Chapter 1

Introduction to ADL

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The potential of computers to aid instruction has long fascinated those in the field of learning, education, and training. Researchers and analysts have published hundreds of technical reports and journal articles illustrating clear advantages in terms of reducing instructional time and increasing effectiveness. Human resource managers, manpower analysts, and educational policymakers are enticed by the possibilities. When designed properly, using sound instructional principles, computer-based instruction can generally reduce training time by about one third, or increase learning outcomes by about one third, a finding detailed as the Rule of Thirds (Fletcher, this volume).

In the 1970s and the early 1980s, when computers were relatively expensive and communication networks limited, the U.S. Department of Defense was at the forefront of this research and analysis. The enormous training and education requirements of the military, with billions of dollars spent each year at training centers, staff colleges, reserve centers, and training ranges, offered fertile ground for the Rule of Thirds to pay dividends. Despite the empirical evidence, however, the implementation of computer-based instruction in the military was low, a notable exception being high-end weapons training devices. In an analysis reported in 1997 (Office of the Under Secretary of Defense, Personnel and Readiness, 1997), only four percent of the thousands of military courses for individual training were using computers for instructional delivery.

This lack of payoff was noted in a comprehensive strategic review of the strategies and priorities of the Department of Defense required by the U.S. Congress on a quadrennial basis (QDR, 1997). An examination conducted to account for the low computer usage rate in military training identified the *lack of interoperability* as the key obstacle. This chapter describes the influence of the ADL Initiative towards overcoming this obstacle.

This chapter overarches all other chapters within this volume. It serves as an organizing framework reflecting a shift from singular approaches to a strategy of wide-scale implementation of training technologies within the Department of Defense. A notional business paradigm, presented later, arrays the various chapters into a whole picture. As described by Khan (this volume), this business paradigm is consistent with other global views of educational technology.

The Interoperability Key

Interoperability refers to the ability of different sytems to exchange and use the same information, assuming that content is readily accessible. In the context of computer-based instruction, instructional delivery systems use specialized software

called learning management systems as their runtime environment. A runtime environment supports programs while they execute in order to enable platform-independent programming. In computer-based learning systems, runtime activities include the loading of content and linking of student records and progress, and, of course, the execution of the programs. Hundreds of learning management systems entered the marketplace over the past three decades. Early on, there were no specifications or standards to ensure interoperability.

In the initial phases of implementing computer-based instruction, companies developed learning management systems largely independently of each other, selling their products and services to the military Services and other Defense components. Subsequently, learning content developed on one specific system, designed, say, for a specific Navy schoolhouse, could not be shared with other schoolhouses unless they used the same system. Vendors designed systems that were proprietary, hoping to gain market share through promotion and pricing, and through added features.

Learning content was chained to a particular delivery system, unable to function, or interoperate, in other runtime environments. There was little incentive to change this business model, and many reasons to keep it. The strength of the ADL Initiative to invoke the use of standards and specifications for interoperability made the exchange of courses and learning content between learning management systems possible. From a student's perspective, the learning experiences across systems for a given course were essentially identical. This benefit has started to be realized on a large scale in the Department of Defense, has extended to other federal agencies, and is now openly available to all others in the learning, education, and training communities.

The Influence of the Internet

In the 1990s, the Internet, spawned from research sponsored by the military, became widely accessible. A separate but related advancement, the World Wide Web, enabled the spread of information over the Internet through the use of a common format, hypertext markup language, or html. Together they provided a common infrastructure for delivering learning content and a convention for its appearance.

Learning content could now be delivered through any number of Web browsers (Kearsley, 1996). Although this was not its intention, the Web formatting imposed constraints on instructional design which proved to be restrictive. For example, displays of instructional material could appear differently on different systems (Hannum, 2001). There were no common provisions for tracking students' progress. The systematic identification and exchange of learning content was not practical. To enable true interoperability, three elements were still needed: first, a common set of specifications for packaging the learning content and allowing that content to work across multiple learning management systems; second, a repository architecture that allows discovery and access to quality learning content; and third, a stimulus to motivate their implementation.

