Connecting Instructional Design to International Standards for Content Reusability

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Introduction

The requirement for standards is incontrovertible. From baseballs to railroad tracks, standard dimensions and approaches to design are essential if the cogs of today's technological world are to intermesh. When pieces fit, things work, progress is made and at times, disaster is even averted.

As a dramatic example of the importance of standards, consider the Great Baltimore Fire of 1904. In 1870 Baltimore had selected for its installation of fire hydrants the invention of local resident James Curran, who had received U.S. Patent #99646 (http://www.firehydrant.org/pictures/baltimore.html). It is not clear if the decision was made on technical merit or from some form of favoritism, but the results of the choice are evident. When fire broke out on the morning of 7 February in the basement of a dry-goods warehouse, it spread quickly, prompting the call to Washington via telegram one hour later, "Desperate fire here. Must have help at once." Although numerous engine companies arrived from as far away as New York and Altoona, as well as Philadelphia, Wilmington, and Annapolis, in addition to those called in from Washington, the visiting fire fighters were unable to connect their hoses to Baltimore's hydrants. The fire burned itself out after 30 hours, having destroyed 70 to 80 city blocks of the city (Nesmith, 1985; Grant 2002).

Shortly after the fire, the National Bureau of Standards collected and analyzed over 600 samples of fire hose couplings from around the country. The next year, 1905, the National Fire Protection Association adopted a standard hose coupling and an interchangeable coupling device for non-standard hoses (Grant, 2002). As late as 1964 however, Baltimore officials "learned that firemen in an adjoining county were requesting that fireplugs which did not fit hoses made to the national standard be marked with fluorescent paint so firefighters could tell where special adapters were needed" (Nesmith, 1985).

The development of standards for railroad tracks is equally colorful and in some ways just as dramatic. In the US in the 19th century, the most prevalent railroad gauge varied from the British standard of 4 feet-8 ½ inches to 4 feet-10 inches, with some tracks measuring up to 6 feet. Efforts to standardize at times brought severe reactions, such as those from residents of Erie, Pennsylvania, who took to the streets in 1853 in bloody riots. The purpose of their fight was to oppose a construction project to move the rails to a more standard width. The rioters wanted to avoid the loss of jobs that had been created by the requirement to unload and load trains and even jack up cars and change wheels as freight was transported through Erie and had to be moved from one gauge railroad to the other. Despite such complications, the importance of railroads in society was underscored a few years later and for many years to come as the Civil War became the first war in which there was a significant use of railroads for army logistics. Even then, in order to complete military operations, it was necessary at rail junction points to unload and reload soldiers, equipment, and supplies from one train to the other (Lowell, 2001).

Making the transition from these stories to standards in educational technology is not difficult. Just as shoppers don't have to worry about whether the cereal (content) they buy in the store today will be compatible next week with the bowls and spoons (delivery system) they have in their kitchens, it seems reasonable to assume that consumers of online learning materials will be able to benefit from their investment in courseware development, not only for their current delivery platforms but also for those they will use in the near future.

Yes, the world of educational technology is rapidly moving toward standards, but is this movement the means for averting disaster or is it in fact a disaster waiting to happen? On the one hand we have the concern that technologists are leading the effort without appropriate concern for valid instructional design principles (Bunderson, 2002). On the other, we have predictions of the not-too-distant existence of a "learning ecology" (Brown, 1999) in which documents made up of multiple data types will be created and flow freely among producers and consumers of knowledge (Looi 2000), a scenario that is totally unrealistic without the existence of standards at some level.

