LATIST: A PERFORMANCE SUPPORT TOOL FOR INTEGRATING TECHNOLOGIES INTO DEFENSE ACQUISITION UNIVERSITY LEARNING ASSETS

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The Defense Acquisition Workforce is getting younger, and its educational expectations include using advanced and innovative learning technologies. The Defense Acquisition University (DAU) has fully embraced this generational trend and has partnered with several institutions to conduct research on Advanced Learning Technologies, or ALT. One such partnership is with George Mason University's Instructional Technology Immersion Program. The partnership's goal was to examine DAU's current learning assets and identify processes and methods for utilizing innovative learning technology designs. This article summarizes this effort and describes the resulting online performance support tool called LATIST (Learning Asset Technology Integration Support Tool) developed to facilitate the understanding, selection, and integration of ALT by DAU faculty and staff.

Keywords: *Technology, Performance Support, Learning Assets, Education, Training, Learning Asset Technology Integration Support Tool (LATIST)*

image designed by Nina Costine »


LATIST
LEARNING ASSET TECHNOLOGY INTEGRATION SUPPORT TOOL

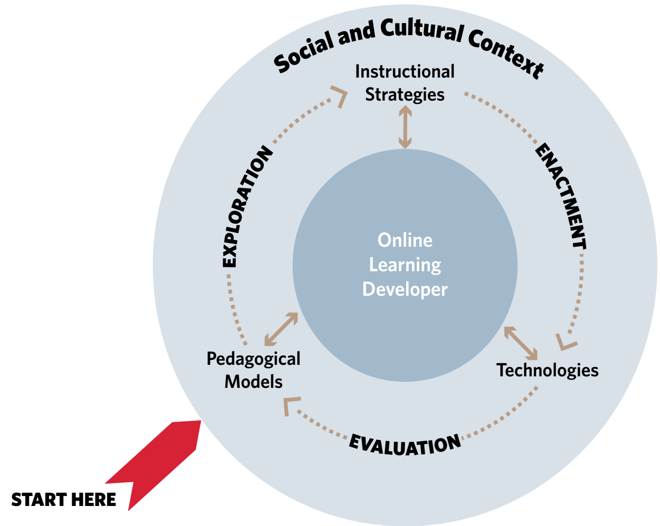
As of September 30, 2008, the Defense Acquisition Workforce was just under 126,000 personnel; an estimated 76 percent of that 2008 workforce was classified as baby boomers—the majority of which are now approaching retirement (DoD, 2007). Waiting in the wings is the gamer generation. As these gamers enter the workforce and subsequently become students at the Defense Acquisition University (DAU), they do so with expectations about their educational environment. The new generation finds classroom settings that have little visual stimulation, passive lectures, and ineffective or unengaging use of integrated technology (Kapp, 2007). DAU recognizes this change in expectations and wants to enhance its learning assets and prepare for the future by smartly integrating available technologies (Anderson, Hardy, & Leeson, 2008). For example, DAU is already using innovative approaches to develop games and simulations designed to improve performance outcomes (Sanchez, 2009). However, the pace from invention to production to maturity of these new technologies is shortening dramatically (Oehlert, 2009).

Keeping pace with these new technologies, their capabilities, and impact as possible tools for training and education is an ongoing challenge. As such, DAU partnered with the Instructional Technology Immersion Program at George Mason University (GMU) to conduct comprehensive research on Advanced Learning Technologies (ALT) in order to determine how best to integrate such technologies into its learning assets. Specifically, the purpose of this research was to:

> Examine current DAU training programs and learning products and identify processes and methods for utilizing innovative learning technology designs and delivery tools within the current DAU learning modalities in order to improve the effectiveness and efficiency of current offerings.

This article summarizes this effort including a description of the instructional design model used to guide this research; the three-step performance analysis process conducted to explicitly define DAU technology integration needs; and the performance support tool, LATIST (Learning Asset Technology Integration and Support Tool), developed to facilitate the understanding, selection, and integration of ALT by DAU faculty and staff.

