Learning Object Based Instruction

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INTRODUCTION

Imagine a vast repository of digital materials that includes an unlimited supply of instructional videos, interactive multimedia exercises, links to Web sites, reading exercises, recorded interviews with experts, interactive graphs, charts, diagrams, photographs and maps—and nearly any other form of digital instruction—all organized according to academic standards, instructional objectives, and specific topics addressed. Teachers could log in to the repository via the Internet, type a simple search string and instantly access hundreds of pertinent instructional sequences that they could use to enhance their teaching practices in both the classroom and in the virtual learning environment. This vision has been the driving force behind a form of instructional technology called learning objects (LOs), and it is becoming an increasingly relevant topic within the field of instructional technology today.

The idea that instructional content can be systematically encapsulated, retrieved, transmitted to others, and then reused is the driving force behind the LO movement. In the face of such enormous potential, the field of instructional technology has made little progress since 2002 when it comes to defining a practical method for populating LOs with meaningful instructional content and research that addresses the pedagogical effectiveness of using LOs in the K-12 learning environment is scarce. As yet, no practicable model for implementing this technology in a "real world" setting exists.

BACKGROUND

Perhaps the most widely accepted definition of the term learning object comes from David Wiley (2002). Wiley (2002) states that a learning object is any digital resource that can be reused to support learning (p.7). While Wiley's definition and other attempts to define the true nature and function of learning objects are important efforts, varying views regarding the true nature and function of learning objects have caused a great deal of confusion within the field of instructional technology concerning this technology (Sosteric, 2002; Welsch, 2000). In any event, the fundamental theme that ties every perspective together is the basic idea that digital instructional content can be encapsulated, stored, and reused in the appropriate context. To put it more succinctly, learning objects are reusable and interoperable. These core attributes make learning objects both appealing and controversial.

The term "learning object" appears in the vernacular sometime around 1994 and is often attributed to the work of Wayne Hodgins (Wiley, 2002, p. 4), but the basic concept of reusing digital resources to streamline computing practices for programmers and to introduce uniformity of experience for end-users can be traced back to the work of Ole-Johan Dahl and Kristen Nygaard from the Norwegian Computing Center, Oslo, Norway, in the mid 1960s with their work on a programming language called SIMULA. This work led to a form of computing called object oriented programming that has had a profound impact upon the field of computer science and information technology. Object oriented programming gained momentum in the 1970s with the work of Alan Kay and became increasingly popular as a result of the work conducted in the 1970s and in the early 1980s by Bjorn Stroustrup with his efforts to apply the basic concepts of object oriented programming to the C computer language to create the commercially successful and widely accepted C++ computer language. Soon after that, a group at Sun led by James Gosling introduced a derivative of C++ called Java that has gained increasing popularity with the expansion of the Internet.

While the effective implementation of learning objects (LOs) will undoubtedly continue to require formative input from the field of computer science, the fields of instructional technology and education will need to add more formative input to the conversation if LOs and Learning Object Based Instruction (LOBI) are to reach their full potential. To date, the majority of work concerning LOs has been focused upon establishing metadata referencing and retrieval schemes that can be used to quickly access LOs. In the 1980s and early

1990s, several metadata referencing initiatives began to address the need to categorize and quickly retrieve digital content and various tagging schemes began to emerge. In the fall of 1997, the U.S. Department of Defense, the White House Office of Science and Technology, the Department of Labor, and others, kicked off the Advanced Distributed Learning (ADL) initiative that established the metadata referencing standard called the Sharable Content Object Referencing Model (SCORM). Since it was introduced, SCORM has come to be the most prominent metadata referencing standard in the United States, but other metadata standardization efforts—like the IEEE's LOM project—also address the same need.

The introduction of, and further refinements to metadata referencing standards like SCORM and LOM are a critical step that must be taken to allow different content publishers to create learning objects that can interoperate within different Learning Management Systems (LMS), but these efforts have little or nothing to do with pedagogical effectiveness of the LOs themselves. These efforts were an important first step because they addressed the need to ensure that LOs are retrievable and interoperable, but they do not address exactly what instructional materials a LO should contain to be instructionally effective (Welsh, 2002, p.2).

