Integrating Technologies for Shipboard Helicopter Signaling Skill Training

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ABSTRACT

A wide range of training technologies, such as instructor-led, hands-on, computer-/web-based training (CBT/WBT), and virtual reality simulation are integral parts of a trainer's toolbox. Since each technology has strengths and limitations, integrating technologies to achieve skill training effectiveness is necessary. Signaling helicopter landings, takeoffs, and flight operations on U.S. Navy ships with small decks is a critical mission skill initially trained in the schoolhouse and later reinforced during shipboard training. Currently, U.S. Navy schoolhouse Landing Signal Enlisted (LSE) courses train signaling skills using a combination of instructor presentations and practice sessions with an actual helicopter, during which each trainee receives only approximately two minutes of supervised practice. Students are not qualified as LSEs after the course; they must pass a shipboard certification, which may not occur for many months after schoolhouse training. As a result, the Navy identified a requirement to develop and implement additional training and simulation opportunities for signaling skills. This paper describes the development of a CBT/WBT solution for the LSE as an Advanced Distributed Learning (ADL) Prototype course. The goals of the project are: 1) to prepare deployed LSE personnel for their Personnel Qualification Standard (PQS) certification once aboard ship and 2) to document the challenges of developing an ADL SCORM conformant course. This paper discusses the results of the training development and integration efforts, and presents examples illustrating novel uses of multimedia and interactive training. In addition, we discuss challenges faced and lessons learned about integrating training technologies and developing SCORM-conformant courseware.

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INTRODUCTION

A wide range of training technologies, such as instructor-led, hands-on, computer-/web-based training (CBT/WBT), and virtual reality simulation are integral parts of a trainer's toolbox. Since each technology has strengths and limitations, integrating technologies to achieve maximum training effectiveness is essential (Ruffner, Antonio, Jeralmon, and Martin, (2001).

Signaling helicopter landings, takeoffs, and flight operations on U.S. Navy ships with small decks, the responsibility of the Landing Signal Enlisted (LSE) position, is a critical mission skill. This skill is initially trained in the schoolhouse and later reinforced during shipboard training. Currently, U.S. Navy schoolhouse LSE courses train signaling skills using a combination of instructor presentations and practice sessions with an actual helicopter. Students are not qualified as LSEs after the course; they must pass a shipboard certification, which may not occur for many months after schoolhouse training. As a result, the Navy identified a requirement to develop and implement additional training and simulation opportunities for signaling skills. The project described in this paper was part of a larger effort to infuse new training and simulation technologies into the LSE program.

This paper documents the development of a CBT/WBT course for the LSE as part of the Advanced Distributed Learning (ADL) Prototype Program. The Joint ADL Co-Lab Prototype Program supports the DoD community by providing information that will be used by the larger ADL community to develop web-based training and/or convert existing content to the web. The purpose of the program is to "encourage use of ADL, support innovation, foster collaboration, test the reuse process, get feedback on implementation issues, identify recommended changes to the SCORM™, identify lessons learned, and uncover issues so that they can be addressed" (Joint ADL CoLab, 2004).

The goal of the Prototype course is two-fold: 1) to prepare deployed LSE personnel for their Personnel Qualification Standard (PQS) certification once aboard ship and 2) to document the challenges of developing an ADL SCORM conformant course. This paper discusses the process and results of our training development and integration efforts, and provides examples illustrating novel uses of multimedia and interactive instructional strategies. In addition, we discuss challenges faced and lessons learned about integrating training technologies in one skill domain that are useful for other ADL training developers.

ORGANIZATION OF THIS PAPER

The remainder of this paper is organized into six sections. In the next section, we provide a brief overview of helicopter shipboard operations and the responsibilities and training of the LSE. In the fourth section, we describe our technical approach. The fifth section summarizes the process we followed in developing the CBT/WBT course, shows illustrative instructional content, and lays a foundation for the later discussion of issues involved in developing and reusing instructional content in the form of Sharable Content Objects (SCOs).

In the sixth section, we discuss issues and challenges in integrating the new course into the existing schoolhouse curriculum. The seventh section discusses lessons learned about meeting SCORM requirements and integrating training technologies in one skill domain that are useful for other training developers and practitioners in other domains. And in the final section, we draw conclusions about our experience and discuss future work.

