Learning Objects and Online Library Instruction

This paper will examine various definitions of learning objects, along with important characteristics. The paper will discuss applications of instructional design, learning styles and how learning objects can help address them. Both evaluation and assessment of learning objects are examined, and finally an application of learning objects to online information literacy instruction.
INTRODUCTION

Academic libraries regularly use web-based materials to teach information literacy. Online materials, especially tutorials, are used with the intent of either supplementing or entirely replacing traditional library instruction. Reasons behind this transition include perceived shortages of library staff and time for instruction, the rise of “millennial” learners who prefer the online environment, the rise of hybrid learning, and the fact that an online tutorial is available anytime, from any place. As libraries try to reach more learners with fewer resources, it may be helpful to understand and utilize some of the ideas behind learning objects in the creation of these online instruction materials. Learning objects can be quickly reused to tailor instruction sessions. Used correctly, they can be beneficial and efficient, especially as more instruction classes are added to an already-full slate\(^1\) (Mardis & Ury, 2008).

DEFINITIONS

Exactly what is a learning object? Unfortunately, there is no agreed upon definition of learning object. A broad definition from Institute Electrical and Electronics Engineers (IEEE) was “any entity, digital or non-digital which can be used, re-used or referenced during technology supported learning.” (IEEE as cited in Keown). David Wiley proposed a narrower definition: “any digital resource that can be used to support learning” (2000, p. 7). Yet another definition was “small but pedagogically complete segments of instructional content that can be assembled as needed to create larger units of instruction, such as lessons, modules and courses (Hamel and Ryan-Jones, 2002). Most definitions included something about metadata that describes the object, making it easy to locate in a shared repository; however, because the scope
of this paper is about use in instruction, there will be no discussion of metadata. The terminology also varies. In addition to learning objects, terms include educational object, media object, reusable learning object, shareable content object, instructional object, data object (Saum, 2007).

The library and information science literature also offers definitions. Mardis and Ury defined a learning object as “digitally reusable succinct portions of self-contained information” (2008, p. 390). Mestre used a broad definition “a resource, usually digital and web-based, that can be used and reused to support learning” (2010, p. 809). Shank, citing the lack of a general, accepted definition, chose “a digital piece of learning material that addresses a clearly identifiable topic or learning outcome and has the potential to be reused in different contexts” (2003, p. 194). Finally, Holmes, in his technology column discussing learning objects, offered “digital learning objects are reusable chunks of learning of any size that may be applied in a number of different contexts. These objects are stripped of extraneous content to produce sufficient granularity to be flexibly sequenced and focus exclusively on a single learning objective” (2003, p. 6).

The lack of a single definition hindered the adoption of learning objects (Metros, 2005; Metros & Bennett, 2002). However, many began narrowing it down to inclusion of

- A single learning objective
- Practice activity
- Assessment (Metros, 2005; Shank, 2003)
Many people use the metaphor of a LEGO building block to explain a learning object. LEGO®s are small, interchangeable, and can be assembled into one type of structure (a house) and used again to build a completely different formation (car) (Mestre et. al, 2011; Metros & Bennett, 2002; Smith, 2004; Wiley, 2002). By connecting learning objects in different ways, instructors can create various learning modules. There is some concern, however, that this analogy oversimplifies learning objects. LEGO®s can be combined in any manner with another LEGO® block. This is not the case with learning objects. To be sequenced effectively to create a learning experience requires more thought and not all learning objects can be combined at will to form to create learning. Wiley (2000) proposed that the metaphor of an atom be used. An atom is small and can be combined with others to form a larger structure. However, not all atoms can be combined with other atoms; atoms can only be assembled into certain structures, which are predetermined by an atom’s internal structure. This more closely resembles how learning objects operate.

There is agreement that learning objects should be

- Interoperable: independent of delivery media, knowledge management systems, browsers, and course management systems
- Accessible: available anywhere and anytime
- Reusable: be able to function in various instructional contexts (Keown, 2007; Metros & Bennett, 2002; Polsani, 2003).
Especially important is reusability, for this feature distinguishes a learning object from other online resources. The learning object should be crafted to stand alone and be transferred to other learning contexts without modification. The key to reusability is the granularity (or size) of the learning object. Size is not the actual size of the object, but is the amount of information the learning object transmits to the learner (Griffiths, Stubbs, & Watkins, 2007). A learning object with a low level of granularity is better suited for customizing instruction and for flexible sequencing (Holmes, 2003). Tension exists between the granularity and the educational value of a learning object. Large learning objects have a high educational value but low reuse value. Inversely, the finer the granularity a learning object has, the greater the potential to be used again (Moisey, Ally, & Spencer, 2006). However, a learning object must be large enough to have educational value (Kendell, Wakefield, & Delbridge, 2007).

