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The Learning Objects Literature*

David A. Wiley
Utah State University, Logan, Utah

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ABSTRACT

The learning objects literature is a collection of journal articles, book chapters, white papers, and blog entries that as a whole recognize few seminal works, share few common definitions of terms, and rarely reference or build upon one another. Learning objects research generally falls into one of two categories. The traditional approach to using learning objects focuses on enabling the just-in-time automated assembly of carefully structured learning objects to create personalized educational experiences. The permissive approach to using learning objects focuses on making the reuse and localization of all resources, regardless of their structure, as effective and efficient as possible. The field is subject to a large number of criticisms. Nascent work in open educational resources points to the likely future of the field.

* The references used in this chapter, together with many that were collected but not used, are available online at http://www.citeulike.org/user/opencontent; all websites referenced in this chapter were available February 1, 2007.

KEYWORDS

Learning object: A digital resource that can be reused to mediate learning.

Open educational resource: A learning object that can be freely used, reused, adapted, and shared.

INTRODUCTION

The learning objects literature is a collection of journal articles, book chapters, white papers, and blog entries that as a whole recognize few seminal works, share few common definitions of terms, and rarely reference or build upon one another. This lack of structure in the research makes it difficult to write an overview of the learning objects research literature. Rather than telling a compelling story that moves clearly and purposefully in a handful of directions, the best an author can do is cluster otherwise disconnected pieces by their underlying philosophies. This places an unusual amount of responsibility on the author. I have chosen the clustering of topics I felt most important, but I understand that others will have different views of what matters most.

HISTORICAL OVERVIEW

The idea of reusing digital educational resources is almost as old as the computer itself. As early as the 1960s, researchers were describing how "curricular units can be made smaller and combined, like standardized Meccano [mechanical building set] parts, into a great variety of particular programs custom-made for each learner" (Gibbons et al., 2002, p. 28). Although the general notion of a learning object is at least 40 years old now, it was Ted Nelson (who coined the term *hypertext*) who developed the conceptual foundations of learning objects and modern content reuse in the description of his Xanadu (Nelson, 1982) and OSMIC (Nelson, 1996) systems beginning in the early 1960s. Nelson's work conceived and grapples with most of the major issues still facing learning object designers and reusers today.

The Xanadu design, which describes Nelson's ideal hypertext system, calls for all content to be archived in a fixed, uneditable manner. Whenever a user desires to make changes to a piece of content previously stored in the system, those changes are stored separately, and users have ongoing access to both versions of the document. The modern Connexions system developed at Rice University uses a similar system (see http://cnx.org/).

Because a specific version or historical view of a specific document is guaranteed to exist in a specific location in perpetuity, it is possible to reuse portions of documents in Xanadu by reference; for example, suppose an author wants to quote a portion of an existing document in a new document. Instead of cutting and pasting the text into the document, the author could reference the specific starting and stopping locations in the existing document, and the content from that existing document will be rendered dynamically in the new document whenever the new document is rendered. This functionality is currently available as the open-source Xanadu Transquoter (see http://transliterature.org/transquoter/).

Issues of granularity and context that plague current designers and reusers of learning objects are completely and elegantly sidestepped. Rather than requiring authors to design and build content with future reuse in mind, breaking their content into chunks, for example, as in the Xanadu approach, authors simply create and publish their content as they see fit. Other authors who desire to reuse portions of the content later on simply indicate the section of the existing document they wish to reuse, and this section is rendered dynamically within the new document later. Also, issues of context of learning objects are also completely avoided, as readers of the new document can always navigate back to the original document from which the snippet came to better understand the context of the learning object. (This functionality is currently approximated in the Purple system; see http://www.eekim.com/software/purple/purple.html.)

Nelson created a vocabulary and catalog of concepts and approaches relating to what would come to be called *learning objects*. Terms such as *primedia* (describing the primitive or primordial media bits that are reused within the system) and *transclusion* (describing the way in which primedia from one document are dynamically included in another) hold huge conceptual value for anyone desiring to learn more about the idea of reusable digital content. Unfortunately, these terms and concepts are all but absent from the current learning objects literature because the father of the modern concept grounded his thinking in another literature.