SHIPBOARD HELICOPTER OPERATIONS

As part of the military's integrated force concept, helicopters and other vertical short takeoff and landing aircraft are increasingly required to conduct operations on Navy ships (Department of the Navy, 1998a; Ruffner, Padukiewicz, and Meier, 2002). These operations include landings, takeoffs, launch and recovery operations, vertical replenishment, and helicopter in-flight refueling. The operations involve a wide variety of helicopter types (e.g., utility, attack, cargo) from the different services (e.g., Navy, USMC, Army, USAF) on a variety of Navy ships (e.g., air-capable ships, amphibious aviation assault ships, carriers), under different sea states and environmental conditions (day, night, inclement weather).

Conducting helicopter operations on Navy ships requires a high degree of coordination and communication among pilots, crew chiefs, and shipboard personnel. The coordination and communication requirements for directing shipboard landings and takeoffs leave little margin for error, especially on small ships with single landing spots and limited maneuvering areas (see Ruffner Padukiewicz, and Meier, 2002, 2003). As noted previously, a key shipboard person is the LSE who is responsible for directing the pilot to the desired spot and general safety conditions on the flight deck (Figure 1).

Figure 1. LSE signaling helicopter aboard ship.

The LSE must observe the aircraft carefully for any sign of malfunction (such as smoke, oil, or hydraulic leaks), or an unsafe condition (e.g., landing gear not lowered), and respond in the appropriate manner. The LSE uses standard arm and hand signals in performing their duties (Department of the Navy, 1998b.) The signals are advisory for the pilot, except for the mandatory *Wave Off* and *Hold* signals. In addition, the LSE ensures that, on signal, the helicopter is started safely, launched, recovered, and shut down. LSE tasks also include supervision and control of the flight deck crew.

LSE Schoolhouse and Shipboard Training

LSE formal training consists of classroom instruction and practical exercises at the schoolhouse followed by shipboard certification training. Schoolhouse training provides students with the basic knowledge and skills required for conducting safe and expeditious helicopter operations aboard Navy ships. The schoolhouse training currently consists of a 35-hour block of classroom instruction conducted over five days. The classroom instruction comprises 11 lessons, including one on basic hand signals. The students receive a one-hour class on basic helicopter signals and two two-hour live helicopter practice periods. The live practice periods are conditional on favorable weather and the availability of a helicopter. LSE instructors use an instructor guide, PowerPoint presentation slides (Figure 2), and an assortment of visual training aids. During each of the two supervised practice periods, the LSE student typically receives only two minutes of supervised live daytime interaction with a helicopter (Figure 3).

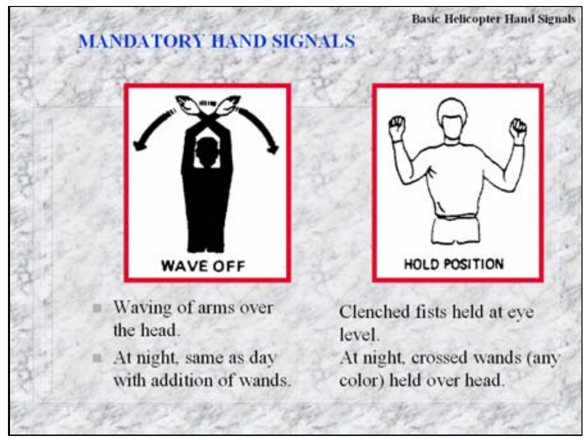

Figure 2. Hand Signal Lesson briefing slide.

Figure 3. Supervised signaling training.

After completing formal classroom-based training at a Navy LSE training facility, the LSE must then demonstrate competency through the PQS program aboard ship before performing specific LSE watch station duties.

Need for an LSE CBT/WBT

The opportunity to achieve PQS certification often does not occur until six to twelve months after the formal classroom-based training, and significant knowledge and skill loss are likely. Thus effective refresher/pre-qualification training is desirable and often necessary. The Prototype trainer is intended to help the LSE student gain or reacquire the necessary knowledge and skill requirements set forth in the NAVEDTRA 43436-B PQS for the Landing Signal Enlisted Position (Department of the Navy, 2000). This will help reduce the time required for certification by providing an essential training tool. The CBT/WBT will also help increase the reliability and consistency within the LSE PQS process.