FIGURE 1. INTEGRATIVE LEARNING DESIGN FRAMEWORK



Research-Driven Design Model

The overarching methodology used to guide this research effort relied on a research-driven approach known as the Integrative Learning Design Framework (ILDF) for E-Learning (Dabbagh & Bannan-Ritland, 2005). The ILDF for e-Learning is an instructional design model that provides a systematic framework for the development of learning assets and products based on sound pedagogy, iterative evaluation, and the socio-cultural context of the learning organization (Figure 1).

The ILDF is a comprehensive and flexible model that draws heavily from the iterative nature of traditional systematic processes of instructional design and can be applied in multiple settings. Specifically, the ILDF consists of three phases:

- Exploration—Investigating and documenting relevant information related to the instructional or training setting, including stakeholders' individual and collective beliefs on learning and solicited information from all involved in the instructional or training situation.
- Enactment—Mapping information gathered in the exploration phase about learning processes, content, and context to existing pedagogical models, considering the characteristics of the selected model(s) to identify and implement effective instructional strategies using technology.
- Evaluation—Determining the purpose, desired results, and methods of evaluation of an online- or technology-

supported learning design, incorporating formative evaluation and revision cycles that result in effective implementation and informative results.

In this research effort, the first phase of the ILDF—Exploration—consisted of conducting a Performance Analysis (PA). Through formal and informal data-gathering techniques and in collaboration with DAU stakeholders, the GMU Immersion team implemented a three-step PA process to (a) identify relevant roles, responsibilities, and processes, (b) define factors for successful performance, and (c) propose possible solutions for effective instructional design. The three-step PA process for this project is explained in the next section.

Performance Analysis Process

The three-step PA process began with a front-end analysis, followed by an extant data analysis, and concluded with a needs assessment.

Front-End Analysis

The front-end analysis provided a preliminary understanding of DAU's education and training program. The analysis relied on informal data-gathering techniques by examining relevant documents such as: the *DAU Course Catalog;* the *Defense Acquisition Review Journal* (now the *Defense Acquisition Research Journal*); the *Defense AT&L* magazine; the *AT&L Human Capital Strategic Plan*; and DAU Directive 709, which addresses the Learning Asset Management Program. Additionally, key stakeholder meetings explored DAU's learning asset development processes, roles, and responsibilities. The analysis indicated DAU's educational philosophy is exemplified through its Performance Learning Model (PLM) (DAU, 2010, p. 28).

The three pillars of the PLM (Career Development, Job Performance, Executive & Leadership) represent the three main types of training and development that the Defense Acquisition Workforce receives (DAU, 2010, p. 28). Training courses, continuous learning modules, performance support, and knowledge sharing capabilities are the primary methods utilized to build DAU's learning environment (DAU, 2008a). These are all considered to be learning assets. Formal courses can be delivered on-site, online, or in a hybrid approach. Informal support is provided through a variety of tools.

For example, DAU provides an extensive Community of Practice (CoP) to help "extend the reach of Subject Matter Experts (SMEs) supporting the workforce" (Garcia & Dorohovich, 2005, p. 21). DAU also supports a virtual library, an electronic *Defense Acquisition Guidebook*, an Ask a Professor service as well as its own version of Wikipedia called Acquipedia.

The front-end analysis also revealed that similar to other learning organizations, DAU faces several challenges and constraints and has multiple motivational drivers when it comes to integrating technology into its learning assets. Challenges included promoting new technologies that may exceed available bandwidth or compromise security standards for some units; constraints included working within an existing learning management system and well-defined certification classes; and drivers included supportive leadership, access to cutting-edge technology, and commitment to advanced technology research. Armed with this preliminary knowledge, an extant data analysis was performed to continue the PA process.

