

## **Developing SCORM-Compliant Media-Rich Graduate-Level Distance Education: A Case Study of Best Practices**

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The advent of the Sharable Content Object Reference Model (SCORM) adds a new dynamic to the instructional systems design (ISD) and production processes. Effective front-end analysis and planning for SCORM conformance offers practitioners the means to design accessible, interoperable, durable, reusable, and affordable learning objects (LOs). Distance educators must understand the implications of SCORM if they are to achieve its potential benefits and remain competitive in the future.

The Joint Forces Staff College (JFSC) developed and implemented the first SCORM-compliant graduate-level distance education program in the Department of Defense. Converting 51 lessons into 86 hours of media-rich courseware in 12 months, JFSC's Advanced Joint Professional Military Education (AJPME) course, serves as an excellent model for educators undergoing a transformation to DL courseware. This case study identifies best practices from front-end analysis through evaluation of instructional design necessary to effectively incorporate SCORM-compliant courseware into higher education.

### **Instructional Systems Design for SCORM Conformance**

#### **Ensuring Instructional Integrity Through the Traditional ISD Process**

The basic model underlying most ISD approaches is a cyclic process of: analysis, design, development, implementation, and evaluation (ADDIE). Within organizations currently applying the popular ADDIE instructional systems design model, the process does not have to change dramatically to develop SCORM content. However, each phase requires some additional considerations. Upfront planning is essential.

For instance, in the *analysis* phase, instructional designers (IDs) should determine if the learning management system (LMS) employed is SCORM conformant and to what version it conforms. IDs should also analyze data tracking opportunities and requirements, potential secondary audiences for reusability, and strategies for recording metadata to help locate LOs within content repositories (Spigarelli, 2004).

As for the *design* phase, IDs should think "reusability" when chunking content and determine what data requires tracking as well as what metadata to store for content organizations, sharable content objects (SCOs), and assets. Designers then formulate content into SCOs or assets depending on whether the content needs to communicate data to the LMS (Spigarelli, 2004).

The considerations presented here are just a sampling of those that arise in the design phase of SCORM content. Additional planning questions asked in this phase include: Depending on the level of granularity, what should be searchable (tagged with metadata)? Should LOs be chunked to cover an objective? Should SCOs include an assessment or should the assessment be its own SCO? How will the content be used initially and what additional audiences could benefit by its reuse? Should it be context-neutral? How will it be cataloged and stored?

Although SCORM-conformant content objects typically require additional time upfront in the analysis and design phases of the ADDIE process, potential savings in time are realized in the *development* stage whenever content can be repurposed or reused. To maximize reusability when developing new content however, it is desirable to purpose the content of each SCO so that it stands alone and does not refer to another SCO. On the other hand, realizing that it is not always possible to develop such discrete and unconnected SCOs without hampering meaning, IDs may choose to incorporate context-specific information when essential to achieving desired educational outcomes. Therefore determinations are made based on whether context-specific information is necessary, while keeping in mind how the context affects reuse and if context can be provided externally from the content without hampering learning.

Of course where SCORM is concerned, the development phase requires additional technical expertise to fulfill the reference model's conformance guidelines. It is not enough to create instructional HTML web pages with text and media elements. Programmers and developers must have a working knowledge of the technology required to implement SCORM, based on the Content Aggregation Model, Run-time Environment, and Sequencing and Navigation guidelines for LOs. They must be able to structure data properly and add metadata to content organizations, content aggregations, activities, SCOs, and assets.

When ready for course *implementation*, the developer creates a manifest file that describes the content package, compresses the content into a zip file, and uploads this content package to the LMS where the students access the material. When accessed online, the application program interface talks to the LMS to enable data tracking. Using these data, faculty may assess student progress, course statistics, and more.

Although audience feedback is important in all stages of the ISD process, the *evaluation* stage centers on employing collected feedback to improve the course and maximize student learning. Organizations must define when, where, and how to collect evaluative data. IDs should determine whether to provide an evaluation for each LO, SCO, or objective. Additional data tracked through the LMS enables users to run statistical reports on learner performance, access times and frequency, etc. As in other learning formats, summative, and formative evaluation data are necessary throughout the course lifecycle to gain a clear perspective of "learner satisfaction, meeting the learning objectives, transfer of learning, and business impact" (Barritt, 2002, p. 29). When a reviewer detects an inadequacy, they should analyze the contributing factors and ultimately, design, develop, deliver, and evaluate the new content to see where and if further modifications are necessary.

### **The Planning Process for AJPME**

The JFSC planning team devoted extensive man-hours brainstorming and analyzing the college's needs to produce a statement of work (SOW). This analysis continued after contract award.

Within the analysis and design stages, both the IDs and production staff formed and agreed upon consistent standards that would guide the basic designs for lesson material. The IDs worked together to determine guidelines such as how to divide and structure the lesson (chunking SCOs, where to put objectives, readings, etc.); when and how to incorporate video interviews and other multimedia; how to assess learner progress (self-checks, assessments); what writing style to use for the Web content; and what links to provide to the learner. The project's senior educational expert worked with production managers to develop a "roadmap" tool for IDs. The roadmaps defined the structure of each aggregation by listing the SCOs and linking to assets within each lesson. Due to the sheer number of files and their complexity, the roadmap was a crucial planning tool that sped the design and development effort.

In the initial design effort, the senior educational expert designed one multimedia-based lesson using the standards proposed by the group and the production team developed this lesson as a rapid prototype. It

provided project IDs a guide to use when creating content, and a means to beta test the online lesson format to gain JFSC approval. Also, as Kevin Kruse (n. d.) has suggested, “The rapid prototype creates an early iteration loop that provides valuable feedback on technical issues, creative treatment, and effectiveness of instruction” (para. 1).