Web-based delivery of an interactive LSE training aid makes an ideal approach for preparing the LSE for PQS certification because of the wide dispersion of the LSE trainees following schoolhouse training, the length of elapsed time between schoolhouse training and PQS qualification aboard ship, and the unclassified nature of the content. Although the ship's commanding officer is responsible for flight operations on a particular vessel, the position requirements are the same for all ships. Thus a standardized curriculum distributed via the web will facilitate training with current or updated course material, while allowing a decentralized certification process applicable to each ship as performed under current policy.

TECHNICAL APPROACH

Our approach included a comprehensive review and compilation of the technical literature on shipboard-helicopter operations and LSE training. Team members attended the LSE course at the Helicopter Operations School (HELIOPS), NAS Norfolk, observed LSE classroom training, interviewed instructors and students, toured the training facilities, and observed hands-on helicopter pad signal training periods. We examined the most current classroom slides and instructor notes, and developed an instructional strategy. We also examined and assembled pertinent materials from the Joint Shipboard Helicopter Integration Process (JSHIP) Program. We then developed a media and content rich course using Macromedia's Authorware™ software. The course includes graphics (.jpg files), animations, and digital video using Apple's Quicktime™ software. Quicktime™ was chosen as the media player because it has integrated media player transport controls.

COURSE DEVELOPMENT

Early in the project, we realized that the organization and content of the PQS is more suitable for use as a checklist of required LSE knowledge and skills rather than as a usable guide for developing an instructionally sound course. In other words, the requirements and tasks are listed in the PQS, but they are not as logically organized and presented as in the LSE schoolhouse course. Furthermore, how the PQS is used (e.g., applicable LSE tasks tested) varies by type of ship (e.g., air capable, amphibious aviation assault, carriers).

Therefore, we based the organization of the LSE CBT/WBT on that of the schoolhouse curriculum. The CBT/WBT covers all the major topic areas that an LSE student is required to master for the PQS, with the exception of Night Vision Devices. We were not able to develop a Night Vision Devices lesson in the final course due to project resource and time limitations. Using the organization of the LSE course for the Prototype also has the theoretical advantage of facilitating learning by tying new information in to a preexisting memory structure. Table 1 lists the lessons included in the final course.

Table 1. LSE CBT/WBT Lessons

1	Introduction
2	Fleet Helicopter Models
3	Flight Deck Organization
4	Marking and Lighting
5	Clothing and Equipment
6	Hand Signals
7	Shipboard Movement
8	Safety , Hazards, & Emergency Procedures
9	Vertical Replenishment
10	Hoist & HIFR Operations

Reusable Learning Objects (RLOs)

One of the goals of DoD through its establishment of the ADL CoLabs, and the Navy's Executive Review of Training (Department of the Navy, 2003a) is to design training from the start that is made of flexible, reusable, and reconfigurable components, and then to give instructors a way to find and make use of them. The Navy adopted the Reusable Learning Object (RLO) Process model as the cornerstone instructional strategy to be used to develop all future learning materials, as well as to help practitioners design strong, robust training based on proven methods of instruction (Department of the Navy, 2003b).

As defined in the Navy RLO Process model, an RLO consists of granular content objects that can be contributed to match the needs of the learner, authors, and organization. An RLO is considered equivalent to a "lesson." Elements of an RLO include an Overview, Reusable Information Objects (RIOs), a summary, and a quiz. An RIO is a self-contained chunk of information built around a single learning objective. In other words, RIOs are those chunks of information (such as facts, concepts, or procedures) that instructors pass on to their students. An RIO, referred to as a "topic" within the RLO, contains content, practice, and assessment items. Groups of RIOs are combined to form the content portion of an RLO. The relationship between a RLO and its component RIOs is illustrated in Figure 4.

