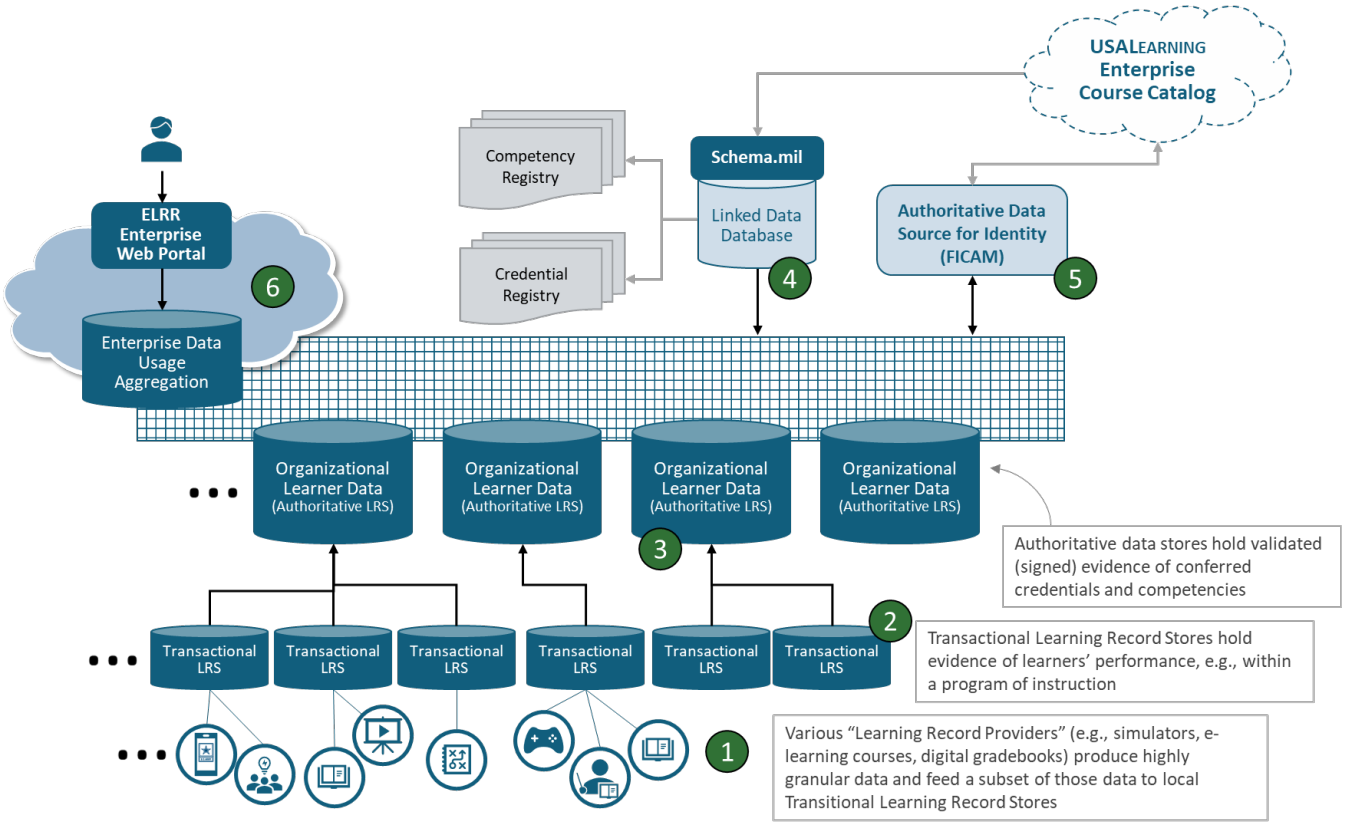

Figure 4. Diagram of the Enterprise Learner Record Repository capability. (1) Various "Learning Record Providers" (i.e., application that produce learning data, such as simulators, e-learning courses, or even gradebooks after a face-to-face class) each feeds-up a subset of their output data to local Transactional Learning Record Stores (LRSs). (2) These Transactional LRSs store granular evidence of learners' performance (e.g., for a program of instruction or series of courses aimed at achieving a certificate). (3) The Transaction LRSs federate up to greater organizational levels, abstracting the highly contextualized and granular data from the Transactional LRSs to the Authoritative LRSs. The Authoritative LRSs hold validated (signed) evidence of conferred credentials and competencies. (4) As with the ECC, the ELRR capability connects to the Schema.mil server, which provides the repository of linked data, namespaces, and vocabularies. (5) Again, like the ECC, the ELRR also uses DoD's FICAM policies to provide single sign-on capability and the necessary privacy and security controls for the learner data at rest. (6) Data drawn from across lower-echelon systems is available via an enterprise-level repository, with access for both human (self, commander, DoD leadership) and machine (AI) uses.

