From E-Learning to X-Learning: Transitioning from SCORM to xAPI

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Abstract

The development of mobile technology and the ability to network, collaborate, and access information anytime and anywhere has effectively effaced the boundaries of e-learning. The durable Sharable Content Object Reference Model (SCORM) standard, with its within-the-frame delivery of content objects, tracks and reports on-screen learner activity, but cannot account for learning, experience, and performance that occur beyond the browser. In response to this fundamental limitation of SCORM, Advanced Distributed Learning (ADL) released in 2013 the first version of Experience API (xAPI), a specification designed to track, store, and report any type of user activity and experience—formal or informal—occurring online and offline. The critical response to SCORM has generally clustered around its constraints, whereas research into xAPI has centered on the ways in which this nascent e-learning technology will make learning more immediate, personalized, social, and authentic. Although the literature is specific in regard to xAPI's conceptual and technical underpinnings as a learning technology, there has been little critical discussion about how it can be leveraged pedagogically and pragmatically in the instructional design of an e-learning experience.

Keywords: e-learning, SCORM, Sharable Content Object, xAPI

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The Sharable Content Object Reference Model (SCORM) has been an e-learning standard for over a decade, allowing self-contained learning objects to be created, used, and shared across learning management systems (LMSs). However, because SCORM is a browser-based specification, one of its fundamental limitations is the inability to track and report any learning, experience, or performance that occurs beyond the browser. From SCORM's earliest iterations, critical literature has focused more on SCORM's shortcomings and constraints. In the context of these constraints—and due to an increase in the use of mobile devices to support learning—xAPI as an e-learning technology has become both necessary and inevitable. Because xAPI is in its first version of release, the body of critical literature generally focuses more on xAPI's potential to mitigate SCORM's constraints than on specific pedagogic and pragmatic uses of xAPI in an e-learning environment.

What is SCORM?

The initial version of SCORM was released in 2000 by Advanced Distributed Learning (ADL), a learning technology initiative originated by the U.S. Department of Defense (DOD) to develop guidelines, standards, specifications, and tools to facilitate on-demand high-quality distributed learning in the DOD and across other federal government agencies (Advanced Distributed Learning [ADL], 2011). ADL defines SCORM as the integration of a series of technical standards and specifications designed to make learning content accessible; reusable; impervious to hardware, software, browser, and operating system updates; and compatible with any ADL-compliant LMS (ADL, 2011). SCORM has undergone several iterations since its initial release (2001, 2004, 2006), with the final version of SCORM released in March 2009.

SCORM Components

The central component of SCORM is the Content Aggregation Model (CAM). The CAM consists of a sequence of sharable content objects and assets, metadata, and a manifest file that communicates to the LMS how everything is to be implemented (ADL, 2011). Because the CAM is at the heart of what is delivered to the learner, it is important to distinguish among the different, and overlapping, parts of this model.

A sharable content object (SCO) is the content the learner accesses in a browser-based environment. SCOs are defined as units of information that can consist of anything from text or images to a multibranched learning scenario to a hundred-page course. A SCO is launched from within the browser, carrying with it information that can be tracked by an LMS as a learning activity (e.g., pass/fail). SCOs are constructed using assets, which can be an HTML page, text, an image, a video, an MP3, or any other digital item (ADL, 2011).

Because a SCO is intended to be sharable and reusable, it should be context-neutral, or self-contained, and granular, representing the smallest unit of learning that can be tracked by an LMS (ADL, 2011). For example, reusing a one-hour video lecture is impractical if any part of the lecture is not relevant to the learning event for which it is being reused. Conversely, a SCO that is a three-minute video microlecture is much more pliable in other learning contexts. For this reason, sufficient *metadata* is needed to adequately tag a SCO to be searched, used, and reused by others (ADL, 2011).

More Constraints Than Affordances

ADL blandly reassured that “SCORM provides some affordances and constraints for design, but doesn’t change the design process” (ADL, 2011, p. 6). A reductive view of the instructional (systems) designer is further prescribed: “Instructional systems designers (ISDs) will still create learning objectives that drive the design of the course. They will design content around those objectives and then create assessments that test whether the learning objectives have been met" (ADL, 2011, p. 6). With this narrow conception of what instructional (systems) designers do, it is not surprising that critical literature highlights SCORM's constraints far more than it extolls its affordances.