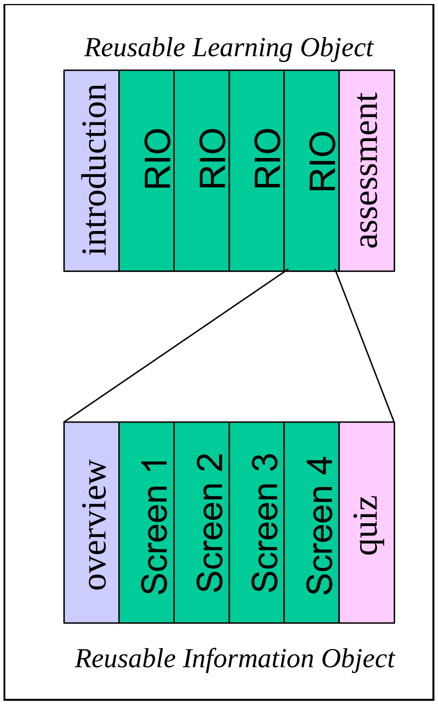

Figure 4. RLO-RIO relationship.

When we organized and designed the CBT/WBT course, we used the Navy RLO Development Process document as guidance, and incorporated its vocabulary in our instructional material and documentation. We began by reviewing the PowerPoint slides the instructors use in class and the instructor guides that accompany them. Given the information provided in these resources, we developed the documentation to establish how the training would be organized. We then developed RLOs and RIOs as recommended in the Navy's process document. This level of design captures the objective of the lesson, and identifies several topics or RIOs that will support that objective.

At the RLO level of documentation, we described the course objective, the RLO titles and objectives, and the component RIOs. We also assigned "metadata" which is the information learning management systems use to find and organize training courses and lessons. The team used the information in the RIO documents, in turn, to generally describe how the information will be presented screen by screen.

Each storyboard screen is identified with a number, given a title, identifies what the text will be on that page, and identifies what graphic may be used to illustrate the teaching point. The graphics or interactions may be tables, diagrams, photos, or a short video clip. At the end of many RIO documents, we wrote practice quizzes so the students can check their understanding of what they just learned, gain timely feedback, and receive reinforcement for correct responses. Test questions taken from the current LSE materials are located at the end of each lesson.

Sharable Content Objects (SCOs)

A Sharable Content object (SCO) is a self-contained and reusable piece of instruction suitable for student learning needs. SCOs include objectives, text of one or more topics, multimedia, a glossary, links, and quiz questions. SCOs also have assets (e.g., text and image files) that have metadata tags (e.g., source of a photograph) useful for locating content or media appropriate for a particular learning application. SCOs can be at different levels of granularity (e.g., course level, lesson level), but most often are at the lesson level. In common practice, RLOs and SCOs are roughly equivalent. For the purpose of this project, each RLO or lesson in the LSE CBT/WBT is considered to be a SCO.

Examples of CBT/WBT Lessons

In order to set the stage for our discussion of issues, challenges, and lessons learned, we provide examples from three of the total 10 lessons that we are using as SCOs (see Table 1). These examples were chosen because they illustrate combinations of tutorial instruction and opportunities for student interaction. The examples are briefly described in the following subsections.

Deck Marking and Lighting. The Deck Marking and Lighting Lesson covers deck marking and lighting configurations that are found on the types of ships on which LSEs serve. It is very important for LSEs to have an understanding of deck marking and lighting in their selection and presentation of signals. An example of a screen from the Deck Marking and Lighting Lesson is shown in Figure 5. This screen features an animation of a helicopter flying to the appropriate part of the deck, based on the deck marking. The animation starts automatically and can be replayed by the student as often as desired. This screen is very useful for familiarizing the LSE with the different types of deck marking lines and where different helicopters are permitted to land and hover. Mastery of this content is assessed by a drag-and-drop practical exercise later in the lesson in which the student must drag different helicopters to the proper deck position, and is given appropriate feedback.

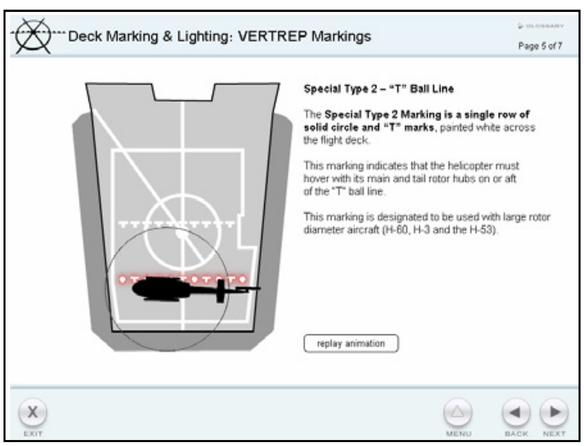

Figure 5. Screen from the Deck Marking and Lighting Lesson.