These factors demonstrated the need to inaugurate a program such as the ADL Initiative to develop options to increase the penetration of computer-based instruction in the U.S. military. Many outside of DoD were similarly interested in a Web-based delivery capability for learning, education, and training (Khan, 1997). Researchers, however, cautioned against overly optimistic views of what technology can do for instruction. Clark (1983), for example, identified the fundamental importance of sound pedagogy and design of instruction as the critical factor for instructional effectiveness, warning against overconfidence in the glittering technology which simply delivers instruction (Sitzmann & Ely, this volume; Gamor, this volume). Proponents of learning technologies have paid too little attention to important instructional design issues, focusing on media rather than learning objectives (Kozlowski & Bell, 2007). The ADL Initiative was well aware of this predisposition.

The Role of the Department of Defense

In 1997, the inability of learning systems and content to withstand infrastructure changes, due simply to the lack of standards, presented the major challenge to wide-scale implementation of education and training technology within the DoD. One military Service could not take advantage of what another Service developed. An inability to easily access quality content which could be repurposed for similar learning or performance objectives, and a lack of incentives for reusing content, further hindered progress. The same or similar courses were being developed multiple times. As a result of its 1997 review, the DoD recognized the need to address the learning needs of warfighters, operators, and Defense civilians in more effective and efficient ways.

In 1997, there was no single rallying point in the industry to lead a broad-scale attempt to change the existing condition. The aviation industry formed an industry-wide computer-based training committee in 1988, but it was geared toward the requirements of its members (Robson & Richards, this volume). There was a compelling need to develop standards and specifications to enable participants in the broader educational and training technology industry to create technical tools and solutions that would overcome the interoperability obstacle. The DoD responded to this need by initiating a program to accelerate large-scale development of dynamic and cost-effective learning tools and environments and to stimulate a vigorous global market for these products.

Formation of ADL

At a meeting sponsored by the White House Office of Science and Technology Policy in November 1997, the Advanced Distributed Learning (ADL) Initiative was formally launched to find a way to close the gap between the potential benefits of using computers in instruction on a broad scale and the current benefits realized with the existing state of usage. More than 350 policymakers, technology experts, educators, and training professionals attended the event and defined the ADL vision of developing the capability to deliver high quality instruction, delivered anytime, anywhere. ADL

set forth a new paradigm based on a structured, adaptive, collaborative effort between the public and private sectors to develop the standards and tools for the future learning environment. By establishing a common technical framework for computer-based and Web-based learning, ADL would foster an environment and the tools for the creation of reusable learning content.

For ADL to succeed, the Initiative needed partners who could collaborate to develop consensus on technical matters of interoperability, instructional designers and evaluators to check for solid pedagogical practice and to verify learning efficiencies and effectiveness, vendors to supply interoperable products, and buyers to demand such products be procured and implemented. ADL needed all stakeholders to work in concert towards a common goal. Developers and users had reciprocal interests. Missing was an overarching effort to channel these interests into a functioning, mutually supportive paradigm.

Executive Order

In 1999, President William J. Clinton issued an executive order (Executive Order No. 13111, 1999) directing the DoD to lead Federal participation in business and university organizations charged with developing consensus standards for training software and associated services. The order further directed the DoD to provide guidance to Defense agencies and advise the civilian agencies, as appropriate, on how best to use these standards for large-scale development and implementation of efficient and effective distributed learning technologies (Bardack, Koch, & Smith, this volume).

The U.S. Congress required the Department of Defense to develop a strategic plan for guiding and expanding distance learning initiatives. The directive stated that the Secretary may take into account the ongoing collaborative effort between the DoD, other Federal agencies, and private industry already known as the Advanced Distributed Learning Initiative, but must focus on the education and training goals and objectives of the DoD. The Strategic Plan for ADL was submitted to Congress in April 1999.