The first attempts to address the need for LO content standards are typically attributed to the work of M. David Merrill from Utah State University in his work in the 1990s. Other early pioneers in the effort to devise a content model for LOs include L'Allier (1997) and his efforts with the NETg Learning Object Model and Barritt (1999) and others from CISCO who introduced the RLO/RIO content models. Verbert and Duval (2004) present a thorough overview of such efforts.

In 2002, Macromedia released a white paper that clearly identifies SCORM as a referencing standard only and acknowledges the fact that

> *the intent of SCORM is not to promote uniform content, but to enable conformant content to work better in a technical level. What content goes into the Learning Object (LO) is determined by the learning designer and not governed by SCORM.* (p. 4)

Other efforts at around the same time, like The Masie Center's white paper (Masie, 2002), the Learnativity content model (Duval & Hodgins, 2003), and the SCORM content aggregation model (Dodds, 2001) all attempted to meet the demand for a content model that addresses the actual instructional media contained within an LO. Despite these early efforts, the confusion between the function of SCORM and how it does (or more appropriately, does NOT) affect the content of a LO remained—and it is still present today. Soon after this flurry of activity, the collective attention of the field of instructional technology moved toward the formation of LO repositories and the issue of how best to populate LOs with instructional content still needs to be addressed in a practicable way.

Much of the recent activity in the LO community has been devoted to building LO repositories like MERLOT,

Table 1. Partial list of existing LO repositories

Organization	LO Repository Name	URL
California State University	Merlot	http://www.merlot.org/Home.po
Discovery Education	Cosmeo	http://www.cosmeo.com
EduSource Canada	Canadian Network of LO Repositories	http://www.edusource.ca/
European SchoolNet	Celebrate	http://www.eun.org/eun.org2/eun/fr/Celebrate_LearningObjects/entry_page.cfm?id_area=1008
The Remediation Training Institute, Inc.	ExtraLearning	http://www.extralearning.net
The Monterey Institute for Technology and Education	The National Repository of Online Courses Hippo Campus	http://www.montereyinstitute.org/nroc/nrocworking.html http://hippocampus.org/
Utah State University	Instructional Architect	http://ia.usu.edu/
Wisconsin Technical College System	Wisconsin-Online	http://www.wisc-online.com/

Wisc-Online, EduSource in Canada, CELIBRATE in Europe, and the newly introduced commercial product from Discovery Learning, Inc. called Cosmeo; but, there has been surprisingly little research and discussion surrounding the use of learning objects within the learning environment (Haughey, 2005). While these repositories represent a great deal of progress and they are, indeed, a critical accomplishment; they are only a first step toward widespread implementation of LOBI in the K-12 environment, and ultimately into every day learning and teaching practices in public schools across America.Table 1 Includes some of the more prominent learning object repositories that are available today.

Each of these projects has made significant contributions to the advancement of LOBI. They are, however, only a first step toward implementing LOs into the main stream of the field of instructional technology and, ultimately, into every day teaching practices.

The Need for a Widely Accepted Content Model

SCORM imposes few restrictions upon the content to which it refers and the position that SCORM is a referencing model only (Brown, 2002) is an important one because it underlines a need to somehow define the parameters of the instructional content contained within the learning objects to which it refers. Just like the Dewey Decimal System refers to all kinds of different media in your local library ranging from microfiche, to encyclopedias, magazines, and classic novels, and so forth, the SCORM metadata referencing model is concerned with brief descriptions and access—it has little-to-nothing to do with the quality and/or the quantity of media to which it refers. Friesen (2001, p. 2) acknowledges the dichotomy between function (metadata) and form (content) by noting that metadata standardization efforts are a start, but there remains a need to answer the basic question "What is the relation between learning object metadata and content?"

The responsibility to practically answer this question and provide some guidelines for populating LOs with meaningful instructional content falls upon the shoulders of the field of instructional technology. The questions remain, however, exactly how that content model will be formulated and how it will be embraced by the educational community as a whole.