Basic Hand Signals. This lesson provides instruction on the basic hand signals that LSEs use to visually assist pilots with the handling of helicopters on board ship. As described previously, current classroom visual aids for training signaling skills are limited to static PowerPoint slides, as shown in Figure 2.

In designing this lesson, we improved the instructional value of the existing material by enhancing the current static image and textual description with a number of topic formats. These include: (1) a front aspect view of an animation of an LSE signaling that was developed during the JSHIP Program) (Padukiewicz, 2001), and (2) a rear aspect view of an actual LSE trainee making the signal to a live helicopter in the background. Both the animation and the video show the mechanics and dynamics of the signal, and the speed at which it should be given. The student can start, pause, and replay the animation or video clip as many times as desired before proceeding to the next screen. Figure 6 presents an example of a screen from the Basic Hand Signals lesson, showing the static silhouette image (upper left), the LSE signaling animation (lower left), and the LSE signaling video clip (lower right) for the *Wave Off* hand signal.

Figure 6. Screen from the Basic Hand Signals Lesson.

Shipboard Movement. The Shipboard Movement lesson describes the proper procedures for safe handling and movement of helicopters aboard ship and the responsibilities of the handling team. One of the learning objectives in this lesson is that the student will be able to describe the proper sequence of actions required to start up a helicopter. These actions involve knowing the correct pilot signals, deck status indicators, LSE signals, and the order in which they occur. To assess this knowledge, we used the drag-and-drop interactive assessment technique in which the student must drag icons depicting pilot signals, deck status lights, and LSE signals and drop them in a target area so that they are arranged in the proper sequence of execution. If the student chooses incorrectly, the icon moves back to its starting position. Figure 7 shows a screen using this interactive assessment technique.

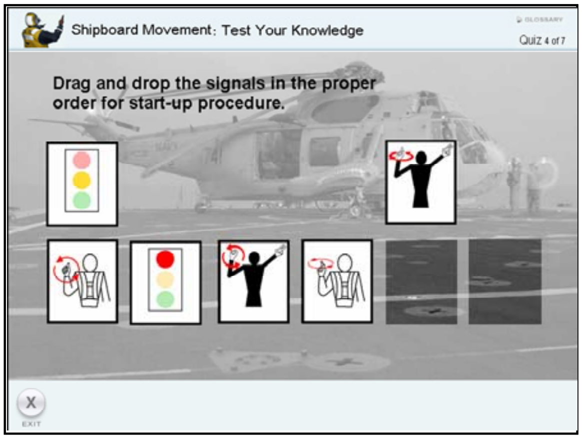

Figure 7. Screen from the Shipboard Movement Lesson.

In this example, the student has correctly selected the icons for the pilot signal for ready to start engines, the red deck status light, the LSE signal to start engines, and the pilot signal for ready to engage rotors. The student must then place the remaining amber deck status light icon (the correct response) and the pilot signal for ready to start rotors icon in the correct order.

INTEGRATING TRAINING TECHNOLOGIES

A variety of training technologies are available to teach and reinforce LSE shipboard helicopter operations skills, and in particular, helicopter signaling skills. These include instructor-led classroom training, hands on practice with a live helicopter, virtual reality simulation, and the CBT/WBT Trainer which is the subject of this paper. Since each technology has strengths and limitations, properly integrating technologies to achieve maximum skill training effectiveness is necessary and is a major challenge.

LSE instructor-led classroom training and hands-on live helicopter practice periods were described in the introductory section of this paper, and the LSE CBT/WBT trainer was described in the preceding sections. We provide below a brief description of a virtual reality helicopter signaling simulation, currently in development, which will soon become part of the LSE course training mix.