The ADL Vision

The ADL vision is to provide access to the highest quality education and training, tailored to individual needs, delivered cost effectively, anytime and anywhere. This vision has remained in place throughout the Initiative, and is worth keeping in mind collectively while charting the future course for ADL.

ADL's vision can be achieved affordably, and made feasible, primarily through the use of technology—specifically computer technology. Since computer technology is constantly evolving, ADL is preparing for a world where communications networks and personal delivery devices are pervasive and inexpensive, as well as transparent to the users in terms of ease of use and portability. ADL is determining how to best use next generation technology infrastructure for learning on demand in operational environments we have yet to experience.

Training for future military operations, which embody all characteristics of the information age, depends on access to the right information, making learning on demand a vital part of any training strategy (Alberts & Hayes, 2003). Training for such net-centric operations will rely on technology, as exemplified by ongoing efforts at the Joint Forces Command (Camacho, West, & Vozzo, this volume).

Similarly, the rapidly changing requirements and practices of the commercial sector are a substantial driver in advancing distributed learning into the workforce (Paradise, 2008). Academic and industrial laboratories continue to offer new insights into the science of learning (Fiore & Salas, 2007) and innovations abound from all corners of the globe (Khan, this volume). The force of these contributors must be channeled and coupled to the greatest extent possible if ADL is to serve as a model for providing high quality training and education to learners from all sectors.

A Notional Business Paradigm

The lofty vision of ADL required a new approach to doing business, one based not on a belief of "build it and they will come," but on a belief that sustainable advances in e-learning could be best achieved through cooperative efforts. Specifying an end state and requesting bidders to build a solution for others to apply was deemed impractical. The end state, such as a universal learning management system, depended on a point of view, a set of fixed requirements, and a means to maintain and upgrade the end state. Rather, the best approach appeared to be to sharpen the focus of the spectrum of users towards a common vision.

From the start, ADL engaged many partners and stakeholders in the learning-education-training field from government, industry, and academia, openly and in a collaborative spirit. Parties outside of the DoD had ongoing interests in contributing to certain elements of the common goal of accessibility and interoperability, most notably specification and standards bodies (Robson & Richards, this volume). To create value, ADL needed a business approach that incorporated two fundamental aspects, one technical and the other dealing with relationships across the sectors of stakeholders.

The ADL Initiative is wholly funded by the U.S. government and operates as a cost center rather than a profit-or-loss activity. Describing its setup in terms of a business approach shows ADL's pivotal and active role in fostering change. It also underscores the need for ADL to maintain neutrality in judging or recommending products from industry. Conformance to open standards and specifications endorsed by ADL is what matters.

Technical Aspect

The technical aspect of the notional model identifies interoperability across learning management systems as a first component. Here, interoperability is a general reference to the functional requirements of accessibility, interoperability, durability, and reusability which are described later. A second component of the technical aspect

concerns the art of sound instructional design, research on pedagogical models, as well as advances in the learning sciences that affect learning outcomes.

Sector Relationship Aspect

On the other hand, the sector relationships aspect represents a reach-out to parties external to ADL, also divided into two components. The first is represented by those who partner directly with ADL as advocates and supporters of common standards and specifications. The second component is represented by those forming the marketplace of buyers, and those developing and selling products and services that conform to the standards and specifications advocated by ADL.

Graphical Representation of the ADL Business Paradigm

The model of the ADL business paradigm may be depicted as a parallelogram, a four-sided figure in which the opposite sides are parallel and congruent. A notional representation of this model appears in Figure 1-1.