A Suggestion for Meeting the Need for a Content Model

Hodgins and Connor (2000, p. 1) claim that revolutionary changes do not take place without widespread adoption of common standards, but, ultimately, those standardization efforts have to address a common need in a delivery environment. The fact that resources currently exist (LO repositories) and that there is a growing demand within the K-12 learning environment for a practicable model for teaching K-12 online learners underlines the need for such an environment that accommodates the natural evolution of this LOBI.

Consider how various forms of recorded media are interwoven into our daily lives. It can be argued that stored digital media like movies, songs, and television shows adhere to at least three types of guidelines that make them meaningful for us. First, they meet the technical requirements of the delivery mechanism—they must be recorded in a way that can be broadcast so we can experience them. Second, they fit within the publishing norms for their respective medium, and third, they must meet an intrinsic need in the target audience. First, there is typically an elaborate process that ultimately results in the creation of a physical artifact that is compatible with projectors, CD players, and/or TV broadcast equipment. Second, the content of that particular production adheres to established standards for publishing content in that particular medium (it is rare to come across a 12 hour movie, a song that is so high-pitched that only your dog could hear it, or a TV production without characters or a plot line), and finally, each of these forms of recorded media meets an intrinsic need within the target audience. They fit into our lives in such a way that they have value for us—they are *used*.

In each of these examples, guidelines, or standards, have emerged that drive distribution, content production, and adoption. Ultimately, it is the iterative interplay between content production and adoption within a target delivery environment that refines the adoption of the particular form of recorded media—and the content publishing standards themselves. To date, the field of instructional technology has (perhaps necessarily) focused its attention upon the interplay between distribution (or retrieval) standards and content production standards. But like any other form of recorded media, it will be the interplay between content production efforts and adoption in the delivery environment that will have the greatest impact upon the development of standards that will guide the widespread implementation and acceptance of LOs. To facilitate this formative process, a theoretical framework that accommodates the interplay between published artifacts (LOs) and the intrinsic needs of learners in the target delivery environment must emerge.

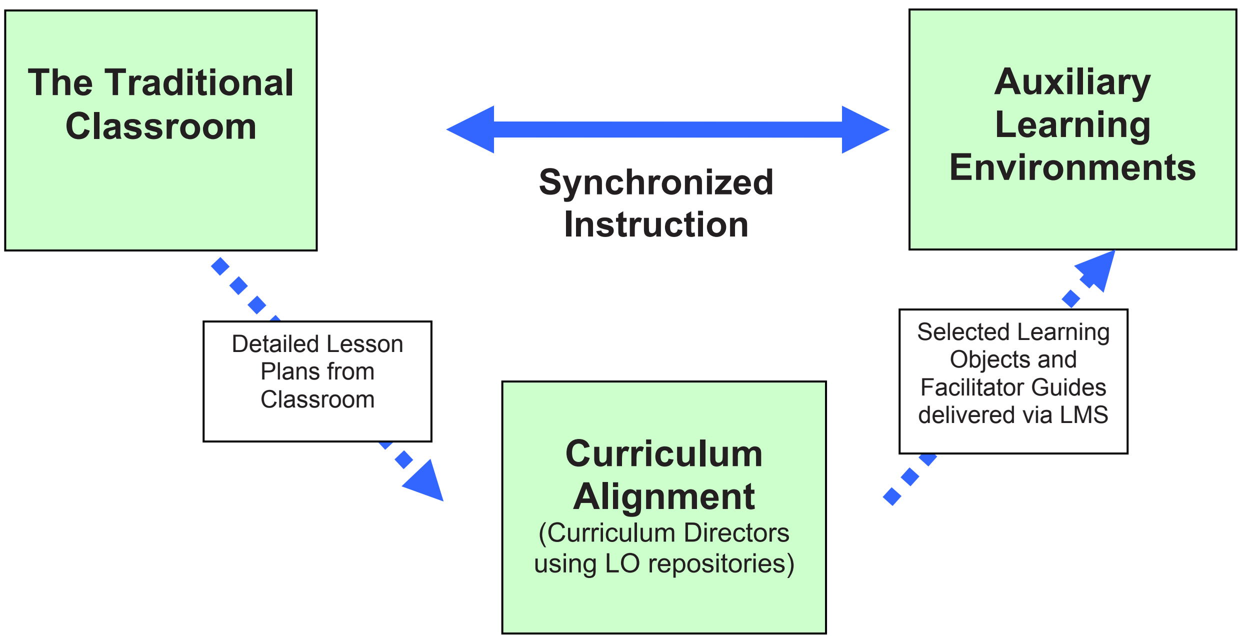
Rather than continuing to rely upon rigid and abstract theoretical perspectives to guide the development of learning objects and the implementation of LOBI, the field of instructional technology has evolved to the point where more pragmatic approaches to instructional design (Visccher-Voerman, 2004) can be employed. Shank (2002, p. 4) suggests that a good opportunity for semiotic research in education will be to create an a-priori set of meaningful concepts that can serve as the basis for a new model for educating in a particular setting. Rather than a "one size fits all" approach to creating a content model for LOs, several types of native interactions will be identified and then specific types of LOs that accommodate those interactions will be developed. The specific methodology that will be employed to transform and translate these different types of native interactions into LOs that are woven into the proposed theoretical framework is what C.S. Peirce calls abduction, or the creative process of reasoning to a satisfactory explanation, of creating a structure in which our observation makes sense (Buchler, 1955).

