

SCORM Reuse: Current Reality, Challenges, and Best Practices

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ABSTRACT

This paper documents the process and challenges with constructing a “patchwork” course comprised of multiple Sharable Content Objects (SCOs) with very different graphical user interfaces from each of the Department of Defense (DoD) Services. SCORM 1.2 SCOs received from the Services were converted to SCORM 2004, aggregated into multiple sample courses with different sequencing strategies, and tested on multiple SCORM 2004 Learning Management Systems (LMSs). The results of this paper will be used to inform the learning community of best practices and lessons learned for aggregating content objects from various organizations and contexts for delivery on any SCORM 2004 conformant LMS.

ABOUT THE AUTHORS

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Paul Jesukiewicz has been the Director of the ADL Co-Laboratory since its inception in 1999. His responsibilities include developing and directing an open and collaborative environment for sharing learning technology research, development, implementation and evaluations across public and private sector domains. His experience has helped in identifying the successes and challenges of SCORM content reuse across DoD. Prior to joining ADL, Mr. Jesukiewicz Prior held various positions within OSD and the Navy including Program Manager for Training Systems and Design Engineer.

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OPPORTUNITY FOR REUSE

One of the goals of SCORM was to enable an “object-based” economy for learning objects that could be shared and reused across DoD. According to a February 2006 ADL survey of SCORM content within the Services, we found that the Army (ATSC) has 161 SCORM conformant courses and 152 under development, Army (DLI) has 1230 SCORM conformant lessons in 12 languages and 576 under development; the Navy (ILE) has an estimated 442 SCORM conformant courses and 330 under development; the Air Force (AETC/AFIADL) has 168 SCORM conformant courses. With all of these courses and more under development, there is great potential for reuse and cost-savings, yet the current reality is that only a small percentage of content has been reused or shared across DoD.

What are the challenges that must be overcome for effective reuse?

There are several well-known and documented factors limiting effective reuse. We have found all of these to be challenges when constructing a new “patchwork” course from existing learning objects in DoD:

- Lack of metadata for search and discovery
- Unexposed silos of content
- Monolithic SCOs
- Overly contextualized learning objects
- Different presentation styles
- Economic disincentives for sharing

Metadata

Metadata is often used for search and discovery of content for reuse, so it is essential to not only apply good metadata to reusable learning objects but to also know what terms to use when searching for those objects. Thus, studies around common vocabularies and ontologies have gained a lot of attention. Another important and often overlooked aspect of metadata is the application of intellectual and property rights. Robby Robson in his workshop materials on “Designing for Reuse” presented at ELearn in Vancouver, BC (2005) addresses the importance of

including copyright information in metadata so that users of content will be able to easily find the rules for reuse and repurposing as well as contact information for obtaining the proper permissions and attributions.

We found in our study that there are lots of good learning objects that lend themselves to reuse in new contexts, but insufficient metadata to help users identify those objects. Thus, we were forced to launch each object and view the contents to determine its appropriateness for the patchwork course we were building. It is often metadata at the learning object level that is missing; this is unfortunate because learning object metadata is critical for search and discovery of reusable content. But what good is metadata when the content is contained in unexposed silos?

Content Exposure

The ADL Registry (ADL-R) addresses this challenge by exposing learning objects via metadata to all of the prospective users within the DoD. For example, the Navy may perform a search on the ADL-R for “History of the Navy” and find that the Army has registered a course on “Military History” which may contain material that could be useful in a course on “History of the Navy”.

The recently signed DoD Instruction (DODI) 1322.26 requires that all DoD distributed training be SCORM conformant and registered with the ADL-R. This requirement is expected to increase the sharing of content across the Services. While the instruction only requires that content packages (which typically represent entire courses) are registered with metadata describing the package as a whole, it will be challenging to expose useful metadata describing the parts, i.e. reusable assets, SCOs, and aggregations within the package. Generally, the smaller the object the more reusable it is.

Granularity

Granularity refers to how big or small the learning objects should be for purposes of reuse. Many organizations have developed best practices defining the level of granularity for a SCO. However, even with the best of intentions, many of the tools for creating

SCORM conformant content packages actually create one large SCO that is not very reusable. Large monolithic SCOs were also common in SCORM 1.2 where sequencing rules had to be built into the SCO. With SCORM 2004 sequencing rules may be separated from the content and handled by the LMS, thus rendering the content more reusable. So tools that only create one SCO per package should be used to create reusable chunks of content that may then be aggregated into a content package using another tool such as the Reload Editor.

The “Business Rules, Best Practices, and Examples for Army SCORM 2004 Conformant Courseware, Version 1.0” contains excellent business rules and best practices for reuse. Army best practices stress the importance of using the SCORM Content Aggregation Model (CAM) to cluster reusable chunks of content corresponding to Enabling Learning Objectives (ELOs) to teach a Terminal Learning Objective (TLO). By breaking lessons to teach TLOs into smaller chunks, there is the greater potential for reuse of the individual parts.