Indeed, technology-assisted learning has had a history built on varying and not always compatible technologies, the list of which reads like a bowl of alphabet soup, a list filled with the likes of IVD (interactive videodisc), CD Audio, CD-ROM, CD-I, CD-ROM XA, and DVI. Multimedia technologies in general and online learning technologies in particular have been moving for some time now from one acronymic world to another, from mainframe-based delivery systems to standalone interactive technologies to Web-based learning with text files and graphics files, as well as streaming audio and video in their various flavors: DOC, TXT, HTML, PDF, JPG, GIF, BMP, PIC, JPEG, MPEG-1, WMA, AVI, MPEG-2, Motion JPEG, MP3, DV, WAV, AU, AIFF, PCM, just to name a few file extensions and associated technologies. To cap off the complexity, add to the mix: Internet-based conferencing, QuickTime video, Media Player, Real Player, DVD, DVD-ROM, and Web DVD, not to mention the multiplicity of operating systems that has always been a problem, a few of which are still present (Mac OS, Windows, Unix, and most recently Linux) with which we must include Web browsers in their various flavors: Netscape, Internet Explorer, Mozilla, and Opera.

Thus, it is not presently very hard to imagine all of us who wish to inhabit this new, all-digital realm standing around or pacing, or, as the case may be, wringing our hands, glancing at each other, probably not too much unlike the erstwhile, guest fire fighters in Baltimore. The exclamations of this modern technological group are also similar to those most likely heard at that dire event of 1904, "How much better off things would be if our pipes would only connect!" Indeed, we seem to be collectively worried about bandwidth, in other words, making our pipes bigger, when the biggest problem is that what we send down the pipes might or might not reach its destination in a form that will be usable by those for whom it is intended.

Finally, we have the instructional use of the content that is created and delivered in the above various forms. Consider: CAI, CAL, CBI, TBT, CBT, ITS, and CMI, conceived within a framework of instructionist or constructivist tenets, designed with ID_1 or ID_2 and developed using an LCMS and delivered with a CMS or LMS, with student records to be collected and stored by SQL Server, Oracle, or DB2. Even if we are successful at getting the content distributed to our users, what assurance do we have that we will get back usable information on how the content was used? Without appropriate standards that guide how we deliver the content and that report on how the content was used by our learners, absolutely nothing is guaranteed.

The payoff for adopting standards thus seems obvious. Indeed, a new report released in June 2002 by strategy and technology consultants, Booz Allen Hamilton (BAH), projects "a resurgence in the e-learning market, expecting it to reach the $12-14 billion range by 2004," up from $5.3 billion in 2000 (Booz Allen Hamilton, 2002). This range of numbers is significantly different from the $23 billion

forecast by IDC last year, a level that an official of IDC recently stated it would now take "a year or two longer" to reach than originally believed (Fisher, 2002). In either case, the numbers are not hard to imagine, given for example that the US Department of Defense alone will spend this year about $17 billion on training (DMDC, 2002), with an increasing amount each year going to interactive technologies. Just as military needs instigated development in railroad technologies, it is safe to assume that they will also have a major effect on standards for e-learning.
Even if the actual amount for interactive training is at the lower end of the range outlined in the BAH and IDC reports, it is difficult to imagine how such growth will be possible without appropriate standards, or specifications as some would prefer they be called[1]. Indeed, given such economic incentives, the implementation of standards seems completely logical, at least at some level. The key question is at what point this level is to be found. We will explore this area, but first it is important to understand how standards are developing with respect to instructional technology.

Overview of Development Efforts for E-Learning Standards

Chronologically, any discussion of e-learning standards will begin with the formation of the Aviation Industry CBT Committee (AICC) in 1989 with its objectives "to standardized [sic] PC hardware and promote system interoperability" (Costello, 2002, 3). This international association of professionals who are connected to technology-based training transcends multiple industries and has worked since its formation for the development of guidelines that enable hardware and software alike to work together in the delivery of computer-based training (CBT).

A key concept that came on the scene early, shortly after AICC's formation, is "learning object," and according to one writer its history "is easier to document than a formal definition" (Jacobsen, 2001). Jacobsen recounts how Wayne Hodgins of AutoDesk came up with the concept:

> In 1992, Wayne was watching one of his children playing with Lego building blocks while mulling over some problems regarding learning strategies. Wayne realized right there that the industry needed building blocks for learning—plug-and-play interoperable pieces of learning. He termed those building blocks, "learning objects."