SCORM is a bundle of technical standards intended to guide programmers, developers, and instructional designers alike. Accordingly, it is useful to review the body of SCORM-themed research within the framework of the taxonomy constructed by Rossano, Joy, Roselli, and Sutinen (2005), in which an issue is addressed from the perspectives of differing professionals in the e-learning field. These perspectives are: *pedagogic* (focusing on the ways in which tools, frameworks, and models relevant to e-learning are constructed); *pragmatic* (focusing on practical solutions); and *technical* (focusing on technological solutions to a specific problem or issue). A review of the critical literature reveals two recurring limitations, generally falling along the taxonomy's pragmatic and pedagogical perspectives.

Limitations of the Shared Content Object (SCO)

The first limitation of SCORM addressed in the literature is the idea of the shared content object as being static and acontextual. Although ADL identifies these traits as essential for a SCO for it to be sharable and interoperable from a technical perspective (ADL, 2011), the general critical perspective (Baker 2006; Barker, 2004; Kang, Lim, & Kim, 2004; Parrish, 2004; Sampson & Karampiperis, 2006) is that the pedagogic and pragmatic value of the SCO is limited.

For Parish (2004), the sharable content object is, by design, inherently acontextual, whereas teaching and learning are expressive endeavors drenched in context. (Parish, 2004). Barker (2004) wrote from a pragmatic perspective, identifying issues with SCOs related to the ability of the learner to navigate between and within SCO. A workaround to this issue would result in two equally cumbersome navigational systems appearing simultaneously on the screen. Kang et al. (2004) adopted a pedagogic perspective, stressing the need for instructional designers to become effective learning object creators. The authors proposed using a theory-based, SCORM-compliant learning object–generating tool that could create customized learning objects (Kang et al., 2004).

Baker (2006) acknowledged SCORM’s gains in facilitating the interoperability of content but restated a main pedagogic concern regarding SCOs addressed by others—that a rich learning experience cannot be created by tagging, sharing, and reusing learning objects in a “syntactic structure” devoid of context and the many processes associated with teaching and learning (Baker, 2006, p. 168). Sampson and Karampiperis (2006) found the utility of SCOs to create more complex learning activities, such as scenarios, to be very limited, and called for a standardization of learning activity components facilitated by a learning activities authoring tool.

Although some have proposed technical solutions to the pedagogic and pragmatic limitations of SCOs, such workarounds come across as inartful (Barker, 2004), whereas other solutions (Kang et al., 2004; Sampson & Karampiperis, 2006) would likely add to the constraints they are designed to mitigate.

Limitations of Browser-Based Learning

Being restricted to the confines of the SCORM run-time environment (i.e., the browser frame) is likewise characterized as a pragmatic and pedagogical obstacle. Robson (2002) viewed the inability of browser-based content to communicate with other content as a fundamental limitation. Edwards, Wiley, and Nelson (2002) saw SCORM’s promise of cost-efficient 1:1 instruction and support through an automated instructional system not as an advancement in technology and education but as an opportunity to retire the teacher-as-transmitter-of-knowledge dynamic and replace it with a new paradigm built on a peer-based, collaborative, supportive learning model that can leverage technology such as instant messaging and “applications like Napster” (Edwards et al., 2002, p. 17).

Feng-Hsu (2008) presented a hypothetical contextualized browsing model to track learners’ browsing behaviors and tendencies and use this data to create personalized content suggestions. Glahn (2012) surveyed several studies that focused on how to organize SCOs in a mobile environment accessed by different devices. Glahn concluded that such an approach would require new extensions (e.g., m-SCORM), which would limit the interoperability crucial to the sharable aspect of content objects. Glahn’s solution is both pragmatic (focusing on a microlearning lesson design) and technical (integrating the Mobler Cards app).

Although critics highlighting the browser-limited aspect of SCORM offer solutions to extend learner activity outside the SCORM-imposed frame, such solutions come across as aspirational (Edwards et al., 2002; Robson, 2002); hypothetical (Feng-Hsu, 2008); or ad hoc (Glahn, 2012).