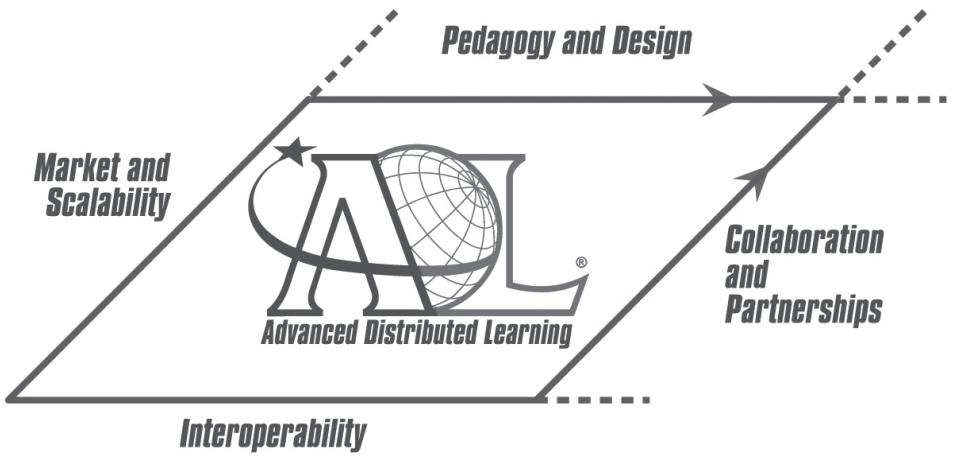

Figure 1-1. Graphic model of notional ADL business paradigm. The parallelogram depicts a structural design component above an interoperability component, and a market and scalability component opposite a collaboration and partnership component.

The solid lines, arbitrary in length, represent the current state of the paradigm. The future state is implied through dashed lines of arbitrary length. Note that the horizontal axes, reflecting the technical aspect, have dashed lines to the right only, implying durability. The thinking is that what has already been developed will sustain until it is improved. In contrast, the vertical axes, representing external relationships, have dashed lines that are bi-directional, implying that relationships can either grow or shrink over time. The thinking is that ADL can gain or lose support from its

stakeholders. The intention here is to have the figure serve as a notional model that frames ADL with providers, users, and technical developers.

Horizontal Axes

The two horizontal axes relate to the technical elements of ADL. The base of the figure is termed the Interoperability Line. Above and in parallel is the Pedagogy and Design Line. Advances in the base make possible new pedagogical approaches to instructional design. For example, a future compatibility of SCORM with online games opens new instructional design possibilities that can be accessed, shared, and reused (Xu, this volume). As one capability grows, so does the other; thus they are congruent. A key to making this happen is that users want such capabilities, and the marketplace offers them.

Vertical Axes

The vertical axes represent sector relationships. They are the Collaboration and Partnerships Line, arbitrarily positioned on the right, in parallel with the Market and Scalability Line. Together they reflect ADL's mutual interests with external organizations and customer needs. As the collaboration towards pursuing a common vision increases, and the partnerships with governments, industry, and academia expand, a marketplace for industry to offer products and services emerges. More buyers scale to more sellers. A growing marketplace can attract new partners and increase the level of collaboration; thus there is a congruence. Roughly speaking, ADL occupies the area inside this notional parallelogram. Elements of this business paradigm are referenced in all ensuing chapters.

The sector relationship aspect reflects the partnerships and collaborative activities needed to design, critique, and build the technical requirements. These relationships span the public, non-profit, industrial, and academic sectors. The relationships also concern those who design learning content compatible with the ADL runtime environment and are ready to make this content available to others for reuse or repurposing (Shanley et al., this volume). The relationship aspect concerns further those who risk capital, the vendor community, and enterprise developers in the learning-education-training marketplace. It concerns those who dispense resources to satisfy learning needs, such as agencies and corporations. Vendors profit from the sales of compatible systems, tools, and content. The buyers and users achieve their organizational goals in delivering quality instruction in affordable ways. Together, these become a loosely coupled collective business practice with a common interest in realizing the potential of computers for instruction and ultimately achieving the ADL vision.