From that early point, groups not only from the US but from around the world have been addressing issues related to learning objects and associated technologies. Probably the earliest efforts were the Learning Object Metadata Group of the National Institute of Science and Technology and the Computer Education Management Association (CEDMA). These were soon joined by key groups such as IEEE LTSC, IMS, and ARIADNE in Europe, among others as shown below:

- Advanced Distributed Learning Initiative (ADL)
- ADL Co-Laboratory Network (ADLCOLAB)
- Advanced Learning Infrastructure Consortium (ALIC)
- Alliance of Remote Instructional and Distribution Networks for Europe (ARIADNE)
- American Society for Training and Development (ASTD)
- Aviation Industry CBT Committee (AICC)
- Canadian Core Learning Resource Metadata Application Profile (CANCORE)
- CEN/ISSS Learning Technology Workshop (LTWS)
- Centre for Educational Technology Interoperability Standards (CETIS)
- Computer Education Management Association (CedMA)
- Dublin Core Metadata Initiative (DCMI)

[1] For many people who work in this area, standards imply some impetus for implementation and conformance, whereas specifications are recommendations that do not carry the weight of any standards-setting body such as the International Standards Organization (ISO).

- Education Network Australia (EdNA)
- IEEE Learning Technology Standards Committee (IEEE LTSC)
- IMS Global Learning Consortium (IMS)
- Open Knowledge Initiative (OKI)
- ISO Standards for Information Technology for Learning, Education, and Training (ISO/IEC JTC1 SC36)
- Schools Interoperability Framework (SIF)

This list[2] contains the names of organizations from the US, Canada, Europe, Australia, Japan, and the United Kingdom, illustrating just how wide spread is the effort surrounding the development of common approaches to learning objects.

Expanded to Reusable Learning Objects (RLO), this concept is now not only the target of development bodies around the world, but it has also become the subject of scholarly publications, dissertations, and books, such as Wiley's (2000a) *The Instructional Use of Learning Objects* that has been published on the Web [see http://reusability.org/read/] as well as in text form by AECT. In the introductory chapter of this volume, Wiley states that "Learning objects are elements of a new type of computer-based instruction grounded in the object-oriented paradigm of computer science" with which "instructional designers can build small (relative to the size of an entire course) instructional components that can be reused a number of times in different learning contexts" (2000a).

The movement toward standards for learning objects had been underway several years by 1997 when the White House Office of Science & Technology Policy (OSTP) co-sponsored the kick-off meeting for the Advanced Distributing Learning initiative (ADL) that was held in November. [See: http://www.adlnet.org/index.cfm?fuseaction=abtadl] The purpose of ADL was to "to develop a DoD-wide strategy for using learning and information technologies to modernize education and training and to promote cooperation between government, academia and business to develop e-learning standardization" (Dodds, 2001a, 1-3). Promoting DoD's (Department of Defense) effort in this direction was its enormous and increasing annual investment in technology-based training, an incentive which motivated officials to find ways to make things move faster. Following this initial meeting and a subsequent investigation into developing standards for interactive learning materials, the effort to define the Sharable Content Object Reference Model (SCORM™) was initiated with support from many of the organizations listed above and development from entities such as IMS, AICC, ARIADNE, and IEEE LTSC.

Explaining this important technological direction *The SCORM Overview* lists four ultimate goals of the SCORM specification:

- **Accessibility**: the ability to locate and access instructional components from one remote location and deliver them to many other locations.
- **Interoperability**: the ability to take instructional components developed in one location with one set of tools or platform and use them in another location with a different set of tools or platform. Note: there are multiple levels of interoperability.
- **Durability**: the ability to withstand technology changes without redesign, reconfiguration or recoding.
- **Reusability**: the flexibility to incorporate instructional components in multiple applications and contexts (Dodds, 2001a, 1-29).

These are restated in *The SCORM Overview* as:

- The ability of a Web-based Learning Management System (LMS) to launch content that is authored by using tools from different vendors and to exchange data with that content;

[2] Web addresses for each organization are provided at the end of the article.

- The ability of Web-based LMS products from different vendors to launch the same content and exchange data with that content during execution; and
- The ability of multiple Web-based LMS products/environments to access a common repository of executable content and to launch such content (Dodds, 2001a, 1-29).