What is xAPI?

Released in April 2013, xAPI is the first of several of ADL’s Training and Learning Architecture (TLA) projects designed to connect learning and training through the latest technology. Although it was originally billed as the “Next Generation SCORM” (Johnson, 2012, p. 3), xAPI effectively severs its SCORM roots. While SCORM delivers file-laden, pre-packaged, pre-loaded content (SCOs) to the learner through an in-browser frame, xAPI captures, stores, and reports learner-generated streams of activity consisting of instruction, experience, or performance in any context, online or offline. The lean and agile nature of xAPI allows true interoperability between platforms, formats, devices, and applications, even when the user is temporarily disconnected from the Internet (Papazoglakis, 2013).

How Does xAPI Work?

SCORM backgrounds the learner as the passive object of the content deployed, whereas xAPI foregrounds the learner as a dynamic subject and creator of experiences. This subject-as-creator notion is embedded in the technical configuration of how xAPI organizes experiences. Such experiences, which can originate from any source, even from SCORM content itself, are rendered in statements that follow the basic syntax of language: subject (or actor)-verb-object (Papazoglakis, 2013). For example, a learner watching a video about xAPI on YouTube would, using a browser bookmarklet plug-in, generate the following activity statement: “davidd experienced ‘xAPI explained’ – YouTube.” In this case, “davidd” is the actor; “experienced” is the verb; and “xAPI explained-You Tube” is the object.

Once an activity statement is generated, it is transferred and stored in a learning record store (LRS). Unlike an LMS, which parcels out tracking data depending on how the LMS has been configured by the vendor, in an LRS, xAPI data retains the actor-verb-object format in which it was tracked. Although an LRS is not an LMS, it can be used in tandem or integrated with an LMS (Murray, Berking, Haag, & Hruska, 2012). Statements can be pulled out and parsed, using analytics tools to capture a snapshot of activity and the experiences for a given group of users; depending on the learning context, this information can likewise be shared with a course tutor and other users (Papazoglakis, 2013).

Toward a Pedagogic Use of xAPI

Because xAPI is “a baby as far as standards go” (Bowe, 2013, p. 50), the body of critical discussion regarding xAPI is still in its infancy. Literature that addresses xAPI touts it as a game changer (Murray & Silvers, 2013), focuses on what distinguishes xAPI from SCORM (Papazoglakis, 2013), doubles down on SCORM's limitations (Roddy, 2013), or trumpets the impending obsolescence of SCORM (Berthelemy, 2013).

Murray et al. (2012) addressed the role that the mobile platform has played in facilitating learning and performance and recognized xAPI as a technology that can both enhance individualized learning and promote collaborative learning. Although the authors focused on how xAPI can be used in connection with a mobile learning format, they did acknowledge that xAPI can mediate the use of mobile devices to support more traditional (i.e., pre-planned) e-learning (Murray et al., 2012).

Because xAPI captures both the individual's creation of learning experiences as well as activities that can promote group and social learning (Murray et al., 2012), xAPI is ideally suited to support constructivist learning design. For Almala (2006), a constructivist environment is one in which learners take responsibility for their own learning (individual constructivism) and one in which there is space to engage and collaborate with others (social constructivism), with the goal of making learning as diverse and authentic as possible. For Keengwe, Onchwari, and Agamba (2013), a constructivist design positions learners to be active and to demonstrate what they know—rather than operating in a receptive mode, as when listening to a lecture and being told what they should know. This direct, hands-on interaction with the learning material facilitates greater understanding.

Toward a Pragmatic Use of xAPI

xAPI-focused research minimizes the role of the instructional designer in the experience process (Bowe, 2013; Murray & Silvers, 2013; Papazoglakis, 2013). One exception is Duhon (2014), who discussed an "experience to events to statements" (EES) method that foregrounds the instructional designer as the creator of learning event descriptions that will translate into more robust xAPI activity statements (Duhon, 2014, p. 76). Although Duhon ultimately focused on the more technical "statements" step in his EES method, his practical example of a workplace Q&A stack overflow style discussion board demonstrated that an xAPI statement should be mapped based on a learning-related event that is specific, authentic, and contextualized (Duhon, 2014).