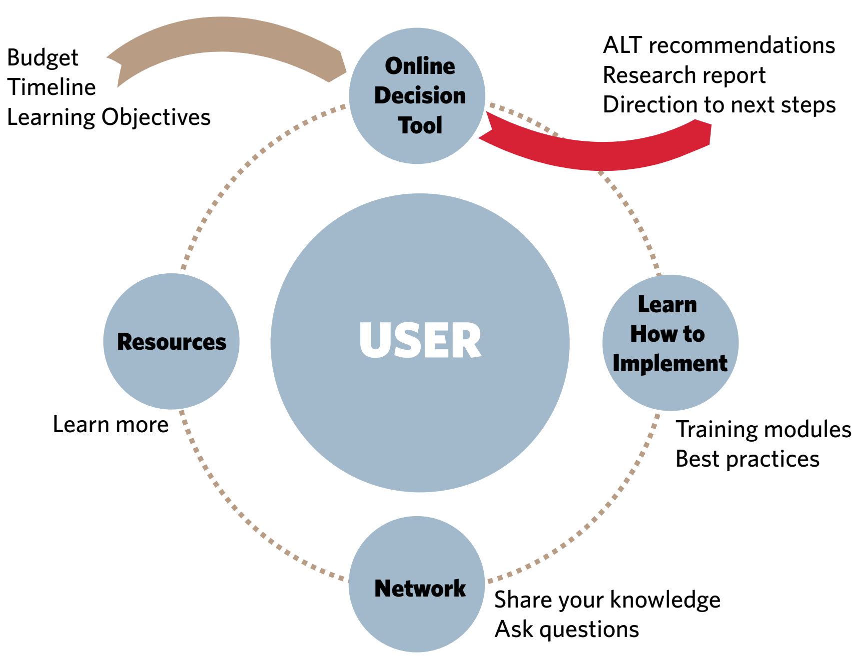
Extant Data Analysis

The extant data analysis revealed that as the provider of acquisition training for the DoD community, DAU supports many external stakeholders and customers including the Services and other Defense Agencies. Within DAU, the Global Learning Technology Center (GLTC) is leading the research on ALT for DAU. The DAU Learning Capabilities and Integration Center (LCIC) is responsible for the development and management of training requirements and content, which traverses 11 functional areas. To support these multiple roles and responsibilities, DAU uses an Integrated Product Team (IPT) approach to develop its learning assets (DAU, 2008b). Commonly, a learning asset IPT is composed of SMEs, a gaming/simulation/technology representative, an instructional systems designer, and a Performance Learning Director (PLD). Depending on the type of learning asset, the use of these roles may vary. In the case of a training course, the SME develops the content document; the instructional systems designer provides recommendations related to learning outcomes and helps define terminal and enabling objectives; the gaming/simulation/technology representative makes recommendations on the use of such technologies in the learning asset; while the PLD oversees and participates, as appropriate. Additionally, functional area representatives have the opportunity to participate and evaluate pilot courses. Once a course is launched, a manager is assigned to oversee postproduction activities such as addressing postcourse surveys that capture student opinions as well as addressing the ever-changing, sporadic requirements that affect content currency, relevancy, and accuracy.

At any point in the learning asset development life cycle process, the recommendation to use learning technologies can be made. However, several factors need to be taken into consideration such as recognizing that duplicate learning assets exist deliberately to accommodate bandwidth constraints. Another factor is speed-to-market, which involves balancing the subject matter vetting process against timeliness of content release. Such factors greatly impact implementing technology recommendations.

The extant data analysis also revealed that DAU needed a formal vehicle or process to effectively diffuse GLTC research findings on how to select and integrate pedagogically appropriate ALT into the life cycle of a learning asset. Furthermore, the analysis revealed that DAU faculty and staff could benefit from an area or "sand-box" to practice and become familiar with ALT. Based on these findings, a potential strategy—namely a conceptual framework comprised of four components—was developed to address these needs (Figure 2). Next, a needs assessment—the third step in the

FIGURE 2. CONCEPTUAL FRAMEWORK



PA process—was conducted to validate these findings and refine the framework.

Needs Assessment

The needs assessment required more formal data-gathering techniques. As such, structured interviews and an online survey were conducted to further the current understanding of roles, decisions, and processes associated with the integration of ALT into DAU's learning assets. The structured interviews consisted of nine sequential questions posed to each of 12 DAU participants, including LCIC leadership, a knowledge project officer, a center director, and eight representatives from the DAU Capital and Northeast Region. The goal of the interviews was to provide qualitative data about the different roles that DAU personnel assume in the process of selecting and integrating ALT into DAU's learning assets as well as identifying factors that influence ALT selection and adoption. At the end of each interview, the conceptual framework (Figure 2) was presented to gather feedback on its usefulness as a vehicle or tool to facilitate technology integration. The online survey was informed by the results of the structured interviews and accessed a wider audience to collect a larger data set. The survey consisted of six forced choice answers targeting demographic data, four Likert-scale questions that targeted respondents' familiarity with ALT, and one Likert-scale question addressing the likelihood that a respondent would use an online framework, namely the conceptual framework.