Other descriptive terms are often used to summarize efforts of the standards movement such as "manageability" (Norman, 2002; South & Monson 2000) or in other words the ability of a system to "track the appropriate information about the learner and the content" (Norman, 2002). There are still others: discoverability, extensibility, and affordability (South & Monson 2000).

Discoverability is in effect related to reusability and fundamentally has to do with metadata, probably the best known aspect of learning objects standards movement. Metadata can be compared to the card catalog in the library, providing a way to get at the objects that have been created (Griffin and Wason, 1997). SCORM uses the SCORM Content Aggregation Model that is based on the IMS Learning Resource Metadata Information Model that is in turn based on the IEEE LTSC Learning Objects Metadata (LOM) Specification. LOM is the product of collaboration between IEEE LTSC, IMS, and ARIADNE (Dodds, 2001a).

Extensibility is directly related to durability, meaning that work and investment will not be lost as progress is made in delivery systems. It also means that it will be possible to incorporate new technologies and have these co-exist with previous generations of capabilities.

As an example of the impact that the SCORM specification is having, the Massachusetts Institute of Technology (MIT) and Stanford are using SCORM in their work in the Open Knowledge Initiative (OKI). Not only is the OKI group connecting their instructional technologies to these specifications, they are developing ways to better connect teaching faculty to online learning initiatives, software that will "supplement, not replace, existing commercial software" (Young, 2002, January 21). With eight institutions working as "Core Collaborators" and nine institutions serving as "Application Developers," (MIT, 2002) OKI anticipates that "If the colleges all used course-management systems with the same technical standards, … then it would be much easier to share software" (Young, 2002, March 11).

E-Learning Standards at Brigham Young University

Interest in e-learning standards has also increased in recent months at Brigham Young University as groups within the university have continued their work on various extensive efforts to make online learning materials available on-campus as well as through distance learning settings (South & Monson 2000). These efforts involve the library, the Continuing Education Division, and the Center for Instructional Design (CID), as well as various research and development projects in diverse areas such as chemistry and foreign language, funded by commercial, governmental, as well as internal sources. CID alone employs about 30 full-time instructional designers, media experts, and project managers who are assisted by upwards of 170 part-time student employees also working in each of these various areas. A mix of locally developed software as well as commercial products such as Blackboard and Perception fit into the extensive infrastructure that is being created.

The receipt at BYU of a fairly significant Federal grant from the National Security Education Program (NSEP) to produce online learning materials in less commonly taught and strategic languages has increased the imperative for pursuing standards. Not only must the materials to be developed fit into BYU's delivery infrastructure, they must also be engineered for broad dissemination, a standard principle for all institutional grants from NSEP, a program funded through the Department of Defense.

It was within this setting that we began to investigate SCORM within the NSEP Project that I direct. One element that became obvious fairly quickly was the apparent compatibility with our previous work on cost-effective materials design methodologies at the US Air Force Academy (USAFA). In particular, in the 1980's and early 1990's I had been involved in the development of a software system for the development and delivery at USAFA of courseware for language learning.

We recognized in our work there that materials development was more a data management problem than a programming problem, a radical departure from development methodologies of the time, and one that yielded significant improvements in productivity (Bush, 1988, 1989, 1992). Furthermore, we found an interesting compatibility between our approach and the Transaction Shell work of David Merrill and his team at Utah State University (Merrill, Li, and Jones, 1990a, 1990b). Not only did we determine that through the separation of content and structure we were able to create tools for content creation and management and thus leverage our programming of system interactions with the learner, but we also established a case for standards in multimedia development (Bush, 1992).

After reading through the SCORM documentation, available at http://www.adlnet.org, it became clear that (1) SCORM would provide a standard method for representing content that was totally compatible with the way that we had been storing content in our work at USAFA and (2) that work had not yet addressed the key issue of how materials would be organized, or "sequenced," to use the term "du jour." Indeed, the first versions of the SCORM specification implied that further development would be necessary to standardize how content objects are to be connected, or in other words, how "branching" among objects would be represented.

