

Paradigm Change in Military Education and Training

Herbert H. Bell
Independent Consultant

Charles M. Reigeluth
Indiana University

All branches of the U.S. military are moving toward education and training that is tailored to meet individuals' needs wherever they are and whenever they are ready to learn. The result will be a culture of continuous, personalized learning with learner progress that is based on proficiency and a greater emphasis on technology-enabled immersive learning environments. This article identifies challenges for military education and training, followed by a description of the ways the Army, Air Force, Navy, and Coast Guard are transforming their education and training systems to address those challenges. Finally, common threads, representative programs, and impediments to paradigm change are discussed.

Introduction

Today information technology creates the opportunity for individuals to acquire knowledge and skills from multiple sources. These sources include peers, mentors, and traditionally structured learning environments as well as evolving sources, such as social media, mobile

Herbert H. Bell is an independent consultant with over 40 years of experience in human factors, simulation, and training. He formerly served as the Technical Advisor of the Warfighter Readiness Research Division, Human Effectiveness Directorate, Air Force Research Laboratory. He received his Ph.D. in experimental psychology from Vanderbilt University and is a member of several professional organizations, including IEEE, the Human Factors and Ergonomics Society, and the Psychonomic Society (e-mail: hbbb46@gmail.com). **Charles M. Reigeluth**, a Contributing Editor, is Professor Emeritus, Instructional Systems Technology Department, School of Education, Indiana University. His research focuses on paradigm change in educational systems utilizing digital technology and personalized educational methods. He is internationally known for his work on instructional theories and methods (e-mail: reigelut@indiana.edu). The authors acknowledge the input to this article from Andrea Marcille, Commanding Officer at the U.S. Coast Guard's Leadership Development Center.

devices, and other electronic means that allow on-demand access to information and experts who address specific questions and problems. The result is expanded models for education and training that can be tailored to meet individual needs and delivered at time of need.

A new military education and training paradigm is emerging in which individuals will enjoy unprecedented access to learning facilitated via computers, virtual environments, and hand-held mobile devices. That learning will be individually tailored using advanced learning management systems, and the resources will be updated not only by "instructors," but also by individual service members based on real-time changes to tactics, techniques, and procedures as they occur in operational environments. The result will be a culture of continuous, personalized learning with a reduced emphasis on traditional learning infrastructure, such as formal classrooms and lectures, and a greater emphasis on technology-enabled learning, such as simulation and gaming and virtual instruction.

The Department of Defense and each of the military services has long sponsored research and development involving both training technologies and training methods. These efforts have included instructional system development, simulation and gaming, advanced distributed learning, and intelligent tutoring systems. The Assistant Secretary of Defense (Research & Engineering) has identified personnel and training as a science and technology focus area. The objective is to discover, develop, and demonstrate advanced training methods and technologies that will improve military readiness and reduce cost. In order to achieve this objective, the Service laboratories are focusing their science and technology efforts on the principles of training design, the development of scenario-based training, and the establishment of "persistent integrated training" (Tangney, 2013).

The switch from the sorting-focused, standardized paradigm of education in which learner progress is based on time, to the learning-focused, customized paradigm in which learner progress is based on proficiency is every bit as important in the military defense sector as it is in the K-12 and higher education sectors. This article describes recent activities in pursuit of paradigm change in U.S. military education and training systems.

Military Education and Training

Military education and training is a big enterprise. It occurs throughout the career of military members and is conducted in two different venues: formal educational and training institutions and operational units. In this article, we focus on institutional education and training rather than operational training. However, it is important to remember that, while institutional training provides the basic knowledge and skills needed for each Service member, advanced competencies and expertise are

currently developed mostly within the operational portion of the Services. In ships, Marine companies, Army battalions, and Air Force squadrons, individuals learn the advanced skills, tactics, techniques, and procedures and engage in the deliberate practice needed to successfully perform their military mission. Many of the same changes associated with institutional military education and training are also becoming a part of operational training.

According to the U.S. Army Training and Doctrine Command (TRADOC), over half a million individuals annually complete course-based training in the US Army alone (TRADOC, 2011a). Those courses span a wide range of learning (e.g., basic military skills, complex technical training, national security policy and strategy) and audiences (from basic recruits to senior officers).