The interview data resulted in 591 comments, which were aggregated across questions and analyzed qualitatively. Descriptive analysis was conducted on the survey, which consisted of 34 responses. The interview data confirmed that LCIC and GLTC personnel consider and provide recommendations regarding ALT integration at various points in the learning asset development process, and that there is significant interest in incorporating ALT in a pedagogically appropriate manner that would lead to improved learning outcomes. Additionally, 20 factors influencing the selection and integration of ALT were culled from the interviews. These factors were provided in the online survey for rank ordering. The results of the survey revealed that the top five factors were long-term revision feasibility, content stability, bandwidth, ability to replicate across regions, and development cost. Survey respondents also indicated that decisions regarding ALT integration are made across all roles and job titles within GLTC and LCIC, reflective of the IPT approach.

With respect to the conceptual framework, half the interviewees expressed interest in it as both a decision tool that guides ALT selection, and training support on how and why to use different technologies; 83 percent of the survey respondents indicated they would use it. These findings further validated interviewee suggestions that developing a systematic process for technology integration would improve the effectiveness and efficiency of learning asset development. With the completion of the needs assessment, and hence the PA, the GMU Immersion team proceeded to the enactment and evaluation phases of the ILDF to formalize the design and development of the proposed conceptual frameworks as a vehicle for disseminating the latest research on ALT and facilitating the integration of ALT into DAU's learning asset development processes.

Prototype Development

In collaboration with DAU stakeholders, the conceptual framework was named the Learning Asset Technology Integration Support Tool (LATIST). LATIST would be developed as an area where users could explore the latest research on ALT; as a decision tool that would guide the selection of ALT based on users' instructional needs and contextual factors; and as an application area where users could practice implementing ALT. Although the initial vision for the conceptual framework included a user community for information sharing and collaboration, this was not pursued for development since DAU has an extensive CoP infrastructure. The specifics of the content and functionality of the three components of LATIST would be determined through a usage-centered design process described in the next section.

Usage-Centered Design Process

A usage-centered design process is commonly used in software development and focuses on identifying user needs to develop a product that allows users to fulfill their needs in an easy, effective, and efficient way (Constantine & Lockwood, 1999). Through content and task analysis, user needs were confirmed, tasks necessary for users to obtain optimal benefit while using LATIST were identified, and content requirements were established based on projected user scenarios and use cases. As a result, it was determined that LATIST would consist of three components that would allow the user to:

1. Explore what the research says about a technology such as advantages and disadvantages;
2. Select a best technology for user conditions such as learning objectives and bandwidth constraint; and
3. Review and learn how to apply a selected technology.

Additionally, the results of the content and task analysis revealed that LATIST would best be utilized as an electronic performance support system (EPSS). An EPSS is an easily accessible, integrated electronic environment that provides immediate, individualized support so employees can perform their duties with minimal intervention by others (Dickelman, 2004). A performance support SME recommended that for maximum effectiveness, information in LATIST should be explicit, accessible, and usable; and confirmed that the three components of LATIST represented a successful integration of process and knowledge.

Design Requirements

LATIST was to support information access in an anytime, anyplace environment, including mobile. Therefore, LATIST was to be browser-based, quickly accessible from the Internet. The design requirements were derived specifically from use cases that delineated the features and functionality of the EPSS based on user perspectives. These included the capability for users to print, save, search, and share content; create a personal space of notes and personally rated content; upload content; navigate across components based on a selected technology; and access support features such as Help and Dictionary. Given the dynamic nature of the “select best technology” component and the need for searchable research resources, a back-end database was necessary to manage the content. Hence, a Content Management System (CMS) was used to build LATIST. Based on these requirements and discussions with DAU stakeholders and information technology specialists, the CMS WordPress was selected to build the core framework for LATIST. WordPress is an open-source blog publishing CMS application powered by an open-source server-side scripting language known as Hypertext Preprocessor (PHP) and by MySQL—a relational database management system that can also be used for content management. LATIST navigation was designed to be intuitive and to address these four focal use cases:

- A user who is not familiar with what technology can do in a teaching and learning context and wants to review what the research says about technology;
- A user who has a known learning outcome (instructional objective) and/or contextual factors and wants to see what technologies might be beneficial for that instance;
- A user who wants to learn how to apply a technology and practice those steps; and

- A user who has been directed to use a particular technology and wants to learn what the research says about the technology and how to apply it.