With the emergence of the World Wide Web in the early 1990s, the idea of reusable materials came to the forefront once more. In 1994, Wayne Hodgins coined these things *learning objects* (Hodgins, 2002). Perhaps because Nelson's Xanadu project had stalled and been largely forgotten by the time Hodgins was writing, Hodgins and other early writers (see, for example, Downes, 2000) located the conceptual roots of the learning objects approach in the reuse literature of object-oriented programming. This led researchers to say things like the following (Fernandez-Manjon and Sancho, 2002, p. 6):

> The idea behind learning objects is clearly grounded in the object-oriented paradigm: independent pieces of instruction that may be reused in multiple learning contexts and that fulfil [*sic*] the principles of encapsulation, abstraction and inheritance.

These statements place the development of learning objects within a computer science paradigm, asking instructional designers to speak about things in terms of encapsulation, abstraction, inheritance, and polymorphism (Morris, 2005). The popular connection of learning objects to software engineering has created a noticeably technical emphasis in the research. Had the learning objects notion been connected to Nelson's work instead of object-oriented programming, the research may well have been more focused on new media, creative writing, technical writing, and other fields more closely related to instructional design than computer science. This review of research is largely structured around this tension between differing views of the conceptual lineage and future trajectory of learning objects research.

COMPETING DEFINITIONS AND RELATED TERMS

The learning objects notion is confusing in part because there are dozens of definitions of the term *learning object* (LO), as well as several phrases referring to the same notion of reusable digital educational resources. The most frequently cited definition of learning objects, and the most all-inclusive, is that put forth by the Institute of Electrical and Electronics Engineers' Learning Technology Standards Committee (IEEE, 2005): "Learning Objects are defined here as any entity, digital or non-digital, which can be used, re-used or referenced during technology supported learning. … Examples of Learning Objects include:

- Multimedia content
- Instructional content
- Learning objectives
- Instructional software and software tools
- Persons, organizations, or events referenced during technology supported learning"

The reaction against this extremely broad definition has been very strong. Wiley struggled to constrain the definition somewhat with: "any digital resource that can be reused to support learning" (Wiley, 2000a, p. 23), but even this is still very broad. More colorfully, people have reacted by writing pieces such as *My Left Big toe Is a Learning Object* (Levine, 2004) and *Urinal as a Learning Object* (Leinonen, 2005).

The problems created by so broad a definition are compounded by the sheer number of more specific definitions that appear in the literature. Indeed, almost every article written about learning objects provides its own unique definition of the term; for example, in reviewing papers from the 2004 ICALT conference, Rossano et al. (2005) found four separate definitions used within that single conference.

Whereas there are literally dozens of published definitions of *learning object*, a number of slightly different terms have similar meanings. Merrill (1998, p. 2) prefers the term *knowledge object* and defines it as something similar to a database schema: "A knowledge object consists of a set of fields (containers) for the components of knowledge required to implement a variety of instructional strategies." Gibbons et al. (2002, p. 27) prefer the term *instructional object*, describing it as any element "that can be independently drawn into a momentary assembly in order to create an instructional event." Other commonly used terms that describe similar concepts include the Department of Defense Advanced Distributed Learning Initiative's *sharable content objects* (ADL, 2004), Hannafin et al.'s (2002) *resources*, and Downes' different use of the term *resources* (Downes, 2004). Friesen (2004) decried the whole state of affairs regarding learning objects definitions and brought the discussion back to the ground by reminding us that, "innovations must be presented in terms that are meaningful for teaching practice."

GUIDING METAPHORS

Learning objects researchers have used a variety of metaphors to describe learning objects and their appropriate use. The most common metaphors—including LEGOs, molecules, and bricks and mortar—provide an extremely interesting view into individuals' underlying beliefs about teaching and learning. The LEGO metaphor characterizes learning objects as small chunks of content which, through their adherence to standards, are each able to be combined with every other in a straightforward manner. This was the first popular metaphor, stressing ease of reuse, and was conceived by Hodgins (2002).

The molecular metaphor characterizes learning objects as small chunks of content which, according to their semantic and structural makeup, have stronger affinities for binding with some learning objects and weaker affinities for binding with others. This metaphor stresses the role of learning objects' contexts, emphasizing that not every object can fruitfully be combined with every other. This metaphor was also popular, showing up in Wiley (1999) and Norman (2004). Mejias (2003) applied for a patent relating to what he called learning molecules.

The brick-and-mortar metaphor characterizes learning objects as small chunks of content which, being a variety of shapes and sizes, are difficult to assemble in a meaningful way without some kind of contextual glue to hold them together and give the aggregation meaning. This metaphor stresses that learning objects are "bricks held together and made meaningful by a contextual mortar" and receives treatment in Wiley's (2005) discussion of learning object metaphors.