Initial military training for each of the Services follows the same general progression from basic training to skill training. Basic training is an intense eight to 12 week period of indoctrination and instruction designed to transform recruits into disciplined Soldiers, Sailors, Marines, Coast Guardsmen, or Airmen who are physically fit and possess basic military knowledge and skills. Basic training provides recruits fundamental training that includes core values, weapon maintenance, military customs and courtesies, drill and ceremonies, first aid, marksmanship, and military justice.

Following the completion of basic training, service members enter specialty training, where they develop skills in a designated specialty that will prepare them for one of the many military career fields (e.g., aircraft mechanic, infantryman, sonar technician) available within each Service. Assignment to specialty training is determined by the needs of the Service, scores on the Armed Services Vocational Aptitude Battery, and individual preferences. The length of specialty training varies widely from only a few weeks to as long as two years. Following completion of specialty training, individuals are assigned to units and begin performing their military jobs. As they progress in their career field, individuals receive both on-the-job and formal skill training.

Each of the Services also provides Professional Military Education (PME) opportunities for officers and senior enlisted personnel. While education and training are not mutually exclusive, PME differs from skill training in that it emphasizes material that has a more traditional academic flavor. Military education is intended to help military personnel develop the good judgment to decide when and how to apply their knowledge and skills in the larger military, political, and social context, and it provides educational opportunities within the Services and at external academic institutions.

Challenges for Military Education and Training

Given both the cost and the importance of producing a well trained and well educated military, "efficiency

(time and resources expended) and effectiveness (production of human competence) are critical" (Fletcher, 2009, p. 72). However, there are several challenges involved in providing efficient and effective training and education for our military. These challenges include:

- less money available to maintain and update classrooms and courses as the overall defense budget declines;
- the need to provide training for a wide variety of missions, each requiring its own set of competencies;
- increased complexity of modern weapon systems;
- rapid changes in doctrine, tactics, and equipment;
- frequent deployments away from home-station that limit opportunities for in-resident training and education; and
- increased workload as the military continues to perform the same jobs with fewer people.

As a result, each of the Services and the Department of Defense are reevaluating their training and education paradigms in order to gain greater efficiency and effectiveness.

US Army Education and Training

Systems change in response to their systemic environment. Small changes in the environment are handled by piecemeal reforms in a system, whereas dramatic changes in the environment require paradigm change in a system. The U.S. Army's environment has changed dramatically over the past decade or two. Complex technologies now pervade all aspects of the Army's operations. Also, the war on terror has made it far more difficult to tell who the enemy is and to find the enemy. These new conditions require much more sophisticated and well-trained soldiers, more adaptability (i.e., distribution of decision-making authority to lower ranks), more problem solving, and more cultural sensitivity, collectively referred to as "operational factors."

In recognition of the dramatically changed needs for its education and training, the Army's Training and Doctrine Command (TRADOC) produced a pamphlet (Pam 525-8-2) in January 2011 calling for dramatic changes in its education and training systems. Called *The U.S. Army Learning Concept for 2015* (TRADOC, 2011a), this pamphlet:

- Describes the need for a new learning model that meets the All-Volunteer Army's need to develop adaptive, thinking Soldiers and leaders capable of meeting the challenges of operational adaptability in an era of persistent conflict.
- Describes a continuous adaptive learning model that instills 21st century Soldier competencies through a learner-centric 2015 learning environment, supported by an adaptive development and

delivery infrastructure that enables career-long learning and sustained adaptation. (p. 2)

The pamphlet suggests that designers and instructors could start making the following changes right away:

1. Convert most classroom experiences into collaborative problem-solving events led by facilitators who engage learners to think and understand the relevance and context of what they learn.
2. Tailor learning to the individual learner's experience and competence level based on the results of a pre-test and/or assessment.
3. Dramatically reduce or eliminate instructor-led slide presentation lectures and begin using a blended learning approach that incorporates virtual and constructive simulations, gaming technology, or other technology-delivered instruction. (p. 9)

In other words, *The U.S. Army Learning Concept for 2015* calls for a transformation to the learner-centered paradigm of education and training. Continuous learning, adaptive instruction, competency-based learner progress, authentic task-based learning, and personalized learning are central to this concept.