Because of a lack of live helicopter signaling training opportunities, the Navy identified a need for a Vertical Flight Deck Training System (VFDTS). The purpose of the VFDTS is to train the Navy LSEs on basic signaling skills during schoolhouse training by using virtual simulation of a helicopter that responds to LSE hand signals or to an instructor/operator's interventions. Carmel Applied Technologies, Inc. (CATI) is building a Vertical Flight Deck Training System (VFDTS) for the Navy as part of a NAVAIR – Orlando Phase II SBIR project in a parallel effort to the LSE CBT/WBT (see Holmes, Franz, Struckhoff, and Salva, 2004 for additional information). DCS Corporation is collaborating with CATI to develop a Hand Signal Recognition System (HSRS) for the Navy to interface with the VFDTS. The purpose of the HSRS is to automate the function of signal recognition (Ruffner, Fulbrook, Struckhoff, Morey, and Franz, 2004).

Given the variety of training technologies available for training signaling skills, the challenge is to determine how to best combine the technologies to minimize their shortcomings and capitalize on their strengths (Ruffner et al, 2001). This is similar to the challenge faced by blended learning which uses a variety of learning strategies, media, or delivery methods in a course or learning event (Navy Human Performance Center, 2004). This includes blending delivery methods as well as technology-based learning solutions (Bielawski and Metcalf, 2003).

Developing a comprehensive model for blending or integrating training technologies for LSE training is beyond the scope of this project and paper. Rather, in the following paragraphs, we set forth some initial recommendations for integrating technologies for LSE signaling training. These recommendations are based on our experience with the LSE training program, our experience with integrating training technologies in other training domains (i.e., night vision training), and industry best practices.

We envision three situations for integrating CBT/WBT into LSE training. First, it can be used to **introduce** basic concepts which are later augmented in the classroom, in hands-on practical exercises with a qualified LSE instructor (whose availability and time is limited), and in the simulator. Second, it can be used to **reinforce** topical instructional points made during previous classroom training, hands-on training, and simulator training. Most likely, some combination of the introductory and reinforcing functions of the LSE CBT/WBT will be most effective for schoolhouse training. Third, because LSE signaling knowledge and skills are highly perishable, CBT/WBT can be used for conducting refresher training after an extended period of nonuse, such as between schoolhouse training and shipboard PQS qualification. We are currently collaborating with NAVAIR – Orlando, CATI, and the LSE instructors to develop an optimal training integration plan.

LESSONS LEARNED

In this section, we discuss eight lessons learned (LL) from the ADL Prototype effort. Many of our observations are consistent with those reported in the general ADL literature (e.g., Stout, Slosser, and Hayes, 2001) and are variations on lessons learned we discussed in a previous paper on night vision training (Ruffner and Fulbrook, 2002).

In this research effort there were two goals and two masters: 1) to develop a prototype course that employs the latest innovations in process and delivery means for the ADL Prototype Program and 2) to deliver an effective content-driven CBT/WBT for the Navy Helicopter Operations School. Here we describe lessons learned related to the areas of process, delivery means, and content.

LL1: It's Tough to Serve Two Masters

When there are what seem like potential conflicts between different goals and interest groups (masters), it is important to keep in mind that the different masters are each concerned with a different aspect of a training product, but that in the end the same goals are being achieved simultaneously. In other words, any time an electronic training product is developed, an emphasis on process, delivery means, and content are essential. While we placed a great deal of focus on CBT/WBT ADL processes and software development, the real goal for training product development is effective, blended training that integrates all training delivery means to yield a better trained user, qualified to a standard in a set of defined mission essential tasks.

Hence, in this study we were able to complete a usable final product for the training community as well as advancing the knowledge base in the ADL community for process and delivery means issues in this integrated effort. The lesson learned here is that these variables are universal and really must be considered in all products in all instances. This is consistent with the ADL goals of reusability, accessibility, durability, and interoperability for a broad user community.

LL2: SCO is a Content- and User-Centered Construct

In this paper we defined and discussed the concepts of RLO, RIO, and SCO. For clarification, an RLO and a SCO are equivalent when considered as lessons. An RIO is equivalent to a concept or topic within a SCO. The focus in SCO development should be centered on the instructional content and the characteristics and needs of the user, rather than on reducing or achieving a content standard based on software requirements. SCOs must be written to be as generic as possible to facilitate reuse, especially when incorporated into a digital library.

An important issue is what metatags are needed at the content level and at the library reference level (SCO and ADL). These are probably not the same in both instances. We found that it is not practical to define at the RIO level a large set of metatags. Again, which metatags you select depend on the master you serve. For a digital library reference to enhance ADL SCORM features, the minimum metatags needed will likely be different than for content developers. However, even among our research group, there is not universal agreement on this list.