These design requirements were documented using flowcharts and wireframes to convey the navigation and site architecture for an external software vendor to develop the LATIST prototype. Additionally, two logical data models were developed to support the dynamic nature of the "select best technology" component of LATIST and enable a searchable repository of the research. Furthermore, two short videos were designed and developed by a video producer to introduce users to the purpose, capabilities, and navigation of LATIST. Based on the documented requirements, an initial prototype was developed to begin usability testing.

Usability Testing

Two rounds of usability testing were conducted to iteratively improve the prototype based on expert and user feedback. Both rounds were intended to determine design inconsistencies and usability problems to establish user performance and user satisfaction levels. Both rounds consisted of two phases; Phase I relied on the GMU Immersion team and proxy participant feedback while Phase II relied on end-user (DAU) participant feedback.

In Round 1, the usability testing focused on participant perceptions and sought their recommendations for improvement. In Phase I, three GMU faculty members provided expert ISD (Instructional System Design) review. In Phase II, DAU stakeholder-users conducted an asynchronous review of the prototype and answered a brief online survey. Survey results were generally positive regarding the layout, navigation, and overall functionality of the LATIST prototype. Improvements were accomplished in preparation for Round 2 usability testing. In Round 2, Phase I testing again relied on GMU faculty members to provide expert ISD review. In Phase II, testing took place at DAU's Fort Belvoir campus to capture representative user performance and user satisfaction under controlled testing conditions. Nine participants selected by DAU received a brief overview of LATIST prior to the usability testing. Once the test began, participants evaluated LATIST using a Web browser organic to the DAU computer. A GMU Immersion team member observing the test guided the participants to the LATIST website. Participants were encouraged to think-aloud as they used LATIST while completing scenarios provided for the test. Their thoughts were captured using a tape recorder, and in some cases supplementary notes were taken. Round 2 results indicated that the majority of participants regarded LATIST as an online support tool that would be helpful in raising awareness of technology options among DAU staff and that, with further development, LATIST would be a good resource. One participant noted that LATIST would be a "good idea generator." Recommendations stated independently by at least two of the nine participants included:

- Add more multimedia resources as the current use of videos was good;
- Add more examples explaining how to integrate technology into learning assets;
- Add a means to easily share information in the tool such as through social media or e-mail options;
- Ensure the tool is scalable, the information relevant, and the content up-to-date; and
- Provide more connectivity across components and between subcomponents within "select best technology" component.

LATIST Prototype

Based on the usability testing results, the LATIST prototype was revised to include the main features and functions intended to support DAU faculty and staff in integrating ALT. As such, LATIST is best described through its main navigation pages: LATIST Home Page, Explore Research, Select Best Technology, and Apply Technology.

The LATIST Home Page introduces the purpose and capabilities of LATIST, providing two video links that further explain what LATIST is and how to use it (Figure 3). LATIST provides many global features. Users will be able to quickly access the three main components: Explore Research, Select Best Technology, and Apply Technology as well as access any one page of content using a Technology quick links function. In the future, the team envisions that users will be able to log in to add personal features such as rating articles, uploading content, and taking personal notes. An advanced search function would be programmed to locate all resources based on filtering agents such as date, title, keyword, and author. A dictionary would be included to provide quick reference on what a technology is and define the influential factors significant to the selection of ALT. A "Help" feature would target technical issues related to system features such as uploading documents to LATIST.