The U.S. Army Training Concept 2012–2020 (TRADOC Pam 525–8–3) was also released in January 2011 (TRADOC, 2011b). It describes a vision for a training system that spans from the institutional learning environment to the operational environment to provide the training capabilities outlined in Pam 525–8–2. The vision features a central role for flexibly adaptive technology (a networked Integrated Training Environment–ITE) to offer high-fidelity simulations of “full-spectrum” operations. These simulations “can provide rapid training content updates and are responsive to the operational commander’s training needs” (p. 23). The technology also offers distributed learning anytime and anywhere in the operational as well as institutional environment.

Clearly, the need for paradigm change in education and training is every bit as important in the U.S. Army as it is in PreK–12 and higher education. Another case in point is the U.S. Air Force.

US Air Force Education and Training

Much like the Army, the U. S. Air Force has also documented the need to update its approach to education and training, given expanded opportunities to bring new approaches and technologies into the learning environment and budget pressures that demand innovative ways of creating and sustaining well trained Airmen. Air Force Doctrine Document 1–1, *Leadership and Force Development* (Department of the Air Force, 2011), identifies the need for a deliberate continuum of learning

involving education, training, and experience to develop the competences needed to meet operational needs. This continuum of learning requires access to learning environments that are adaptive to both the individual and to their rapidly changing world, based on sound theory, and enabled by technology.

In 2008 the Air Education and Training Command (AETC) issued a vision of continuous and collaborative learning (AETC, 2008). It focuses on creating a new learning culture for the Air Force based on a paradigm change from “*education and training to...learning and the learner*” (AETC, 2008, p. 11). This paradigm change is based on the creation of precision learning opportunities that are tailored to the learner and delivered using a variety of formats. Critical to creation of such precision learning environments is the development of a new generation of learning management systems linked to a dynamic, enterprise-wide knowledge repository that provides accurate and timely content.

In February 2013 the AETC expanded on that vision with the release of *An AETC Vision for Learning Transformation*, which expressed the need to “change the paradigm of how we deliver education and training to our Airmen” (AETC, 2013, p. v) in order to provide personalized, interactive, anytime, and anywhere instruction in which learners accept responsibility for their own learning and are able to progress at their own pace. This vision is supported by the *Air Force Global Science and Technology Vision* (DAF, 2013), which calls for a “state-of-the-art information technology communication backbone [that will] facilitate full-spectrum use of virtual learning technologies...where students learn on demand by interacting with combinations of real and avatar/virtual teachers” (p. 34) to enable faster and more effective learning.

In support of this vision, AETC has undertaken a project to update the guidance in Air Force Manual 36–2234 (DAF, 1993) for the development of education and training systems. Among the changes being considered for the update is to add guidance for designing learner-centered, project-based, and anytime anywhere instruction. The little guidance that is currently provided for instructional strategies in the manual does not address learner-centered instruction, project-based instruction, or anytime anywhere instruction.

US Navy Education and Training

Although the Navy has not issued the same kind of broad, overarching documentation regarding the need to improve its education and training paradigm, the same themes are reflected in a variety of documents. For example, the Navy views itself as a learning organization that must deliver training in a timely, modular manner throughout a Sailor’s career (U.S. Navy, 2010). *The Naval Education and Training Command Strategic Plan 2013–2023* (NETC, 2013) has identified a number of

education and training focus areas to include:

- exploiting instructional design and technologies such as simulation and virtual reality;
- reducing training time and cost;
- assessing training effectiveness;
- developing training delivery capabilities that increase access to training material; and
- developing effective cognitive learning strategies.

Furthermore, the Office of Naval Research is developing innovations that support both the Navy and the Marine Corps.

US Coast Guard Education and Training

In the US Coast Guard the Advanced Distributed Learning (ADL) work group is developing a tool that identifies and prioritizes potential resident training to an ADL environment that includes facilitated online training, self-paced e-learning, electronic performance support systems, and structured on-the-job training, according to the ADL charter.

In the Senior Enlisted Leadership Course, four modules were converted to facilitated online training, so that the overall focus of the course became much more learner-centered, where students assumed total control of their learning experience from the minute they posted their biographies online. Consequently, the students' intrinsic motivation toward the subject matter and themselves as leaders increased.