Furthermore, the key words that retrieve a group of SCOs (or assets for that matter) should yield different levels of granularity (depth and breadth) just like a key word search in a library would yield multiple texts on the same topic – some done at a simple level, some done at an encyclopedic, biblical reference level. Thus multiple levels (granularity) of SCOs covering the same topic offer the greatest benefit to instructional developers and facilitate reusability.

LL3: There are Some Essential SCO Elements

There are a number of essential content elements that constitute a SCO. Specifically, a SCO must include learning objectives, main and embedded topics identified, operational definitions, a glossary, and an abbreviation/acronym list as a minimum. This is consistent with the findings of Stout et al. (2001). As we pointed out in the examples presented in the previous section, an instructional developer cannot search for all the pieces to a puzzle to assemble it. The pieces must be in place for any given SCO. From there, the elements may be modified, but a complete SCO must be accessed from its source. Libraries do not keep card files on chapters, tables, and figures within texts. Hence, a digital library will likely not provide access to individual images and embedded topics. Each SCO must be composed of all necessary elements and a comprehensive "packing list" of contents must be included as part of the elements to include imagery (figures), video, tables, and text.

LL4: Develop SCOs with Delivery Method and Available Bandwidth in Mind

The notion of reusability is consistent with the notion of avoiding a duplication of effort. Any time a training product is being developed, it is advisable to consider how the SCOs will be used (and reused), and try to design the presentation to be compatible with all media from the get go. There are numerous differences between a CBT presented on computer- and web-based trainers. This is a topic that can be a paper unto itself. Suffice to say that the advantages and disadvantages between CBT and WBT must be considered – memory, bandwidth, processor speed, and CD ROM limitations are always at the forefront. However, other considerations include navigation buttons (location and response), development software, level and complexity of interactivity required, and image quality. Finally, CBTs are usually platform dependent, whereas a WBT is usually platform independent when delivered. This lesson learned can easily be extended to the emerging concept of anytime, anywhere mobile learning with wireless delivery to such platforms as handheld PCs and personal data assistants (PDAs).

LL5: Integrate SCOs with the Existing POI

As noted previously, we had to make a decision about content development organization where we followed the PQS or the schoolhouse program of instruction (POI). We choose the schoolhouse POI because it had a better organization and logical flow. Lessons are only part of a total training support package for most given topics. The POI must identify all the lessons that comprise the Total Training Package. Some training specialists have suggested that a SCO should never be written within a SCO. However, in any program of instruction it is not practical that an entire POI would be a single SCO, and some topics within the POI require a stand-alone SCO. All lessons should identify available training support packages so that "train the trainer" materials can be readily developed. As noted in the previous lessons learned, awareness of the delivery methods and bandwidth available to the intended user group is paramount. For example, we received feedback from the Fleet that bandwidth on many Navy ships at present is not sufficiently high or reliable to support WBT with even simple student interactions.

The point here is that SCOs must have a "crawl, walk, run" progression like any other set of topics and lessons. For convenience, it is best to think of a SCO as a single lesson topic, even if multiple topics are required within a lesson (more typical than not). For every qualification course, there are required lessons (topics), designated times to complete the lessons, and established standards for each skill level. SCOs must conform to these standards and requirements. In this regard, as legacy course material is converted to ADL/SCORM conformant CBT and WBT products, the entire concept of time to complete lessons and standards for qualification should be reevaluated. Some SCOs will require more time, others less, and the level of difficulty may change as some topics can be more easily presented in a CBT/WBT environment than others.

LL6: A Text and Multimedia Library is Required

An organized library of text and multimedia is essential for retrieving SCOs and assets, such as graphics and digital video clips. The library must be independent of the software used to organize and present the text and multimedia information. This is an extension of the previous lesson learned. A digital library must be organized based on content, not on software design or lines of code. The metatags that will define SCOs and assets should be intuitive and obvious – just like a key word search. The creator of any SCO or asset should apply a key word set in the same way as they would for any stand-alone composition, no matter the media.