Curriculum Directors—The Missing Link

Every lesson that uses learning objects needs to be assembled. Just like any other well designed lesson, someone has to analyze instructional goals and learning objectives and then create a strategy for conveying information to the learners that will help them meet those objectives. The fact that LOs are self-contained, meaning that the instructional message is already inherently part of each learning object greatly streamlines the process of creating a lesson and, as search techniques become more and more refined and repositories become more and more standardized, it may be possible for classroom teachers piece learning objects together to make online lessons, but this is not presently a practical reality.

In the meantime, LOBI will be implemented by a select few curriculum directors who work with classroom teachers to "hunt and gather" pertinent learning objects from existing repositories and deliver them online in a learning management system. This development process is an extension upon Wiley's (2002) manual assembly techniques and has come to be known

Figure 1. Using the collaborative model for distance education to refine a content model for LOs in the K-12 online learning environment



as *the collaborative model for distance education.* This process effectively enables classroom teachers to "broadcast" lessons online that mirror the instruction that they present in their classrooms. Ultimately, this simple assembly process opens the door to many exciting possibilities for students who are absent from the classroom for any number of reasons because it effectively blends virtual instruction with traditional classroom instruction in such a way that effectively accommodates the existing infrastructure of public schools and utilizes stored media as a performance support tool for classroom instructors.

By analyzing native instructional design documents like lesson plans as a guide, curriculum directors can employ rapid prototyping techniques (Tripp & Bichelmeyer, 1990) and situated instructional design methods (Wilson, 1995) to quickly assemble online learning object based lessons that mirror the instruction presented in the traditional classroom environment. More recent advocates of this approach include Suhonen and Sutinen (2005) with their work on formative methods in sparse learning environments. Other instructional technology visionaries like Hodgins (2000, p. 14) agree that the best way to arrive at a future that embraces LOBI, it is most practical to adopt a backward approach, and more mainstream instructional designers like Wiggins and McTighe (2005) advocate this approach as a practicable way to achieve results in a learning space.

FUTURE TRENDS

The apparent benefits of decoupling stored, reusable, and self contained digital instructional content and retrieval and delivery mechanisms is a fundamental aspect of LOBI and computer mediated instruction that opens the door to many exciting opportunities for educating K-12 students, but also poses fundamental challenges to paradigms that guide existing classroom practices. More specifically, if facilitators in a computer mediated learning space that accommodates LOBI can rely upon stored and reusable instructional content to convey the instructional message to their students, it becomes possible for them to devote their energies to other critical aspects of the teaching and learning process (like behavior support and more individualized instruction). This interplay between stored media and facilitated learning is one of the great strengths of LOBI that makes it more suitable for the K-12 audience than other forms of distance education because children often need more guidance in learning activities than adults.