One additional effort described in the FORCECOM 2013 Business Plan is to launch a new "Virtual Training Center" via a learning management system. This will enable members to have full access and control of their learning and development, whether completing a required skills resident training, an e-learning mandated training, or on-the-job training and qualification. This transition puts each member at the helm of their own development, which is a major part of paradigm change.

Common Threads

The Department of Defense and each of the Services clearly see the need to modify their historical approaches to training and education. Common themes include:

- the need to move from an Industrial-age model of skill training to a more cognitively oriented model;
- more rapid and responsive development and modification of learning resources;
- blended learning environments;
- optimization of training times and elimination of idle time;
- increased use of information technologies;
- more targeted personalized and adaptive training; and
- increased emphasis on human competencies.

However, while the military clearly seeks to shift from an industrial-age to an information-age model of

learning, this shift may not be appropriate across the entire spectrum of military education and training. For basic military training (e.g., Army Basic Combat Training, Navy Boot-Camp), standardized training may typically remain a more appropriate paradigm for several reasons: (1) the recruits all need to learn mostly the same common military skills, such as first aid, drill and ceremony, marksmanship, and basic combat tactics; (2) the experience establishes a culture and mindset based on traditional military discipline and courtesy that would be difficult to establish in a more personalized setting; and (3) it serves a sorting function for recruits who are not well suited for the service. However, basic training has become more learner-centered within a standardized content environment. For example, the Coast Guard has used tablets to deliver information-rich content in e-learning modules for its Direct Entry Petty Officer Training (DEPOT), and some of these modules are used in a personalized way in basic training via a student learning resource center.

Representative Programs

Intelligent Tutoring Systems

While it is well established that a computer-based or intelligent tutoring system (ITS) can be as effective as human tutors (VanLehn, 2011), their use is still not widespread. Reasons for the limited use of this technology include development costs, difficulties in modifying or reusing content, and inflexible pedagogical strategies. However, decreases in the cost of information technology and new techniques for developing and updating the underlying models and content of a tutoring system offer the promise of a new generation of cost-effective, flexible ITS.

Each of the Services continues to invest in advancing the state-of-the-art for ITS. For example, the Air Force Research Laboratory recently issued a Small Business Innovation Research topic for the development of goods that would allow more efficient production of simulation-based intelligent tutors and adaptive instruction (Department of Defense SBIR Topic AF141-025, n.d.). The goal is to develop tools that are user-friendly for subject-matter experts and instructional specialists to design and update training materials.

Another example of the military's desire to improve its ability to deliver training using ITS is the Generalized Intelligent Framework for Tutoring (GIFT) program led by the Army Research Laboratory. GIFT is an open-source, publicly available, Service-oriented, ITS architecture that is intended to create a modular framework and standards to increase the application of ITS by providing enhanced authoring capabilities, to support alternative training strategies, and to lower overall costs (Sottolare, Graesser, Hu, & Holder, 2013).

GIFT is specifically designed to include ITS compo-

nents for the creation and delivery of training, a learning management system, and a testbed component that will evaluate how well alternative ITSS approach training methods, strategies, and content to achieve the desired learning outcomes. The long-term goal is to empirically evaluate learning outcomes and to use those outcomes to modify learner models, training strategies, and content based on the analysis of those outcomes.

Virtual Worlds

The U.S. Air Force Squadron Officer College (SOC) is designed to provide lieutenants and captains professional military education that will foster their leadership skills. Providing both resident and nonresident instruction, SOC is working to eliminate “day-long lectures and unending decks of PowerPoint slides” (Air University, 2013).

As part of its educational transformation, SOC purchased a *Second Life* region and created an immersive virtual campus (Arenas & Stricker, 2013). SOC has developed a series of immersive learning activities for SOC students. One example of these learning environments allows students, as embodied avatars, to interact with one another in a decision-making game. The learning objective of this game is to develop the collaborative skills needed to complete a complex mission (e.g., hostage rescue) involving critical thinking, problem identification, analysis of alternatives, risk assessment, and performance monitoring during an interactive, continuously evolving exercise.