An important thing to note from this progression of metaphors is not that each one places more emphasis on the important role of context in the meaning making and learning process. The most important thing to notice is that each metaphor assumes that a learning object is a closed, uneditable unit—but unlike the primedia of Nelson's Xanadu, there is no mechanism for creating alternate versions of the objects. The prevailing metaphors make the assumption that learning objects can be aggregated but not adapted. This frequently unspoken assumption is discussed further below.

DEGREES OF SPECIFICATION

Unsurprisingly, a wide variety of opinion exists regarding how learning objects should be structured internally, marked up for search, and reused in the context of learning. These differences of opinion are best characterized as lying along a continuum of specification. Some instructional design approaches demand adherence to exacting standards for the way learning objects are structured and tagged with metadata (e.g., the shareable content object reference model, or SCORM), while others completely reject the notion that such decisions can be made ahead of time and forced upon the instructional design community. Both intellectual camps have important arguments to make in favor of their approach. Both approaches suffer from significant drawbacks as well.

Highly Specified Approaches to Using Learning Objects

Merrill's (1999) instructional transaction theory provides a significant amount of instructional functionality to users of conforming systems. At a high level, a system implementing instructional transaction theory is a simulation environment with embedded facilities to both prompt learners to practice specific tasks and give personalized, intelligent feedback based on learner performance in the environment. All system content is represented as knowledge objects in a database, and system software operates on these knowledge objects to render the simulation, cue and respond to user actions in the simulation, and create and deliver feedback.

A system implementing instructional transactions is able to make such sophisticated use of knowledge objects because the format and structure of this data have been very precisely specified ahead of time, and system algorithms can depend on finding content structured and marked up in specified ways. Sophisticated, automated reuse is the strength of instructional transaction theory and other approaches that specify the manner in which learning objects should be structured and marked up. For additional highly specified approaches to using learning objects, see O'Keeffe et al. (2006), Duitama et al. (2005), and Colucci et al. (2005). The weakness of these approaches is that no learning objects occur "naturally" in the highly structured manner they specified—each existing chunk of content must be (paradoxically) specially prepared before it can be reused.

Less Specified Approaches to Using Learning Objects

On the other hand, Wiley and colleagues' (2004) O2 model of using learning objects requires much less from the learning objects in terms of their structure. The O2 model centers on a sequence of increasingly difficult problems to be solved by learners. Instructional designers locate learning objects to be used by students and present them (perhaps with recommendations for the sequence in which learners should engage the materials) in the context of the problem whose solution they support. Extending the brick-and-mortar metaphor, learning objects are the bricks of this design model, and the problem statement (and optional learning object sequencing information) is the contextual mortar that gives the individual learning objects meaning.

The publicly accessible Internet contains literally thousands of terabytes of digital materials that can be reused to support learning without reformatting by models such as O2. The structure of this material varies greatly—some is video, some is audio, some is PDF (portable document format), some is HTML (hypertext markup language), and so on—but, because humans carry out the aggregation of these resources, the heterogeneous nature of the resources is not problematic. These resources may be amenable to semiautomated reuse via what Spector (1999) called *weak intelligent* *design support systems*—systems intended to supplement what a human does (whereas strong systems are intended to replace what a human does).

Immediate reuse is the strength of instructional design approaches that can use any kind digital resource. The weakness of these approaches is that only the most rudimentary, unsophisticated reuse of materials can be automated. Reuse in the context of less specified approaches almost always requires the involvement of human instructional designers (Wiley, 2000b).

Highly Specified Approaches to Cataloging and Finding Learning Objects

Several technical specifications exist that describe the types of metadata that should be collected to enable the discovery of learning objects. As with the confusion regarding learning objects themselves, a large number of specifications or standards specify learning objects metadata. Metadata is data about data. A metadata record captures title, author, publication date, and other information to help people find learning objects, much as the cards in a card catalog help library patrons find books.