Metrics

Similar to the ECC, for this line of effort, the benchmarks first apply to a developmental capability, tested through experiments during the R&D phase. These same metrics apply, but are assessed differently, as the ELRR matures into a full operational capability. The initial metrics for the ELRR include the following:

- Number of connected Authoritative LRSs (i.e., a proxy for the breadth of adoption)
- Number of unique learners' records (i.e., individuals) accessible at the enterprise level (i.e., adoption proxy)
- Estimated cost avoidance due to exchange of learner records across organizational boundaries

BIG PICTURE

As DoD modernizes its acquisition and management of digital learning (through Line of Effort 1), and as it matures the corresponding data strategy (through Lines of Effort 2 and 3), it will not merely achieve three separate goals. Rather, in concert the three efforts build toward a "future learning ecosystem."

> At the highest level, the future learning ecosystem reflects a transformation—away from disconnected, episodic experiences and towards a curated continuum of lifelong learning, tailored to individuals, and delivered across diverse locations, media, and periods of time. Improved measures and analyses help optimize this system-of-systems and drive continuous adaptation and optimization across it. Its technological foundation is an "internet for learning" that not only allows ubiquitous access to learning, it also provides pathways for optimizing individual and workforce development at an unprecedented pace (Walcutt & Schatz, 2019, p. 4).

Achievement of the "future learning ecosystem" vision is still many years off, but the EDLM reform represents several major steps toward its realization.

STATUS AND NEXT STEPS

As of the writing of this paper (FY20 Q3), DoD continues to institute category management practices for training and education and is increasing the volume of products and services acquired through USALearning's assisted acquisition process. Last year, DoD recorded more than $110M in "spending under management" through USALearning. To further streamline those acquisition processes, OPM and DoD designed an automated business process and, in February 2020, launched a portal for submitting training and education requirements (https://projects.usalearning.net). The portal also automatically captures key performance indicators, such as spending and acquisition cycle time, and it provides visibility for monitoring the use of shared services and realization of cost savings.

In addition to acquiring software, USALearning also provides SaaS solutions. DoD and OPM are developing a secure USALearning SaaS digital learning environment for DoD-wide use. Initially, that environment includes a government off-the-shelf LMS and Learning Record Store, but additional applications will be added to that baseline over time. Some of those new features will include the aforementioned ECC and ELRR. Those two elements require ongoing research and development, however, but initial R&D deliverables are expected in FY21.

WHAT'S IN IT FOR ME?

Already the EDLM reform is having notable impacts on DoD. However, you still may be wondering: How does EDLM affect me, my organization, or my mission?

For DoD personnel who manage or deliver training and education: Submit your requirements related to digital learning products and services via the USALearning portal (https://projects.usalearning.net). Also, review the *USALearning Assisted Acquisition for Training and Education Guide* (distributed by the DoD CMO) for the associated policy guidance, "how to" information, and specific details on the scope of products and services included.

For DoD organizations developing or managing digital learning technologies: Check the USALearning portal to see if it can more efficiently provide some of your backend services, such as via their DoD-wide LMS or other enterprise-wide SaaS solutions. Additionally, as the EDLM capability matures, ensure your technology developers integrate the software and data specifications that enable the ECC and ELRR into your systems. Information on those specs will be published in DoD Instruction 1322.26 ("Distributed Learning"), with more details at www.adlnet.gov.

For technology vendors: When you develop systems for DoD digital learning, consider how they fit into the larger "learning ecosystem" rather than thinking of them as standalone platforms. More precisely, monitor progress on the software and data specifications associated with the EDLM reform, and as you develop new digital learning technologies, use those standards-based approaches for your data encoding, transport, and application programming interfaces. Similarly, use SOA designs so that your software can "plug into" other systems of systems and, ideally, so that subcomponents of your product can be individually added, removed, or upgraded. This advice applies broadly across the training and education community—to e-learning and mobile learning app developers, e-learning and simulation content creators, companies making classroom support technologies, and even simulation providers.

In summary: The EDLM effort is not simply an incremental improvement on the status quo; it represents a paradigm shift in the technology, methodology, and organization of training and education across the Department. EDLM also represents a true "modernization," in the deepest sense. As a result, it is having—and will continue to have—a profound impact on DoD's learning, development, operational efficiency, and, ultimately, personnel readiness.

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