In July of 2000 I queried Philip Dodds, the editor of the SCORM documentation, to this effect. He responded that work on SCORM had thus far been limited to a Course Structure Format, based on AICC's previous work, but would more than likely be expanded in the future (Dodds, 2000). Indeed, areas of emphasis to be targeted for SCORM 2.0 and beyond will address the design of "new run-time and course data model architectures" (Dodds, 2001a).

I alerted David Merrill to our investigations and asked how the ADL efforts might fit into his work at Utah State. His response was straightforward, "Bottom line I think that these efforts fall short of the goal" (Merrill, 2000). In fact, it seems that designers of the Learning Objects Metadata (LOM) Specification intentionally left out any reference to instructional design, apparently in the hope that this would add to the applicability of the standards beyond any one instructional theory, a development that is "disturbing" to at least one instructional theorist (Wiley, 2000b, 11). Conversations with other leaders in instructional technology led us to the conclusion that a needed next step for SCORM was to connect the standards to instructional design principles.

This sentiment was echoed by Dodds during a telephone conversation in the fall of 2001 in which he said that he would like nothing better than to have their efforts with SCORM connect to instructional design theorists like David Merrill and others (Dodds, 2001c). This led us to sponsor at Brigham Young University in March 2002 a conference entitled, "Online Instruction for the 21st Century: Connecting Instructional Design to International Standards for Content Reusability" (ID2SCORM). The conference drew a significant attendance as well as interesting and relevant speakers and will be held again in 2003.

After speaking at the ID2SCORM Conference, David Merrill commented to a reporter concerning his message to the developers of standards, "I want them to develop standards that enable me to build things that can be plugged into anybody's system and have them be able to operate, but I don't necessarily want those standards to tell me what those instructional things ought to be" (Baker, 2002). In his presentation at ID2SCORM, Bunderson (2002) expressed concern that the goal of automated, on-demand assembly of instruction as called for in the *SCORM Overview* (Dodds, 2001a) is fantastic and unrealistic. He also expressed concern that standards thus far constrain the best instructional, measurement, and cognitive theory practices and suggested that "a more realistic goal may require fewer and less burdensome mandatory specifications" (Bunderson, 2002). In his presentation at this same conference Clifford stated that "not everyone is in agreement about what SCORM is, what its benefits are, how advanced it is" and went on to say that "no one has yet demonstrated a return on investment (ROI) for the hours spent adding metadata coding to each object" (Clifford, 2002).

Instructional Design and Reusability Standards: Making the Connections

So what is needed to address the apparent disconnect between the promise of standards and what some suppose is their reality? There are at least four categories of technical concerns that address this disconnect:

- A lack of definition of the terms used to discuss standards,
- Questions about appropriate levels of granularity of learning objects,
- An absence of generally accepted theoretical models for describing the instructional design principles encapsulated in learning objects, and
- An absence of generally accepted theoretical models for determining sequencing among learning objects.

Concerning the lack of definition of terms, probably the most salient example is the lack of consensus as to what a learning object actually is (Wiley, 2000b; Gibbons et al, 2000). It is interesting to note that these two authors in their articles in Wiley's (2000a), *The Instructional Use of Learning Objects: The Online Version,* each use different terms, "learning objects" (Wiley) on the one hand and "instructional objects" (Gibbons) on the other. Driving this point home, Clifford (2002) provided a list of terms that includes these two and others, pointing out additional inconsistencies:

- Raw objects
- Content objects
- Course objects
- Learning objects
- Curriculum objects
- Instruction objects
- Assessment objects

Is a "learning object" different from an "instructional object?" If so, what is the difference? If they are the same, then why not use the same term? How does a "course object" differ from a "curriculum object?" How do "raw objects" differ from "content objects?"

To help resolve such questions, we should be able to turn to the SCORM documentation for clarification. Indeed, the *SCORM Content Aggregation Model* (Dodds, 2001b) refers to "assets" and "Sharable Content Object" (SCO). Based on the description and examples provided, it seems that "assets" are what people mean by the term "raw objects" from Clifford's list. An SCO is trickier: "A Sharable Content Object (SCO) represents a collection of one or more Assets that include a specific launchable asset that utilizes the SCORM Run-Time Environment to communicate with Learning Management Systems (LMSs)" (Dodds, 2001b, 2-4).