The five most important metadata standards or specifications for researchers of learning objects to know are the IEEE Learning Object Metadata standard (IEEE, 2005), the IMS Learning Resource Meta-Data Specification (IMS, 2006), the ARIADNE Educational Metadata Recommendation (ARIADNE, 1998), the Dublin Core metadata standard (DCMI, 2006), and the SCORM metadata specification (ADL, 2004). Briefly, the Dublin Core, IMS, and ARIADNE projects began their lives working independently, developing separate specifications for what metadata should be captured and how it should be expressed. Eventually, the IMS and ARIADNE projects found out about each other (the IMS project was running in the United States and the ARIADNE project was running in the European Union), and it was agreed that they should harmonize their efforts under the auspices of a true international standards organization and guarantee that their work would interoperate. The IEEE Learning Object Metadata (LOM) Standard is the context in which they chose to carry out this work. Dublin Core later agreed to participate under similar terms. The ADL's SCORM work inherits the benefits of these interoperability agreements because SCORM is a best-of-breed package of existing specifications.

Practical efforts to create interoperability between these varying specifications and standards have been quite successful. Najjar and colleagues (2003) described how they transformed ARIADNE metadata into LOM metadata using XSLT. The authors are quick to point out that the work was not trivial. IMS (2006) has also released a best practice guide for using XSLT to transform IMS Learning Resource Meta-data into IEEE LOM.

Given its status as an internationally recognized, accredited technical standard, the IEEE Learning Object Metadata Standard is emerging as the primary standard. Perhaps more than any other metadata specification or standard, LOM belongs in a section on highly specified approaches. The LOM includes dozens of elements, many with their own controlled vocabularies. As an example, when describing the learning resource type of a learning object, creators of metadata must choose one of the following values: exercise, simulation, questionnaire, diagram, figure, graph, index, slide, table, narrative text, exam, experiment, problem statement, self-assessment, or lecture. In addition to using the list of elements and their possible values correctly, implementers of the LOM will also need to conform to the lengthy 54-page XML binding.

In addition to formal specifications and standards, several published research studies also describe highly specified approaches to cataloging learning objects using novel ontologies (see, for example, Qin and Hernandez, 2006). As with highly specified approaches to using learning objects, highly specified approaches to cataloging learning objects come with the strength of enabling sophisticated, automated uses of the metadata to support the location and use of learning objects. The weakness with following such a highly structured approach is the significant degree of time and technical expertise required to conform with the specified standards.

Less Specified Approaches to Cataloging and Finding Learning Objects

In the mid-2000s, several web-based services provided their users with a new way to catalog information. Both del.icio.us, a social bookmarking service, and flickr™ , a photo-sharing site, implemented functionality that has come to be called *tagging*. Tagging differs from the creation of traditional metadata in two significant ways. First, when librarians or educational content producers create metadata for learning objects, they create the metadata to support an unknown future user in finding resources. Conversely, when people tag bookmarks or photos in del.icio.us or flickr™ , they are creating metadata to help themselves find the materials sometime in the future. Second, when librarians or educational content producers create metadata they use terms from previously specified vocabulary lists, such as those provided by the Library of Congress or the

IEEE LOM standard. Conversely, when people tag bookmarks or photos in del.icio.us or flickr™, they use any terms they like—whatever they think will best help them find the bookmark or photo later.

As opposed to the more complicated Open Archives Initiative metadata harvesting protocol employed by more structured approaches, services such as del.icio.us and flickr™ expose their metadata by means of Really Simple Syndication, or RSS. The idea of thinking about learning objects as syndicated resources rather than packaged resources was first described by Downes (2000) and then made explicit by a number of authors, most notably Downes (2002) and Lamb and Levine (2004).

The economics of the highly and less specified approaches are very different. In the first case, one works through lengthy, complicated standards to support the activities of an unknown future user. In the second case, people tag resources with whatever terms they think appropriate to support their own future uses. The combination of a simpler approach to creating metadata with clear personal incentives to create metadata has made tagging extremely popular. Although only large organizations or projects with trained staff can afford to create Library of Congress or LOM metadata, hundreds of thousands of people around the world have applied tens of millions of tags to millions of learning objects available online (understanding learning objects to be digital resources that can be reused to mediate learning). As of late 2006, most popular online services provide users with the ability to tag.

The strength of less specified approaches to cataloging learning objects is that the economics are such that hundreds of thousands of people now voluntarily create metadata. The weakness of the less specified approach is that the potential for problems related to polysemy in which a single tag may have many meanings (e.g., *web* may refer to a spider's web or the World Wide Web) and synonymy, in which a single concept may be tagged with different words (metadata vs. meta-data). Both problems can make it difficult for users to locate learning objects even when they have been tagged.