The Explore Research component of LATIST is a research-based body of knowledge on ALT organized into three broad categories: (a) Social Media, (b) Virtual Worlds/Games and Simulations, and (c) Mobile Technologies (Figure 4). While one user may be satisfied with reviewing a technology overview, advantages/disadvantages,

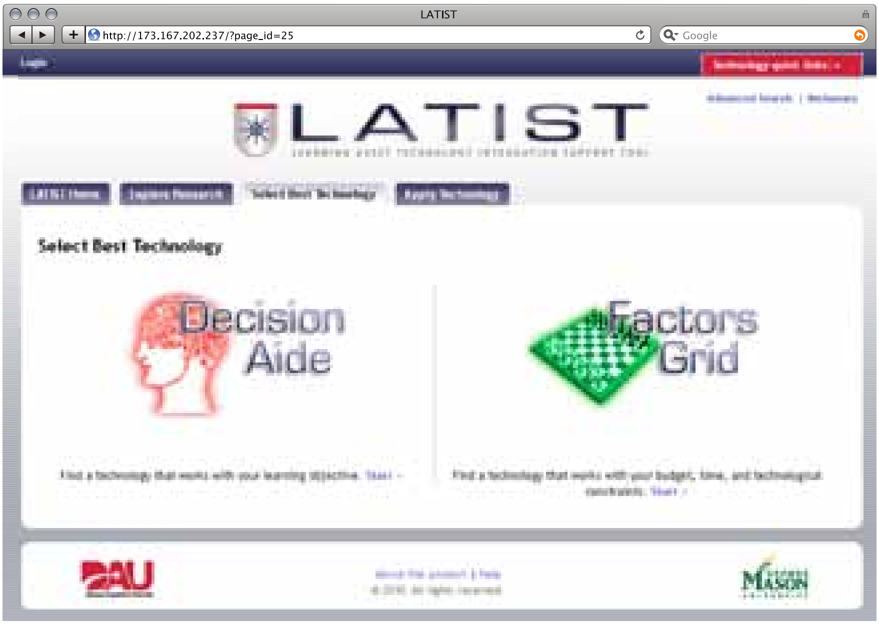
FIGURE 3. LATIST HOME PAGE

and best practices of a specific ALT, another may want to pursue more in-depth research by reviewing the available literature of that technology. The team envisions that DAU faculty and staff will be able to print, share, add, upload, mark their favorites, rate resources, and select articles rated highly by their peers. Additionally, in the future the system will provide "Amazon-type" recommendations for other resources to review based on tagging or other such classification-type metadata. Users will be able to easily and intuitively move within the different information sections of the Explore Research component and across all LATIST components.

The Select Best Technology component of LATIST guides users to make informed decisions about which technologies to integrate into learning assets in a pedagogically sound manner while taking DAU-specific criteria into consideration. This component has two subcomponents: the Decision Aide and the Factors Grid (Figure 5). Through the Decision Aide, users select a learning objective level that matches the learning objective for an identified DAU course or learning asset. The Decision Aide responds by providing a list of potential instructional strategies for that learning objective level.