Functional Requirements

An important factor in achieving the ADL vision is the re-shaping of what traditionally and conveniently has been called a "course" into a set of constituent "learning objects" (Fletcher, this volume). A learning object is an entity (learning

material) that can be used, re-used, or referenced in technology supported learning environments. From the student's perspective, they can be modules, lessons, units, chapters, sections, and assignments. Learning objects include multimedia content, instructional content, learning objectives, instructional software and software tools, instructional interventions, and persons, organizations, or events referenced in technology-supported learning. An early industry champion of the learning object construct, Cisco Systems, viewed a learning object as a single learning or performance objective that can be tested through assessments (Barritt & Alderman, 2004).

Learning objects are called sharable content objects (SCOs) in the terminology of ADL (Gallagher, this volume). These SCOs are individually tagged with defining terms, according to a standard, and housed in repositories for later discovery and use (Lannom, this volume). A fixed sequence of these objects may constitute a traditional course, but the power of ADL technology allows them to be sequenced in ways unique to an individual's prior knowledge, learning patterns, and goals, and, ultimately, on demand.

Sharable Content Objects—Functions

Sharable content objects need to meet specific criteria that represent the essential functional requirements that are at the heart of ADL. The most prominent requirements are:

Accessibility. It must be possible to find needed and sharable content objects. They must be accessible.

Interoperability. Once found, the objects should be usable. This means that they must be interoperable and portable across most, if not all, platforms, operating systems, browsers, and course development tools.

Durability. Once implemented, the objects should continue to operate reliably. If the underlying platform, operating system, or browser is modified (for instance when a new version is released and installed), the objects should continue to operate as before. They should be durable.

Reusability. Finally, objects should be reusable. Multiple platforms, operating systems, browsers, and courseware tools should be able to reuse, and even modify as needed, the original content objects.

Certainly, there are many views and perspectives on how these functional requirements can or should be accomplished. Ideas abound on the impact technology has on learning, education, and training. No one organization has the answers. From its inception, ADL followed an approach of community development. The stakes were high not only within the DoD, but to the many other interested parties across sectors willing to invest time and resources to achieve a common goal.

ADL Method of Work

The global marketplace for technology-based tools for learning is massive. Before the ADL Initiative took the lead, there were no common standards for creating tools that work in harmony and on a large scale. Collaboration was essential. Certain communities, such as the aviation industry, had already recognized the value of standards within their vertical market, but the vast enterprises representing education and training were locked into approaches and products that were proprietary. There was a clear need to spur industry to build a consensus to develop learning management systems, content, and tools that could be freely exchanged, to the advantage of all. ADL was in a unique position to serve this role due to the buying power of the DoD. The long-term value proposition was high quality education and training at a low cost.

The decisive first function of the Initiative was to contribute to the development, evaluation, and promotion of standards. This was done through working relationships with and participation in technical working groups and specifications and standards bodies (Robson & Richards, this volume). The Sharable Content Object Reference Model (SCORM) was the first product of the extensive public-private collaborative effort advocated by ADL, beginning in 1999. SCORM, at a high level, is a reference model—a collection of interrelated technical specifications and guidelines. It applies proven, but limited, developments in training technology through use of a specific content model to enable consistent formatting, packaging, and delivery of training across the e-learning community. In the opinion of numerous experts external to DoD, SCORM has become the global *de facto* standard for developing and delivering e-learning with tremendous possibilities for extensions to more recent advances.

Working the Technical Aspect

The business paradigm has at its base a consensus of technical specifications, standards, and architectures which define interoperability. Industry, through partnerships and collaborations with ADL, expressed a willingness to build conforming systems and develop conforming content. One of ADL's assumed roles is to compose a reference model that unifies various specifications into a harmonized whole, rigorously defined and testable. Learning content, media assets, entire courses, and even training interventions can be easily exchanged among users. This harmonized technical infrastructure allows different learning management systems to deliver, track, report on, and manage learning content and learner progress in a common way. Additionally, it sets the stage for making content discoverable, accessible, and reusable. Extensions to the base must permit backward compatibility, so that content is durable. The Interoperability Line in the ADL business paradigm represents this technical base.