Context

Business rules and best practices also recognize the importance of minimizing contextual dependencies (within a learning object) on information external to the learning object. For example, references to prerequisites that may not be required of the same content in new contexts (i.e. courses) limit reusability; and, external references such as references to a particular audience, course title, or link may limit reusability when the content may otherwise be suitable for a different audience under a different course title. The following is a business rule in [Army, 2006]:

“Hierarchical higher level instruction titles or words (course, phase, module, lesson, etc.) must not be contained within independent SCO content or titles. If an independent SCO contains an ELO, it must not reference its TLO within the content or title of the SCO. Independent SCO titles must not include the MOS, Skill Level, SQI, ASI, or "SCO" acronym within the actual SCO, navigation links, or the manifest. Independent SCO content and titles must not include sequencing numbers.” (p. 25)

Presentation Styles

Different presentation styles for learning objects have also impeded reuse. For example, the Army may require a green background and common button styles and positions for intra-SCO navigation. While this content may be very useful for the Navy, the Navy may want to change the background to blue and change the style of the navigation controls. (The Army and the Navy have different style guides.) One possibility to overcome dependencies on inconsistent style guides is for everyone to agree on a common look and feel.

Economic Incentives

There need to be economic incentives for sharing intellectual property. It is often the case that vendors do not want to share their work outside their organization.

THE “PATCHWORK COURSE”

To begin addressing these reusability challenges, we started with previously developed SCORM courses to create a new course. The idea for the patchwork course grew out of the Joint Services Advisory Group, Co-chaired by Dr. Bob Wisher, Director of the ADL Initiative and Mr. Carlton Hardy II, Instructional Systems Specialist at the Training & Doctrine Command (TRADOC).

Our study resulted in four different types of reuse:

- Reuse of entire [previously packaged] course
- Repurposing of content to achieve a common look and feel (i.e. presentation style)
- Addition of context-setting SCOs to improve flow between pre-existing learning objects
- Application of new sequencing strategies to existing content structures

We chose the content to create our versions of the patchwork course from SCORM courses contributed by the U.S. DoD military Services for the purposes of this study. See Table 1 for a complete list of those courses. The Reload Editor 2004, a free and open-source content packaging tool, was used to assemble our patchwork courses and apply sequencing strategies between the learning objects.

Legend

The following SCOs were chosen for our new [patchwork] course “National Guard Exercise 101”. The overall course objective was to prepare the soldier for fire support coordination including safety measures.



Figure 1: Key to Titles of SCOs used in Patchwork Course

Variations on Reuse

Reuse of Entire Course

One form of reuse is to use an entire course / learning object with no modifications. This is the simplest type of reuse. In our simplest case, we chose SCOs (some of which were entire courses) to create a new aggregation. No new SCOs were created for the course and no modifications were made to the pre-existing SCOs. However, we found that some of the SCOs contained reusable content that could have been isolated and reused in different contexts had the SCOs been broken up into smaller chunks and aggregated using the SCORM Content Aggregation Model. For example, each USMC course consisted of a monolithic SCO with intra-SCO navigation and contextual dependencies that made it difficult if not impossible to use subparts without editing the source code.

Figure 2 describes the organization for our simple version of reuse. In this example, the soldier would receive safety training prior to the USMC “Fire Support Coordination” training.

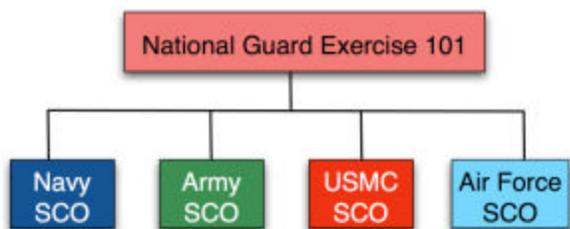


Figure 2: Reuse of Content in new Structure with no Modifications to Content Itself

Repurpose to Create Common Look and Feel

Absent of either modifications to the existing SCOs or addition of context-setting SCOs to improve the flow of content from one learning object to the next, the objective of the Exercise was lost. Thus, we implemented the next type of reuse – repurposing.

Figure 3 describes a variation on the “National Guard Exercise 101” in which modifications are made to the presentation style of the SCOs to present a more cohesive unit of instruction. Text could also be added to each of the first three learning objects to prepare the learner for the next learning object / SCO. However, this type of text may be considered a type of external reference that adds context to the learning objects rendering them less reusable in new contexts. An alternative would be to add interstitial context-setting SCOs.