Middle-Ground Approaches to Cataloging or Using Learning Objects

Some researchers have tried to walk a middle ground by blending some of the benefits of high degrees of specification with some of the benefits of lesser degrees of specification. Wang and Hsu (2006) developed an ontology-based system for cataloging materials that is not used to support an automated instructional design system. Their system supports human users in the discovery of learning objects, which humans then combine into courses by hand. They have reported an 80% mean savings in time to produce a new course across 30 users using either their blended system or traditional approaches.

Verbert and colleagues (2006) presented another approach they refer to as the *abstract learning object content model* (ALOCoM). ALOCoM includes an ontology that differentiates between content fragments, content objects, and learning objects. Content fragments are combined into content objects, which in turn are combined into learning objects. Content object types and their structures are defined with reference to IBM's Darwin Information Typing Architecture (DITA), a system for creating and managing reusable technical documentation. Verbert et al. (2006) defined types of learning objects only after analysis of what instructional content is actually already available to mediate the primary problem with highly specified approaches—the extensive retooling necessary for content to work in these systems. They therefore chose Slide as the first type of learning object to work with, and they built support for OpenOffice (Impress) and MS Office® (PowerPoint®) presentations into their system.

The system includes a disaggregator, into which users can upload presentations. The disaggregator pulls the slides apart into their constituent pieces (e.g., bullets of text, paragraphs of text, images) and maps these into the ALOCoM ontology, automatically creating metadata and storing metadata and content for future use. When building a new presentation, users search the repository from with PowerPoint® itself (by means of a plug-in) for satisfactory bullets of text, paragraphs, images, or entire slides, and they can pull these directly into the presentations they are building.

Criticisms of Learning Objects

Researchers have critiqued the entire learning objects way of thinking from a number of perspectives. Friesen (2004), in a well-known paper titled "Three Objections to Learning Objects and e-Learning Standards," clearly articulated some of the most popular criticisms. First, the community of interest seems incapable of reaching agreement on a common set of terms, a criticism echoed by Parrish (2004) and others. Second, specifications and standards related to learning objects are almost completely technical, focusing on things such as XML and controlled vocabularies. They fail to engage pedagogy directly and miss the opportunity to move the practice of teaching and learning forward. Third, the disproportionately large influence of large corporations and the American military on specifications and standards makes them all but irrelevant for public and higher education. Friesen (2004) summarized by suggesting that "objects and infrastructures for learning cannot simultaneously be both pedagogically neutral and pedagogically valuable."

Tompsett (2005) provided a mathematical, graph theoretic criticism of the purported capability of automated systems to assemble learning objects into instruction. Tompsett began by considering learning objects as nodes in a graph, where "mutually consistent" learning objects are connected by edges in the graph. He next modeled the problem of choosing learning objects for automated assembly as the search for a *k*-clique, in which at least *k* nodes in the network are completely connected. Finally, he modeled the problem of sequencing these learning objects as a traveling salesman problem, in which a path must be found that traverses the collection of learning objects without visiting any learning object twice. Tompsett described these problems as being mathematically complex: "Each is almost trivial to solve on a small scale, but becomes unsolvable, within any practical terms, as the scale increases" (p. 443).

Wiley and colleagues (2004) identified a number of problems with learning objects regarding context. Instructional designers work to make learning objects as free from surrounding context as possible to increase their potential for reuse; however, in the current intellectual climate that emphasizes things such as social context, various aspects of settings, and situatedness, the move to decontexualize educational materials is troubling. Jonassen and Churchill (2004) viewed the entire learning object approach as supporting outdated instructivist ways of thinking about teaching and learning, and although Bannan-Ritland et al. (2002) agreed, they saw exciting opportunities for constructivists who are willing to work with learning objects. Wiley and colleagues summarized the context-related issue as the reusability paradox, in which the more reusable learning objects are, the less instructionally effective they are, and *vice versa*.

A final criticism relates to the anticipated emergence of an educational object economy in which individuals and corporations can buy and sell access to learning objects via micropayment systems—systems capable of selling digital goods for arbitrarily small amounts of money (e.g., access to an online news story for a penny or less). As Liber (2005) noted, the idea of micropayment systems has been around for a very long time (all the way back to Nelson's work in the 1960s!), but no viable micropayment has yet been implemented. Wiley and colleagues (2004) posited that the fear of pirated copies of learning objects being traded in Napster-like networks has prevented publishers from creating these systems. Wilhelm and Wilde (2005) reported that the burden of clearing copyright for learning objects to be used in the course production process can block the process altogether.