FIGURE 4. EXPLORER RESEARCH: BLOGGING—OVERVIEW

FIGURE 5. SELECT BEST TECHNOLOGY HOME PAGE

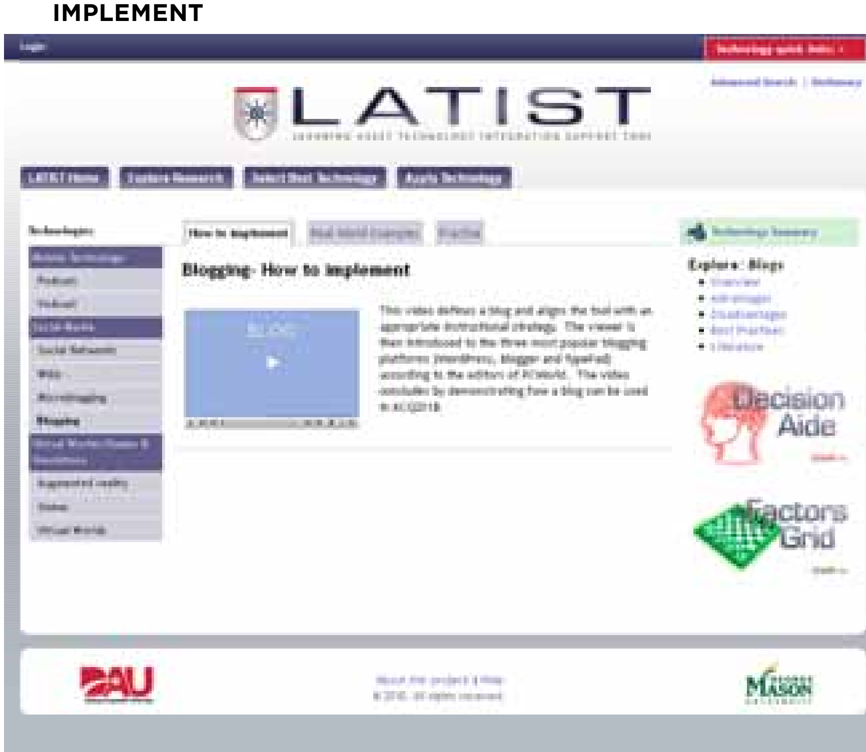


Based on the user-selected instructional strategy, the system returns a "best technology." The Factors Grid allows the user to evaluate technologies based upon criteria specific to DAU such as bandwidth, information stability, development cost, maintenance cost, and speed-to-market. The team envisions that these two tools would become connected or intertwined so both types of considerations (learning objectives and influential factors) can be addressed in a singular activity.

The Apply Technology component enables the user to learn how to apply a specific technology by providing options to learn how to implement it; view real world examples of use in a DAU context and other business, military, and educational contexts; and gain hands-on practice (Figure 6). The user can access the information through a combination of embedded or hyperlinked videos, text documents, or URLs to external websites. The information provided in the Apply Technology component will allow the user to incorporate a selected technology suitable for a learning asset.

The LATIST Home Page introduces LATIST to new and occasional users while the three components of LATIST work hand-

FIGURE 6. APPLY TECHNOLOGY: BLOGGING—HOW TO IMPLEMENT



in-hand to facilitate the understanding, selection, and integration of ALT by DAU faculty and staff into DAU's learning assets.

Conclusions

DAU is committed to research and excellence in education and training. As such, a partnership between DAU and GMU's Instructional Technology Immersion Program was formed to conduct research on ALT. A performance analysis revealed that DAU faculty and staff could benefit from a tool that summarizes research on ALT, guides selection of ALT, and enables implementation of ALT. As a result, LATIST was designed as a scalable electronic performance support tool that allows DAU faculty and staff to: (a) explore what the research says about a technology such as advantages/disadvantages; (b) select a best technology for user conditions such as learning objectives and bandwidth constraints; and (c) review and learn how to apply a selected technology. A usage-centered design approach was used to develop the LATIST prototype, and two rounds of usability testing were conducted to iteratively improve its design and functionality. The results revealed that overall, LATIST was perceived by DAU stakeholders and participants as a highly valued performance support system. Specifically, LATIST was perceived as: (a) useful in raising awareness of technology options among DAU faculty and staff, (b) a "good idea generator," and (c) a "good resource." Additionally, participants recommended enhancements to increase performance and user satisfaction. Implementing these recommendations and fully realizing the envisioned functionality associated within each LATIST component will ensure that DAU faculty and staff can use LATIST to make research-driven and pedagogically sound decisions regarding the integration of ALT into their learning assets to improve their effectiveness and efficiency, and empower the Defense Acquisition Workforce to better manage and execute job performance. So how will you choose a technology for integration into a learning asset? Check out LATIST at http://cehd.gmu.edu/LATIST.

Authors' Note

LATIST was designed and developed in academic year 2009–2010 at George Mason University (GMU) by a team of nine graduate students enrolled in GMU's Instructional Technology (IT) Immersion Program and supervised by IT faculty Dr. Nada Dabbagh and Dr. Kevin Clark. The Immersion Program, a resident graduate program of the College of Education of Human Development, is designed to allow teams of 6–10 graduate students to immerse themselves in project-based learning experiences that require them to utilize and apply Instructional Design and Development (IDD) principles and processes through authentic practice. This goal is achieved through research and training development grants that engage student teams and faculty in real-world IDD projects. These grants enable the integration of research, theory, and practice in an authentic problem-solving context, resulting in a beneficial situation for the funding organization, the university, the program, the students, and the faculty. For more information about the immersion program philosophy and projects, visit http://immersion.gmu.edu/. To learn more about this DAU research project, visit http://immersion09.onmason.com/.

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