Parallel to the base, the important contributions from instructional designers in creating learning experiences needs representation in the business paradigm. However, there can be a disparity between what a designer may have in mind and what the specifications allow. The early phases of the interoperability work limit what is possible in the design using SCORM (Roberts & Gallagher, this volume), so designs

using peer feedback, for example, are not included. Eventually this will be overcome through additions and new technical approaches. Such capabilities can be handled in various ways with learning management systems, but interoperability and content sharing are lost.

Requirements for advanced instructional designs will, in time, influence the extension of the technical base. For example, intelligent tutoring systems can lead to higher learning outcomes, but how should the technical base be extended to make this possible (Hu, Graesser, & Fowler, this volume)? Change can be accommodated but interoperability of systems and durability of content must be maintained. This aspect is referred to as the Instruction and Pedagogy Line in the ADL business paradigm.

There is, thus, a congruence between the Interoperability Line and the Instruction and Pedagogy Line: The instructional design can push the technical base to require certain functionality. In contrast, technical advances arising from progress in information sciences can pull new instructional design approaches. For example, the capabilities available in a virtual world environment have much appeal but how to best harmonize this environment for interoperability and apply it to learning is not yet clear (Gamor, this volume; Fowler, this volume). What is evident is that as the interoperability base extends, so too do the possibilities for innovative approaches to instructional design.

ADL practice is to work with others to identify and refine a common ground for a specification or standard. ADL plays a vital role in harmonizing the raw specifications. Alternate approaches to the specification approach are possible in the future, such as through architectures, services, and data models external to the learning management system (Panar, Rehak, & Thropp, this volume).

Working the Sector Relationship Aspect

The ADL business paradigm also involves relationships between those who develop the technical features, those who design instruction, and those who build the systems, tools, and content to make this all work. The ADL strategy depends on collaboration and partnerships. In 1999, the ADL Initiative established the first of several collaboration laboratories (ADL Co-Labs) in Alexandria, Virginia, to foster partnerships, resource sharing, and large-scale collaboration among the public and private sectors. The Department of Labor and the National Guard Bureau provided staff to support the mission to seek common tools, standards, content, and guidelines for the ADL Initiative (Bardack, Koch, & Smith, this volume).

Examples of ADL's formal activities that contributed to this business system include the sponsorship of technical working groups on SCORM, participation in specification and standards bodies, hosting a succession of Plugfests that brought together hundreds of participants from the broad e-learning community to discuss their concerns and demonstrate their solutions, and the provisioning of an active Web site and help desk. ADL also provided the test suite for all versions of SCORM and established independent test centers to conduct the testing. Less formal activities

included participation in the many e-learning conferences, such as providing keynote speakers, information booths, pre-conference workshops, and so forth. The ADL Co-Labs hosted hundreds of groups, including visiting researchers and government policy makers, some for periods of more than a year. Webinars are a more recent addition to ADL's informal outreach. Throughout, ADL has remained vendor-neutral.

Plugfests

Beginning in 2000, ADL began sponsoring a series of events, Plugfests, inviting the participation of all those active in the field of Web-based learning. The Plugfest events were cooperative efforts designed to offer "no-fault" interoperability testing for vendors, content providers, and tool makers. Participants plugged into a local area network and tested their wares with other providers, seeking to verify or reject interoperability claims, function by function, feature by feature. The ten Plugfests hosted in the United States were interspersed to coincide with enhancements to SCORM (Hasselbrack, Parmentier, & Downes, this volume). Two international Plugfests, one in Europe and one in Asia, served to broaden the commitment to the reference model.