A problem arises with the rest of the description of SCO, raising the second area of questions, that of granularity. "A SCO represents the lowest level of granularity of learning resources that can be tracked by an LMS using the SCORM Run-Time Environment" (Dodds, 2001b, 2-4). This seems clear enough, but then the description continues, "To be reusable, a SCO by itself should be independent of learning context," something that seems difficult or even impossible with respect to designing objects with sound instructional design principles. How can a well-designed object not embody principles of instructional design that are by definition dependent upon context? Finally, "SCOs are intended to be subjectively small units, such that potential reuse across multiple learning objectives is feasible" (Dodds, 2001b, 2-4). The challenge here derives from the acceptability of the use of the word, "subjectively." Subjective determination of any sort must be based on some number of principles that have been previously enumerated, something that apparently has not yet happened with SCORM and how it should be informed with instructional design principles.

Illustrating the problem of granularity, one hears the statement that a learning object can be "a drop in the ocean or the ocean itself," demonstrating not only the issue of lack of definition of learning object as a concept, but also the importance of the related issue of levels of granularity. No one will dispute the value of the reusability of a single graphic (asset) or perhaps even a whole course (SCO). For example, it is obvious that a map of Europe can be used in any number of instructional scenarios. It is equally apparent that a Fortune 500 company would like to be able to deliver instruction that teaches how to use software from various vendors on their delivery platform of choice and track employee performance on the company's LMS. Such companies should not have to have two software and hardware configurations to support their training on an inventory management system on the one hand and their standard word processing software on the other.

The challenge lies with how to standardize everything (or actually, anything useful) that is in the middle between an individual media object on the one hand and a full course on the other. As an example, Merrill in his presentation at the ID2SCORM conference (2002) described "knowledge objects" and how they are different from learning objects. He pointed out that knowledge objects do not include instructional strategies where learning objects do, and any single given knowledge object can be used in conjunction with a variety of different instructional strategies.

With respect to connecting instructional design to standards, it seems rather obvious that if standards were derived for ways to represent knowledge objects as he described them, then it would be possible to also create standard instructional interactions to be used with each knowledge object of certain types, as described by Merrill, creating various types of learning objects. The problem with this scenario to date has been that "no instructional design information was included in the metadata specified by the current version of the Learning Objects Metadata Working Group standard" (Wiley, 2000b, 11). If this possibility is to become a reality, then we need common definitions for specifying the instructional design inherent in a particular learning object, an obvious potential contribution from the instructional design community.

The final area of concern has to with the development of models for incorporating instructional design into standard approaches for determining and representing sequencing, or "sequencing and navigation" as described by Dodds (2002). Some work is already underway through the Simple Sequencing Team of IMS with their first specification having been released in May (Wilson, 2002, May 17). Another IMS group, the Learning Design Team, has its first specification under development, the purpose of which is to describe standards for "learning and instructional design" and is based in part on the Educational Modeling Language being developed by the Open University of the Netherlands (Wilson, 2002, June 10) (See also http://eml.ou.nl/).

From all indications, however, these efforts are currently missing support from recognized instructional design theorists. It should be clear to anyone connected with instructional design that involvement from the field is essential. In his presentation at the ID2SCORM conference, Anderson (2002) listed several questions that such involvement could address:

- How is "content" represented?
- How can the behavior of an instructional strategy be represented?
- How might popular learning theories be captured in software?

- How can the granular interactions between learners and the instructional system be represented?

Benefits of the Instructional Design to SCORM Connection

What are the incentives for the instructional design community to address the above challenges? Shapiro (2000) lists two benefits of standards. First, they enable a greater realization of network effects: the more people present in a particular network the greater the value for all participants. This attracts more players, encouraging competitive innovation and pricing. Success for any member of the network adds some measure of value for all in the network. Shapiro cites a second benefit as protection from stranding, a key concern for bleeding edge investment in systems like learning management systems. It is obviously important to any entity that chooses a particular system that they still be able to run their courseware should their supplier not be in business in the future.