Individualized Learning Models

To help meet the need for technologies and methods to improve Marine training, the Human Performance Training and Education in the Office of Naval Research, Code 30 (2012) sponsors research and development efforts targeted toward accelerating the knowledge and skill learning necessary for adaptive thinking and decision making. The long-term goal of this program is to develop the capability to create individualized learning models for each Marine. These learning models will then be used to create and tailor individual and small-unit training based on the specific needs of the individual or unit, rather than relying on one-size-fits all training (Office of Naval Research Code 30, 2012). Similar research and development programs targeting longitudinal, individualized training models are also being pursued by the Air Force and the Army and are consistent with the National Academy of Engineering's identification of advanced, personalized learning as a major challenge for the 21st century.

Impediments to Paradigm Change

While it is obvious that the United States Military is aware of the need to change its education and training paradigm, there are a number of impediments to such

change. Just like any other transformation, changing the paradigm of military education and training is a complex activity that must occur within an incredibly complex system of systems.

One impediment to changing military education and training is that it requires resources. Money, time, and manpower are required to translate the vision for more effective, personalized learning into reality. Unfortunately, there is no new money for that translation. Therefore, paradigm change will be a gradual, evolutionary process that occurs in small steps as the Services seek to maintain a steady output of qualified individuals while attempting to move toward the new paradigm.

The military personnel system is also a potential impediment, since it is not currently designed for individualization. When training is calendar-driven for a set period of time, the personnel system knows that those individuals will be the responsibility of the school for that time, and upon successfully completing that training, they will be available for duty at a new station on a fixed date. If, on the other hand, training is individualized, trainees might enter training on different dates and complete training on different dates.

The Instructional System Design (ISD) process and the instructors are another potential impediment to change. Because trainees, instructional media, and content are dynamic components within the instructional system, it is difficult to perform a one-time, front-end analysis with enough breadth and depth to support a robust, continuous, personalized learning system that meets the changing needs of learners as their operational hardware, software, and knowledge evolves. As a result, continuing reanalysis and rapid prototyping are likely to occur throughout the entire instructional cycle of future education and training systems.

Personalized learning will also place new challenges on the instructors. They will have to be prepared to deal with widely divergent levels of learner knowledge and experience on a continuous basis. And their role will need to change from “sage on the stage” to “guide on the side.” □

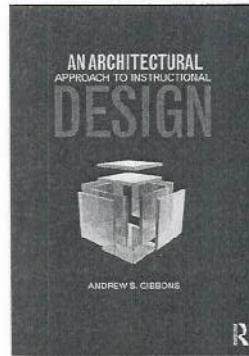
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Book Reviews

Advancing Design for Education: The Maturing of Instructional Design



Book Review: Andrew S. Gibbons. *An Architectural Approach to Instructional Design*. Routledge; 478 pages; 2013; \$59.95 (hardcover, \$160.00; e-book, \$47.36).

Reviewed by Brad Hokanson

An Architectural Approach to Instructional Design is an encyclopedic and valuable exploration of ideas and theories about the design field and its role in instruction. Andrew Gibbons takes a broader and more nuanced view of the concept of instruction—and instructional design—than most in the field, exploring concepts that are both theoretically strong and directly applicable on a number of levels of learning.

The book is well suited to an audience that includes professors, researchers, and graduate students in the field. It would be invaluable for graduate students in exposing them to a wide range of ideas, while at the same time providing a strong background in designing for the use of educational technology. As an educational effort in itself, it is a deeper and more thoughtful book than many texts that focus on more dogmatic processes, as it

Brad Hokanson is Professor in Graphic Design at the University of Minnesota and serves as Director of Educational Futures for the College of Design. He has a diverse academic record, including degrees in art, architecture, urban design, and a Ph.D. in Instructional Technology. He teaches in the areas of creative problem solving, interactive media, and critical thinking. His research focuses on creativity and design thinking. He currently is researching the relationship between creativity and achievement in school children, comparing measured creativity with standardized achievement scores in approximately 2000 students in a suburban school district. He is also teaching a massive online course (MOOC) on creativity for the University. He is a registered architect, with a number of award-winning projects (e-mail: brad@umn.edu).