The ADL Network

For the business aspect, partnerships and collaboration are required to gain traction in creating a marketplace and supply chain for systems, tools, and content. ADL's creation of a network of Collaborative Laboratories, or Co-Labs, is a leading example of collaboration.

ADL Collaborative Laboratory (Co-Lab) Network. Since the first ADL collaborative laboratory was founded in 1999, the initiative has sponsored three additional co-labs that focus on specific communities of interest. The ADL Co-Lab Hub in Alexandria, Virginia, focuses on all ADL activities whereas the Joint ADL Co-Lab in Orlando, Florida, focuses on U.S. military applications of ADL. The Academic ADL Co-Lab in Madison, Wisconsin, and the ADL Memphis Intelligent Tutoring Systems Center (formerly called the Workforce ADL Co-Lab) in Memphis, Tennessee focus on higher education and workforce development. What the Co-Labs have in common is support for a common reference model and assisting their respective sectors in implementation activities.

ADL Partnership Labs. Another innovation within the business aspect is the creation of an international network of ADL Partnership Laboratories. These were not envisioned during the initial strategic plan submitted to the U.S. Congress in 1999. Based on the practices surrounding ADL and the progress and name recognition coming from SCORM, other nations were interested in establishing a more formal relationship with ADL, such as Norway and Romania (Roceanu & Isaksen, this volume), Korea (Park, Ho, & Yun, this volume), and the Latin America region (Cartas, this volume). Starting with the United Kingdom in 2002, several nations have volunteered to champion the ADL cause, namely Canada, Korea, Australia, Norway, Romania, Germany, and a consortium of 14 Latin American and Caribbean nations. Some translate the ADL

documentation into their native languages, others develop internal compliance test centers, and others share content.

Additional Affiliations. Not formally affiliated as an ADL Partnership Lab is the ADL Working Group under the Consortium of Defense Academies and Security Studies Institutes, headquartered in Geneva, Switzerland (Synytsya & Staub, this volume). The Working Group has developed dozens of online courses through cooperative development teams across nations such as the Ukraine, Switzerland, Bulgaria, and Estonia. In October 2008, President George W. Bush signed the National Defense Authorization Act of 2009. One provision of the new law supports selective distribution of U.S. education and training materials and information technology to foreign personnel in order to enhance interoperability between our armed forces and the military forces of friendly foreign nations.

The global interest in ADL incubates a marketplace for the buying, selling, or exchanging of products and services. Industry must be willing to make up-front investments to ensure that their systems comply with the common technical infrastructure. Tool makers are needed to refine the common framework, incorporating functions and extending features needed by some but not necessarily all. Designers and content producers are needed to contribute best practices and quality learning content in order to achieve the economies of scale that make all this affordable. All are needed at the planning table to chart the next big steps for ADL.

The ADL Marketplace

Along with many organizations and much industry participation, ADL has accomplished much. The ADL vision is long term, and the progress must be steady. The ADL chronology (Hasselbrack, Parmentier, & Downes, this volume) illustrates a steady path of progress, from the launch of ADL to the issuance of its most recent edition of a reference model that incorporates numerous standards and specifications into a harmonized, working package.

ADL is the steward of the Sharable Content Object Reference Model (SCORM) which makes possible the interoperability of learning content, its initial goal (Gallagher, this volume). ADL has created a large following, evidenced not only by participation in the many Plugfests and the growth of its Co-Laboratory and international partnership networks, but especially by the number of vendors who develop products that are SCORM-conformant. The table below illustrates the interest in developing such products, starting with the earliest version of SCORM to its current version, 2004 4th edition. Each product has been independently certified through a third party test center (Panar, Brannon, & Poltrack, this volume).

Table 1-1
Certified SCORM products

Version of SCORM	Products Formally Certified
SCORM 1.2	158
SCORM 2004 2nd Ed.	65
SCORM 2004 3rd Ed.	63

Note: SCORM Version 1.2 was the first official specification with the option to certify. SCORM 2004 4th Ed. certification is expected in early 2010.