One gap in the body of xAPI research, and one which Duhon's discussion stops short of filling, is how xAPI can be used as more than just a discrete service that tracks experiences, even if they are as nuanced as those in Duhon's example. One approach is to integrate xAPI more broadly as a component into what Dempsey and Van Eck (2012) referred to as a *functional architecture*, whose meshing and mashing of component elements is what generates a rich, complex e-learning environment that can reflect "current conceptions of learning as a constructed experience" (Dempsey & Van Eck, 2012, p. 285). By designing specific, authentic and contextualized events that leverage xAPI to record beyond-the-browser experiences, the instructional designer can transform the most preplanned, self-paced e-learning "container" into a student-centered, collaborative e-learning environment that connects the learner to the real world (Dempsey & Van Eck, 2012, p. 285).

By way of example, an online asynchronous SCORM-based Teaching English to Speakers of Other Languages (TESOL) training course could incorporate specific, authentic, and contextualized xAPI-based activities to support, reinforce, and enhance primary learning content by transporting the learner beyond the confines of the course. Typically taken by those wanting to teach English abroad, TESOL training courses are designed to cover the fundamentals of teaching English as a foreign language. Because the content in this example course is delivered via SCORM, the course follows a linear structure and is self-contained within the frame of the browser. Moreover, learners can start and complete the course at different times. Finally, being a self-directed course with only a facilitator to monitor progress, learners will not come into contact with one another or have regular communication with an instructor.

The following xAPI-based learning activities promote personalization of the learning material as well as interaction and collaboration with other students taking the course, even if they are progressing through the course at a different pace.

1) xAPI Activity One: Using either video or audio, describe your favorite teacher and identify the qualities that made the teacher so effective.
2) xAPI Activity Two: Visit Dave's ESL Cafe, locate a forum with a discussion focus on the country you want to teach in, and ask a question for which you would like to receive a response from those currently teaching in that country.
3) xAPI Activity Three: Create an information gap activity that you think others taking this course will find useful.
4) xAPI Activity Four: Using the bookmarklet app, curate five TESOL resources that you feel will be helpful to your continued professional development as an EFL teacher once you begin teaching overseas.
5) xAPI Activity Five: You and several colleagues arrive at the school where you have been posted overseas and are told that the textbook for your class will not be available for a week. Using the activity stream as a reference, develop three strategies that have not been listed by your colleagues to teach the first week of classes without the main text.

Conclusion

Despite ADL's promotion of xAPI as the next generation of SCORM, SCORM 2004 remains the most widely-used e-learning standard. Because xAPI is still in its first version of release, there is a paucity of critical xAPI research; extant research largely focuses on the technical aspects of xAPI (Bowe, 2013) or its potential to overcome SCORM's shortcomings (Berthelemy, 2013; Murray & Silvers, 2013; Papazoglakis, 2013; Roddy, 2013). For xAPI to gain traction as a viable replacement for SCORM, research needs to progress beyond these trends and address the specific pedagogic uses of xAPI. Future investigations should also address how practitioners can use xAPI within an e-learning environment to create what Dempsey and Van Eck (2012) called *instructional technics*, or "activities or tactics that use technology designed or selected to attain specific learning outcomes" (Dempsey & Van Eck, 2012, p. 284).

Research that focuses on the pedagogic and pragmatic uses of xAPI in an e-learning environment can help ensure that xAPI achieves the same wide usability that SCORM has attained. Naturally, xAPI as a service will have to keep developing as well. Specifically, more xAPI-native tools, such as the bookmarklet and third-party applications (e.g., Tappestry, GrassBlade) need to be designed to capture more of the beyond-the-browser experiences that xAPI purports to facilitate and which instructional designers can use to create specific, authentic, and contextualized xAPI-based activities.

Because the development of xAPI has been the result of the input, feedback, and perspectives of a diverse community of practice from the beginning (Papazoglakis, 2013), it is not unreasonable to assume that the current gap between what xAPI is designed to do and what instructional designers will actually be able to do with it will close as the body of xAPI research grows and as xAPI continues to mature as an e-learning standard.

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