Some assert that the potential economic advantages parallel those that accrued to the steel industry, and thus to consumers, with the adoption of standard methodologies for steel making (Gibbons, Nelson, & Richards, 2000). They write, "Standardization efforts related to object properties and indexing will open the floodgates for object manufacture and sharing, but without attention to design process, interoperability among all the necessary varieties of instructional objects and the favorable economics needed to sustain their use will not materialize" (Gibbons, Nelson, and Richards, 2000, 50).

This analysis is similar to one of the desired outcomes cited by ADL for its efforts, fostering an "instructional object economy" (Dodds, 2001a). Speaking in this same vein, Ed Walker, CEO of the IMS Global Learning Consortium stated, "I think that available content and ways to use it are going to increase; the average instructor is going to have more material to choose from and probably, over time, higher quality material. I believe faculty will be able to develop educational materials, be they short episodes of learning or full courses, with less effort. The result will be that more material and courses will be available. Hopefully, learners around the world will find resources more available, at lower costs" (Syllabus, 2002).

Conclusion

Just like standards that enable the connection of rail lines or connections among various types of fire fighting equipment, the value of connecting instructional design to standards for learning objects at some level seems intuitively obvious. Supporting this notion, one of the speakers at the ID2SCORM conference summarized characteristics of the setting within which standards are being developed:

- Most machine mediated instructional content is no longer viewable.
- Each new succeeding delivery alternative tends to be more complex.
- The cost of conversion approaches the cost of original development itself (Jarvis, 2002).

Recognizing this challenging situation, at least one group claims that "the Learning Object has the potential to revolutionize the paradigm for organizational learning" (S3 Working Group, 2002). Even if one does not go quite that far, it is not difficult to realize that standards of some sort are essential. If that is true, what will it take to make them not only a reality, but a reality at a level that makes them useful for creating and delivering good (read well-designed) e-learning opportunities at affordable prices? Speaking at ID2SCORM, Anderson (2002) called for instructional design people to "get involved, read the specs, and build a bridge!" It goes without saying that this involvement must be more productive than were the actions of the 19th Century residents of Erie, Pennsylvania. Just as a standard gauge for railroads was inevitable, the momentum of the e-learning standards movement is such that the standards *will happen*. *How they happen* will be a function of the level of involvement of the instructional design community.

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Useful Web Links

Advanced Distributed Learning Initiative (ADL)
http://www.adlnet.org/
ADL Co-Laboratory Network (ADLCOLAB)
http://www.adlnet.org/index.cfm?fuseaction=colabovr&cfid=135990&cftoken=21456024
Advanced Learning Infrastructure Consortium (ALIC)
http://www.alic.gr.jp/eng/index.htm
Alliance of Remote Instructional and Distribution Networks for Europe (ARIADNE)
http://www.ariadne-eu.org/
American Society for Training and Development (ASTD)
http://www.astd.org/
Aviation Industry CBT Committee (AICC)
http://www.aicc.org/
Canadian Core Learning Resource Metadata Application Profile (CANCORE)
http://www.cancore.ca/
CEN/ISSS Learning Technology Workshop (LTWS)
http://www.cenorm.be/isss/Workshop/lt/
Centre for Educational Technology Interoperability Standards (CETIS)
http://www.cetis.ac.uk/
Computer Education Management Association (CedMA)
http://www.cedma.org
Dublin Core Metadata Initiative ((DCMI)
http://www.dublincore.org/

Education Network Australia (EdNA)
http://www.edna.edu.au/
IEEE Learning Technology Standards Committee (LTSC)
http://ltsc.ieee.org/
IMS Global Learning Consortium (IMS)
http://www.imsglobal.org/
Open Knowledge Initiative (OKI)
http://web.mit.edu/oki/
Standards for: Information Technology for Learning, Education, and Training (ISO/IEC JTC1 SC36)
http://www.jtc1sc36.org/
Schools Interoperability Framework (SIF)
http://www.sifinfo.org/