Haughley and Muirhead (2005, p. 2) suggest that "learning objects do not have value or utility outside of instructional contexts and that their value is in their application to classroom settings and to online learning environments where teachers may or may not be present." Currently, teachers in the traditional classroom setting follow a model for presenting information that simply does not accommodate the use of LOBI. The very nature of how information is presented in the ideal delivery environment differs so dramatically from traditional classroom practices (lecture-based instruction vs. inquiry-based facilitated learning), that introducing LOBI into a traditional classroom setting requires a complete rethinking of the role of the teacher and the way that information should be presented in the target delivery environment.

In a sense, learning objects are an anachronism—they are artifacts that are available in an environment that does not yet know how to use them. While LOs themselves will undoubtedly be transformed and refined as the educational community develops learning environments and practical pedagogical principles that accommodate LOBI, the majority of the evolutionary change will happen within the learning environments themselves. As may be expected, sociocultural approaches to learning and teaching that view LOs as semiotic tools and/or social resources that can mediate the link between the social and the individual construction of meaning (Hung, 2002, p. 175) will play a formative role in the adoption and development of LOBI. Ultimately, LOBI will be defined by the environment in which it is delivered and, like any other form of instruction, its efficacy must be determined by the effect it has upon learners themselves.

CONCLUSION

Since the introduction of learning objects in the 1990s, the field of instructional technology has struggled to develop implementation models that fully take advantage of the vast potential that this form of instructional technology affords. While nearly all instructional designers and technologists currently acknowledge the nearly endless possibilities associated with LOs, several obstacles remain that make practical implementation of

LOBI difficult. At this point in the evolution of computer assisted instruction, LOs and LOBI are being under utilized and only when these barriers are isolated and addressed (and/or eliminated), will learners and teacher reap the benefits that LOs can provide.

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KEY TERMS

Collaborative Model For Distance Education: The term used to describe the process formative and iterative of using native resources to guide the translation of classroom instruction into learning object based instruction so it can be delivered online.

Content Model: A commonly accepted set of specifications that developers can use to guide their efforts when they create media. Commonly used interchangeably with the term *publishing standard*.

Curriculum Director: In the collaborative model for distance education, the curriculum director is the person who is responsible for analyzing classroom instruction, searching through a repository to collect learning objects that address the same topics, and then delivering those learning object to end users in a learning management system.

Learning Object: Any digital resource that can be reused to support learning.

Learning Object Based Instruction (LOBI): The process of utilizing assembled learning objects to teach in a learning environment. LOBI is a form of facilitated instruction, or performance support, as opposed to direct instruction and/or lecture based models for presenting information to learners.

Metadata: The standardized information that is used to describe learning objects. Typically metadata comes in the form of completed form fields that describe the formative characteristics of a learning object.

Metadata Referencing Scheme: A shared, syntactical approach to the use of metadata that programmers can use to ensure that learning objects are retrievable and interoperable.

Publishing Standard: A commonly accepted set of specifications that developers can use to guide their efforts when they create media. Commonly used interchangeably with the term *content model*.

Pragmatic Paradigm: An instructional design approach that emphasizes environmental factors like adoption and use in the test when evaluating the validity and efficacy of learning materials.

Rapid Prototyping: The process of quickly analyzing instructional needs in a learning environment and selecting relevant instructional materials that meet those needs.

The Shareable Content Object Reference Model (SCORM): A set of guidelines that The Learning Technology Standards Committee of the IEEE began their efforts to come up with one set of metadata guidelines that can be used to systematically categorize digital content. Currently, this effort is being refined by the U.S. Department of Defense's Advanced Distributed Learning Division (ADL).

Situated Instructional Design: Brent Wilson's theory for instructional design that posits that implementation and design are ultimately inseparable.

ENDNOTE

* www.vlnpartners.com