For example, because of the nature of the content, the course we developed was graphics intensive. We developed a huge database of images from various sources. At the end of the project we had assembled 6,899 images in the database with 2,550 unique keywords, most of which were from the Navy but not from the legacy LSE instructional material. For identifying graphics assets, we found it most helpful to use the NAA/IPTC tags, which are an industry standard method of storing textual information in the images, rather than the ADL/SCORM recommended metadata categories.

LL7: The Importance of a Content Champion

A "champion" within the development team to orchestrate the finding, assembling, and reworking of SCOs to meet new user's needs and organizational requirements is absolutely essential. This champion must be available throughout the entire instructional development process to ensure content and media availability and SCO survival. This requirement is in addition to the need to have a champion on the user side as well. When a mistake or discrepancy in legacy content or media is recognized, there has to be a plan and an authority that will make decisions as to content accuracy and inclusiveness, and what to do to resolve any differences that may arise.

The importance of a champion cannot be overemphasized – it is more than a team leader and much more than a one-man show. The complexity of developing CBT and WBT courseware requires a team effort of graphic artists, technical writers (and topic

SME), and software experts to develop and create any trainer as a minimum. Any one person who could do all these things could not complete most trainers in a timely manner and the benefits of teamwork to brainstorm and create beyond one vision would be lost. We have only touched the surface on this aspect – an entire paper could be dedicated on the importance of a project champion. Any given training development team will have strengths and weaknesses related to process, delivery, and content capabilities. How one compensates for weaknesses in any given area must be part of any development effort.

LL8: Budget Sufficient Time and Resources for Course Development

The ugly truth of the great majority of training development efforts is that the amount of work necessary to achieve the ideal scope of effort exceeds funding and time available. Possibilities are always endless. ADL developers must budget sufficient time and resources to tailor legacy content and media as well as appropriate SCOs for users other than the original target audience. We have already experienced the agencies that want and need a training product who assume the trainer will cost next to nothing because we already have all of the lessons ready to go. On the other hand, it is too easy for the course developer to mistakenly assume they can complete a project by reuse alone, and at a cost estimate that falls far short of the actual requirements. Hence, the estimates of manpower that are entered into any statement of work to produce a training product need to be rethought reflecting the new reality of changes in effort based on reusable SCOs and requirements of ADL SCORM conformance.

CONCLUSIONS AND FUTURE WORK

In this paper, we described the development of a CBT/WBT trainer for teaching and refreshing LSE shipboard helicopter flight operation skills, particularly signaling. Two primary ADL requirements for the project were that the course be SCORM conformant and be deliverable over the Web. The Beta version of the course passed the SCORM 1.2.6 level tests and was successfully accessed from the Web.

The LSE instructors at the Helicopter Operations Schools at NAS Norfolk and NAS North Island are reviewing developmental versions of the trainer. Although the evaluation was still in progress at the time this paper was submitted, the initial comments have been very favorable. Several instructors expressed a strong interest in immediately using the CBT as a teaching aid to supplement classroom instruction and discussion, as well as using it as a "study-ahead" tool. Encouraged by this feedback, we are currently working closely with the LSE instructors, the NAVAIR program manager, and CATI to develop an integrated course of instruction for the LSE that takes maximum advantage of the technologies.

As noted previously, this project was performed as part of the Joint ADL Co-Lab Prototype Program. We believe that it can be considered an ADL success story. This program is mutually beneficial to the Joint ADL Co-Lab and to the Fleet. In this case, the Joint Co-Lab obtained data about what it required in terms of resources, lessons learned, time spent, etc. to create a first class training product immediately ready for Fleet use. The Fleet, in turn, obtained a computer based training application that their students can have available aboard ship and use for review as they work through the PQS certification process.

The LSE PQS CBT/WBT has shown immediate potential for use as a study-ahead instructional aid and as an in-class teaching aid. Furthermore, the content and media developed for this project has high reusability potential, for other shipboard Navy ratings (positions) as well as for Navy, USMC, and Joint Service aviators who are tasked to perform shipboard aviation operations, with the understanding that some customization and modifications will be required.

Future work should include a formal evaluation of the CBT/WBT, and the development and validation of a model for optimally integrating the CBT/WBT with the LSE schoolhouse curriculum, including the forthcoming VFDTS virtual reality simulator. A tougher, but eventually more important and rewarding challenge for the future, is to determine how to integrate these elements into the sailor's lifelong learning plan at shore-based facilities and aboard ship.

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