Finding Learning Content

One functional requirement of ADL is that learning content be accessible. SCORM does not address finding and reusing learning objects after they have been created. ADL researchers investigated the difficulties of creating learning objects, storing them, and managing them for discovery and access. This investigation drew from the fields of library science, computer and network systems design, and publishing (Dodds & Lewis, 2008).

Through a partnership with the Corporation for National Research Initiatives, the investigation resulted in the Content Object Discovery and Registration/Resolution Architecture (CORDRA). The first instance of this architecture is the ADL Registry, where learning objects are centrally registered and stored in repositories distributed throughout the DoD (Lannom, this volume). The architecture is open and available to others to replicate. A long term goal is to federate the various registries, creating a truly global resource for learning objects and other content packages that can play on SCORM-compatible delivery devices.

ADL Applications

ADL is being broadly implemented within the DoD (Murray & Marvin, this volume). During a recent one-year reporting period, more than ten million online courses had been completed by Service members and DoD civilians. These courses would otherwise require classroom space, time for transportation, instructors, and so forth to meet the same learning objectives. ADL is having a significant impact on training within the U.S. military.

One application area concerns the integration of content authored in SCORM environments with content in the form of technical publication data residing in S1000D™ common source database. An international body of researchers and engineers, led by the ADL Job Performance Technology Center, are defining requirements for a specification for such an integration of content sources (Gafford & Heller, this volume). Given that technical publications serve as the authoritative source of much technical

training content, the specification will enable a government to acquire, manage, and produce integrated training and technical information in vendor-neutral formats (International S1000D-SCORM Bridge Project Team, 2009). If widely adopted, a change in a technical publication can lead to an immediate, corresponding change in online technical training.

Defense Acquisition University

Another example of an application is the work at the Defense Acquisition University (DAU), which is a corporate university that trains the acquisition, technology, and logistics workforce of 125,000 people within the Department of Defense. Faced with the need to provide training as quickly and as cost effectively as possible, DAU has made strategic decisions that have allowed it to experience both growth and budget efficiencies simultaneously (Anderson, Hardy, & Leeson, 2008).

The enterprise provides workforce support in critical areas: certification training, performance support, communities of practice, and continuous learning. Each of these areas is supported by the learning network architecture that enables delivery of content in multiple modes, enriching interaction between learners, instructors, and content. By focusing on content as a strategic asset and implementing SCORM, DAU plans to benefit from the system's scalability by identifying opportunities for reuse and sharing of assets across multiple organizations.

The metrics are truly impressive. From 2001 to 2006, student enrollment increased from 46,000 to 113,000 per year while the average training cost per student dropped from $3,000 to $958. At the end of 2008, more than 240 continuous learning modules were available online and more than 330,000 completions were recorded. To accomplish this, DAU implemented its Performance Learning Model—a model through which traditional classroom training, distance learning, knowledge sharing, and other workforce resources are connected and aligned with mission and goals. DAU learning products are available around the clock—more than just a convenience, a necessity with a global, deployed workforce located across several continents and at sea.

Summary

The ADL Initiative has grown from a concept in 1997 to a global undertaking. The expansion of the use of technology in military training has increased tremendously, either for stand-alone delivery or in blend with other forms of instruction (Wisher, 2005). An unexpected consequence is the extent of global adoption of the ADL approach by other governments, for military as well as civilian training and education. The activities described in this chapter, and in the entire volume, are by no means comprehensive but rather demonstrative of the many ingredients of ADL.

The business paradigm used to describe ADL depended on solid technical ideas coupled with solid support from collaborators, partners, sellers and buyers, and steady funding from the U.S. Department of Defense. Since its inception, ADL

has hopefully made permanent strides towards providing high quality education and training, delivered on demand, and has done so in a manner that is open and fair. As ADL explores new technologies and new approaches toward achieving the vision, the future of e-learning is definitely bright.

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