OPEN EDUCATIONAL RESOURCES

Earlier in this chapter, I commented that the prevailing learning object metaphors make the assumption that learning objects can be aggregated but not adapted. Wilhelm and Wilde (2005, p. 69) made explicit the all-pervasive, fundamental barrier to repurposing or adapting learning objects: "While we contemplated modifying some learning material to construct part of our course, this task generally required obtaining permission from web site owners."

Acquiring copyright-related permissions from a rights holder entails two kinds of costs. The first kind of cost is the license cost paid in exchange for the rights to reuse a learning object. The second kind of cost is the hidden transaction costs associated with determining who holds the rights to a specific learning object (which can be very time consuming), contacting the rights holder, and negotiating a contract under which you can acquire the right to reuse the learning object. The sum of the transaction and license costs can literally bury an instructional development process primarily dependent on learning objects, particularly when large numbers objects are being used. For this reason, most people assume that for all practical purposes learning objects can only be aggregated and not adapted to fit their specific contexts or meet the needs of their specific learners.

In the spring of 2002, the William and Flora Hewlett Foundation sponsored a forum at UNESCO related to this topic. The report of that meeting introduced the term *open educational resource* to the world (UNESCO, 2002):

> Open Educational Resources are defined as "technology-enabled, open provision of educational resources for consultation, use and adaptation by a community of users for non-commercial purposes." They are typically made freely available over the Web or the Internet. … Open Educational Resources include learning objects such as lecture material, references and readings, simulations, experiments and demonstrations, as well as syllabi, curricula and teachers' guides.

Individuals who wish to reuse open educational resources bear neither the license costs nor the transaction costs associated with materials trapped within traditional copyrights due to the way in which these materials are licensed. Open educational resources are licensed with open-source-style licenses, such as the Creative Commons licenses (http://creativecommons.org/) or the GNU Free Documentation License (http://www.gnu.org/copyleft/fdl.html).

Although the idea of open educational resources sounds idealistic, according to Wiley (2006) over 2500 university courses (which are composed of individually addressable learning objects) are currently available as open educational resources, including over 1700 courses from U.S. universities, 450 from Chinese universities, 350 from Japanese universities, and 175 courses from French universities. As if to showcase the adaptability of the materials in these courses, many of them have already been translated into Spanish, Portuguese, Chinese, and Thai. The Connexions project at Rice currently hosts 3590 open learning objects; Textbook Revolution (http://textbookrevolution.org/) contains links to 260 freely available, copyright-clean textbooks.

Each of these millions of learning objects—everything from modules to textbooks to courses—is licensed in such as way that reusers can both aggregate and adapt the materials with neither license or transaction costs.

CONCLUDING REMARKS

A review of the learning objects literature reveals a largely disconnected group of researchers united by an interest in reusing educational materials but little else. The research area is a conglomerate of competing terms, competing metaphors, competing technical standards, and competing ontologies. As implied by these many bifurcations, the research area itself is an uncomfortable amalgam of two competing philosophies.

First are the traditional learning objects researchers whose goal is to automate the just-in-time assembly of learning objects into personalized educational experiences. They rely on learning objects adhering to specific structural and content standards to leverage the power of intelligent systems to provide the learner exactly what she needs.

Second are the permissive learning objects researchers whose goal is to make the reuse and localization of all resources, regardless of their structure or adherence to other standards, as effective and efficient as possible. They assume that humans will be involved in the process of localizing learning objects, and they rely on learners to engage in selecting what they want.

Although the arguments of both parties have their strengths, neither has yet contributed the promised application or process that will revolutionize education and training. In such a young and leaderless field, great opportunities remain for researchers who can unify the field around practical, working responses to historic and emerging problems in education, training, informal, and lifelong learning.

Hybrid approaches that find creative ways to synthesize the seemingly contradictory agendas, prerequisites, and strengths of the traditional and permissive approaches to learning objects research are likely where the future of the field lies. Nascent work in open educational resources has revealed one assumption many seem to have looked past—namely, that when properly licensed learning objects can be adapted and adjusted in addition to being aggregated and aligned. As visionary people help the field identify and remove additional unspoken barriers we should eventually be able to bridge the gap between philosophical differences to better serve learners everywhere.

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* Indicates a core reference.