While people may equate learning objects with online tutorials, the category encompasses far more. Learning objects can be text based learning modules and lessons, along with animated or streaming videos. Examples include instructional modules, games, blogs, PowerPoint with narration, tutorials, podcasts, online quizzes, photos and more (Mestre et. al, 2011). It can also be helpful to see examples of learning objects. Two well-known repositories are the Multimedia Educational Resource for Learning and Online Teaching (MERLOT): http://www.merlot.org and Wisc-Online: http://www.wisc-online.com/.
For a learning object to transmit learning, instructional design (ID) must be utilized (Wiley, 2000). There are many ID models that can be applied to learning objects. One is the ADDIE model, often depicted as a five-stage cycle. Using ADDIE for learning objects does not differ greatly from using ADDIE to design traditional instruction. Baruque and Melo (2004) outlined some steps.

**Analyze**

Ask and answer the following questions:

- Who are your learners?
- Are there any specific learning styles to be addressed?
- What instruction is needed?
- What are the learning objectives?
- Is there a performance gap that needs to be addressed?

**Design**

Once learning objectives are in place, a task analysis should be conducted, what should the learner be able to do? Alongside the task analysis, a content analysis is in order. What should the learner know in order to perform the tasks? What are the definitions, principles or procedures that should be learned? The design phase also includes the sequencing of instruction, designing the learning object’s interface, and storyboarding.
Development

This is the stage to produce the digital learning objects, using an appropriate tool (Captivate, Camtasia, etc.), along with review of the design and functionality.

Implement

The delivery system (web page, course management system, etc.) must be chosen and the learning object tested.

Evaluate

There should be both formative and summative evaluation. The learning object should be evaluated as the ADDIE stages unfold. There should be pre- and post- assessments to see if learners are learning as intended. The learning object should be modified as needed. Evaluation will be covered in greater detail later in this paper.

Dick, Carey, and Carey Model

Another ID model to consider is Dick, Carey, and Carey (Mestre et. al, 2011). The steps are outlined below.

1. Identify Instructional Goals
2. Conduct Instructional Analysis
3. Analyze Learners and Contexts
4. Write Performance Objectives
5. Develop Assessment Instruments
6. Develop Instructional Strategy
7. Develop and Select Instructional Materials

8. Design and Conduct Formative Evaluation of Instruction

9. Revise Instruction


Though there are more steps than the ADDIE model, there are several similarities. The learning object creator will need to determine what new information and skills need to be learned (instructional goals). What should the learner be able to do after the instruction (performance objectives)? Learning styles need to be considered (Analysis of learners). How will learning be measured (development of assessment instruments)? What content, demonstrations, practice activities, and format will the learning object include (strategy and materials)? What is the delivery method?

Cisco Systems Model

Another and perhaps less familiar model for creating reusable materials is the Cisco model of Reusable Learning Objects (RLOs) and Reusable Information Objects (RIOs), which is recommended by Northrup, Rasmussen and Dawson (2004). Cisco Systems, Inc. developed the model in response to high volume training demands, moving away from static, customized, single-purpose courses. RIOs are granular chunks of information that can be reused. They are also independent of any media. Once developed, the RIO can be delivered in multiple ways. A RIO is based on a single learning objective, and is comprised of content, practice and assessment. The larger RLOs (which can be an entire course, module of instruction, or unit of
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instruction) are comprised of the RIOs. The RLO is based upon a single objective tied to a specific job task. The RLO includes an overview, several RIOs (which support the RLO objective) and a summary. (Cisco, 1999)

The RLO overview includes an introduction, an explanation of the RIOs’ importance, the RLO’s objectives, and prerequisites. The summary concludes the RLO, gives a review of the material, and is segue way between the RIOs and the assessment. The RLO assessment is a collection of items written to match each RIO’s objective.

According to Cisco, benefits of this model for instructional designers include

- consistent design and development,
- job/task based training, reuse of RIOs
- the ability to combine older and newer RIOs into larger RLOs

Learners can benefit from this model due to

- consistent presentation and structure of RIOs
- access to timely training and information
- ability to create customized learning paths and delivery, based on individual learning style (CISCO, 1999)

Cisco Systems later changed the terminology, RLO became “lesson” and RIO became “topic”. A single topic could convey a single process, concept, fact, or a procedure. The
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overview, summary, practice and assessment portions of the lesson remained in place (Cisco, 2003).

There is no correct ID model to follow. Those models that break down the ID process into segments work well, since learning objects involved instructional segments or chunks that can be reassembled and reused in different instructional contexts. It may be helpful to incorporate elements from several ID models.

LEARNING STYLES

Regardless of the instructional design model, those creating learning objects need to be familiar with learning styles; not all people learn in the same way. There are many theories of learning styles. A widely referenced one is Kolb’s Learning Style inventory (Holmes, 2002; Mestre, 2006; Mestre, 2010). Kolb’s model shows the learning process as a four-part cycle:

Reflective Observation: the learner reflects on what happened during a particular experience and how that experience relates to previous experiences. The learner observes before making any judgments and looks at different perspectives.

Abstract Conceptualization: the learner develops deeper understanding of what happened during the experience. The learner uses logic, concepts, and ideas.