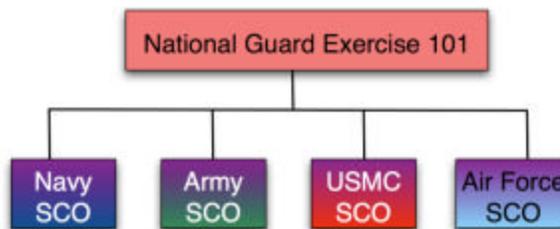


Figure 3: Repurposed SCOs

Addition of Context-Setting SCOs

Overly contextualizing a learning object limits reuse; however, context is often important for addressing a particular audience or for describing how one learning object relates to the next. Lack of context may confuse or frustrate the learner and obstruct the learning experience. As Robson (2005) puts it, “Context is the friend of learning and the enemy of reuse.”

By adding context-setting SCOs we’re able to personalize the learning experience and harmonize the learning objects. For example, a context-setting SCO may contain information such as, “You’re about to see a yellow triangle. For the Navy, that corresponds to a blue square.”

Context-setting SCOs may also be in the form of an introduction or post-test to assess the learner’s mastery of the material presented. Figure 4 depicts the National Guard Exercise interspersed with “Segue” SCOs to provide a smooth transition between the learning objects.



Figure 4: Addition of Context-Setting SCOs

Context-setting SCOs free us to design learning objects according to best practices for reuse. More information and helpful resources on designing for reuse may be found at reusablelearning.org.

Table 1: List of SCORM content / courses evaluated for inclusion in patchwork course.

Contributor	Content	SCORM Version	LMS
USMC	Operation, Plans & Orders	1.2	ThinQ v 4.6
	MAGTF Sustainment	1.2	ThinQ v 4.6
	Task Organization	1.2	ThinQ v 4.6
	Fire Support Coordination	1.2	ThinQ v 4.6
	MACCS	1.2	ThinQ v 4.6
	Graphic Control Measures & Airspace Control Measures	1.2	ThinQ v 4.6
Army	63J10 Intro	1.2	Saba
	88K10	1.2	Saba
	Basic Principals	1.2	Saba
	Drug Education	1.2	Saba
	Epidemiology of Bioterrorism	1.2	Saba
	Equipment Operator Forms and Publications	1.2	Saba
	Military History	1.2	Saba
	Rail Operator Overview	1.2	Saba
	Range Safety	1.2	Saba
	Training Overview	1.2	Saba
Air Force	AGM-130 GPS	1.2	Meridian
	C130 Block InOut	1.2	Meridian
	F-15 Secondary Power	1.2	Meridian
Navy	AP Cardiovascular System	1.2	ThinQ v 5.2
	Basic Mathematics	1.2	ThinQ v 5.2
	Driving for Life	1.2	ThinQ v 5.2
	UWD Training	1.2	ThinQ v 5.2

Application of New Sequencing Strategy

The last form of reuse is the application of new sequencing strategies to existing content. Figure 5 represents our version of the National Guard Exercise in which the learner is given a pre-test and allowed to “test

out” of the Safety Training SCOs. Note that no modifications need to be made to the Navy, Army, USMC, and Air Force learning objects when applying new sequencing strategies.



Figure 5: Application of New Sequencing Strategy

Templates make it easier to apply new sequencing strategies to existing content. The “SCORM Best Practices Guide for Content Developers” (CMU, 2005) contains templates for implementing sequencing strategies such as pre- and post-test assessment, n-way branching, and remediation using SCORM Simple Sequencing and Navigation. Those templates have been adapted [with permission] and used by the Navy Integrated Learning Environment (ILE). They are also included in the Reload Editor 2004 content packaging tool used to create our patchwork examples.

CONCLUSIONS

SCORM content reuse may be achieved successfully if the known challenges are overcome. SCORM makes it possible to reuse content from the technical standpoint, in terms of platform/server interoperability. Best practices and business rules are essential to make content reuse a reality.

The DODI 1322.26 requiring that all DoD distributed training be SCORM conformant and registered with the ADL-R serves to ensure that a standard solution is implemented so that content reuse is possible. Requiring content to be SCORM conformant ensures technical interoperability while requiring that the content be registered with the ADL-R ensures that the content can be found for reuse. But, once found, will it be reusable in terms of instructional design?

Ensuring the quality of content and its suitability for reuse in terms of instructional design is a matter for best practices and business rules which may vary across organizations. Guidelines for best practices and business rules must take into account the known barriers to reuse and benefits of an object-based approach to content design and development.

Below we’ve listed again the factors inhibiting effective reuse followed by opportunities for overcoming them.

- **Lack of metadata for search and discovery**
 - May be overcome with common vocabularies, ontologies, application of metadata at learning object level as well as course level
- **Unexposed silos of content**
 - May be overcome by registering content with the ADL-R
- **Monolithic SCOs**
 - May be overcome by designing for reuse and using SCORM authoring tools to create one learning object or SCO at a time
- **Overly contextualized learning objects**
 - May be overcome by omitting context from learning objects and using context-setting SCOs as “glue” between the objects
- **Different presentation styles**
 - May be overcome by separating presentation layer from content and agreeing on a common presentation style
- **Economic disincentives for sharing**
 - May be overcome by encouraging the sharing of objectives through incentives

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