To create the prototype, the production team designed an attractive interface that functioned properly within the LMS’ SCORM Player. They then created the SCOs and assets using HTML web pages with embedded multimedia files based on the roadmap layout and content files provided by the designer. To speed future development efforts, the production team used previously outlined standard styles to create a variety of templates, cascading style sheets, and library items – these were imperative to develop a consistent look-and-feel between and within lessons. After several iterations, key players signed off on the design and the production team was able to enter the development process with a running start.

### **Developing SCORM Conformant Content for AJPME**

With so many IDs and multimedia/Web developers on the project, good communication was imperative to bring the designers’ intent alive in the developed multimedia lesson content. Implementing best practices based on tools, templates, and testing, helped insure this translation.

For each lesson the main design/development tool was the roadmap, which communicated the designer’s planned content structure to the developer(s) creating SCORM content. After the ID completed his/her design, the production staff received the roadmap in addition to all of the basic content pieces (raw data files - such as Microsoft Word, PowerPoint, and image files). Using the roadmap as a guide, the production staff created all of the lesson’s resource files (web pages, video, animation, text, etc.).

The production staff used Macromedia Dreamweaver MX as the HTML editor and Web site management tool of choice. Dreamweaver allowed developers to create and manage site-wide cascading style sheets (CSS), assets, libraries, and templates to both speed development and insure consistency. With templates developed for each of the web page types, developers could quickly and easily modify existing library items, import new text and media, link and format items using CSS, and create web pages.

Macromedia Flash MX was used to create all of the multimedia and animations in the AJPME online lessons. Flash pieces produced included drag and drop exercises, self-check assessments, process demonstrations, and video and/or audio segments. Video was incorporated into a majority of the lessons, and used in a variety of ways. The multimedia specialists and Flash developers created several templates that allowed them to import raw video or audio files as well as text transcripts, into the Flash movies.

After the media elements were created, developers then formed the assets into SCOs, and linked the SCOs with the necessary files (manifest and schema) during the packaging process using Reload Editor. Once the content packages were created however, they did not automatically get posted, or uploaded to the LMS, for student usage. An intense quality assurance phase was used to revise and approve all lessons prior to implementation. Initially, the production staff posted the lessons into an internal workspace on the LMS. This allowed them to test for functionality and make obvious changes. Next, the lessons were uploaded to Blackboard to undertake comprehensive team testing, a basic quality assurance (QA) measure. For most lessons there were at least two official QA meetings that gave reviewers (IDs, SMEs, etc.) the opportunity to request changes. When the lesson changes were complete, the production team tested for SCORM conformance and delivered the SCORM content packages to JFSC.

Now in implementation, the course development team in place at JFSC has the flexibility to create and modify content, as well as repackage and post lessons to Blackboard as necessary. Additionally, although

formal evaluation methods take place at strategic intervals, continual QA is foundational to providing a solid learning experience for RC officers in the AJPME program.

### **Best Practices Identified**

Best practices for SCORM implementations are collected from the JFSC case study and sorted below by ISD phase. Practitioners can use these as a guide to employ the reference model in higher education.

**Best Practices for Analysis.** Devote ample time examining project/audience needs and planning the key facets of your project accordingly. Solicit input from all of the key players, but have one ultimate authority when a consensus is not possible.

**Best Practices for Design.** To help insure design consistency and maximize reusability, allow IDs to work together to determine required lesson components (assessments, rubrics, media, etc.), standardized naming conventions, how best to chunk SCOs, and other design issues (such as establishing a custom metadata tagging system). Document agreed upon design styles and standards (within a style guide). Provide IDs the documentation, templates, and examples.

**Best Practices for Development.** Utilize rapid prototype development as a means to establish a common vision. Develop a sample lesson and tweak it as necessary until the major players have approved the prototype. Based on the approved prototype, create, share, and utilize standard tools, templates, CSS, and library items to author and assemble content. This will cut development time and aid consistency efforts.

**Best Practices for Implementation.** Once developed, pursue an intensive quality assurance process to insure content is accurate, functional, and conformant. Test content on the chosen LMS to insure student results/progress are properly recorded. Apply adequate student support measures to overcome technological issues that may arise. Create a content reuse system; store objects in a repository that can be queried (or searched) to access content for reuse or repurpose (Meyerding, 2004).

**Best Practices for Evaluation.** Execute a variety of evaluation measures at different stages in the process and use all student feedback to analyze where deficiencies in program materials and execution exist. For example, use online surveys to solicit feedback on different lessons and also analyze tracked data from reports based on pre- and post-assessment scores. Incorporate procedures for correcting any deficiencies. Document standing operating procedures to insure efficiency and ease the transition of duties for new personnel on the project.

### **Conclusion**

The Shareable Content Object Reference Model is no longer just a good idea—it is a requirement for all distance learning courseware developed for the Department of Defense. In the future, DoD-owned content is forecasted to exist in repositories that can be searched for reuse or repurposing throughout organizations to provide personalized, “just-in-time” training. Additionally as educators’ understanding of SCORM concepts and LOs increase, more institutions will embrace collaboration and content sharing efforts. Institutions will form “communities of practice” in order to “provide a rich and economical source of learning materials, generate new pedagogies and provide a supportive and challenging collaborative network” (Griffith & Academic Co-Lab Staff, 2003, p. 16). Therefore to remain competitive in a world of reuse and sharing, educators should understand the implications of courseware development in compliance with SCORM standards.

As the first Professional Military Education program to be SCORM-compliant, the JFSC distance learning initiative provides a useful model to practitioners in the rush to standardize learning materials. This case study revealed a number of best practices and processes involved in converting traditional course materials to highly interactive, SCORM-compliant courseware.

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