Active Experimentation: the learner tests new insights, which results in concrete experience. This is learning by doing.
Concrete Experience: Learning starts with direct experience. Relevance and real situations are important here. Feeling, rather than thinking, is stressed. (Mestre, 2006; Mestre, 2010)

The Kolb model then classifies students as either preferring concrete experience or abstract conceptualization (how they take information in), or active experimentation or reflective observation (how they internalize information) (Felder, 1996). The four types of learners are

- **Assimilator**: abstract conceptualization and reflective observation: Persons in this category understand a wide range of information and put it into concise logical form. Enjoy ideas and theory as opposed to application. This learner asks "what?"
- **Converger**: abstract conceptualization/active experimentation: These learners take ideas and transform them into concrete situations. They gravitate toward technical tasks and issues rather than social issues. They excel at problem solving and the application of ideas. This learner asks “how”?
- **Diverger**: concrete experience and reflective observation: Very imaginative. Can view specific situation from multiple standpoints. Prefers to observe rather than experiment, as well as minimal structure. This learner asks “Why?”
- **Accommodator**: active/concrete: Likes trial and error and hands on. This learner asks “what if?” (Felder, 1996, Holmes, 2002; Mestre, 2006)

Another option is North Carolina State University’s Index of Learning Styles Inventory, which is broken down as follows:
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- Active/Reflective learners
- Sensing/Intuitive Learners
- Visual/Verbal Learners
- Sequential/Global

Active learners enjoy group work and learn by doing.

Reflective learners prefer to think about material first and to work alone.

Sensing learners like to learn facts and dislike material that has no tie to the real world. These learners prefer solving problems using well known methods.

Intuitive learners like innovation and dislike repetition and memorization. They prefer to discover possibilities and relationships.

Visual learners learn by seeing. Pictures, diagrams, charts, demonstrations, etc. work well.

Verbal learners prefer works and text, either written or spoken.

Sequential learners learn in linear steps, preferring a logical sequence.

Global learners learn in large leaps, absorbing material randomly, formulating a greater understanding at once.

Yet another learning style categorization is VARK, which states how learners prefer to get and give information:

- Visual
- Aural
Read/Write

Kinesthetic

Learners are classified in categories according to responses provided on a questionnaire (Mestre, 2010).

In addition there are millennial learners. Millennial learners have always lived in a digital world, often multitask, and are very visual and tactile learners; they prefer relevant, self-selected tasks, and lots of interactivity (Mestre, 2006). Because millennials have been immersed in the digital world, this can mean a positive response to online instruction, as well as overconfidence in their abilities, especially with searching (Manuel, 2002).

Having a greater understanding of learning styles (many of which overlap), coupled with the learning in the online environment, will help in the design and development of learning objects (Mestre, 2010). The online environment emphasizes certain types of learning. Instruction in an online setting requires that students learn by watching and listening (reflective observation) and learning by thinking (abstract conceptualization). The online environment will capitalize more on a student’s watching, listening, and thinking abilities (Aragon, Johnson, & Shaik, 2002). The creator of the learning objects will need to address a multiplicity of learning styles, making sure to include learning styles not automatically favored by the online environment (kinesthetic, active, etc.). There should be multiple paths to information, both sequential and of the students choosing (e.g. a hyperlinked table of contents). Images, sound, text, and multimedia should all be available. There should be relevant scenarios that require students to think about and related to their world experience? Are there
explanations and instructions (the what, how and why)? Are the segments short? (Mestre, 2010). The learning object should also be interactive; interactivity transforms something from a mere information source into a learning experience, which is the purpose of the learning object (Dewald, 1999). It is important to know a variety of learning styles, and not just one model, and to consider and apply them when designing and developing a learning object. For example, when text and images occur close together, connections between the two will be more easily made and meaningful learning more likely to occur; if verbal and visual information are presented together, a higher rate of transfer will occur (Tempelman-Kluit, 2006). This practice will increase the chances of a learning object's success.

EVALUATION AND ASSESSMENT

People will adopt learning objects if they are seen easy to use and useful (Lau & Woods, 2009). Ideally there should be formative and summative evaluation at each stage. There are several ways to evaluate the functionality. Some of these methods are tied back to the Analysis and Design Phase. Many are similar (if not the same) as with online tutorials.

Several authors recommended use of Multimedia Educational Resources for Learning and Online Teaching (MERLOT) process of evaluation and review (Cochrane, 2005; Moisey, Ally, & Spencer, 2006). The MERLOT Evaluation Criteria for peer reviews has three categories of evaluation standards

- Quality of Content
- Potential Effectiveness as a Teaching-Learning Tool
• Ease of Use

In addition to MERLOT, there are other checklists for evaluation that can be considered and incorporated into the evaluation process. The Learning Object Review Instrument (LORI) (Nesbit, Belfer, & Leacock, 2003) and the Southern Regional Education Board’s “Checklist for Evaluating SREB-SCORE Learning Objects” (SREB-SCORE) are two examples. Evaluations can incorporate a rating system or scale in response to questions and/or criteria. Evaluations should consider the following

Content

• Does the content present valid concepts, models, and skills? Is it error and bias free?
• Does the content present educationally important concepts, models, and skills?
• Is the content sequenced logically and effectively?
• Will the content supply the content and learning experiences to achieve learning outcome? Are there enough activities to support outcomes?

Ease of Use:

Elements that affect ease of use include:

• Are the labels, buttons, menus, navigation elements, text, and general layout of the interface consistently placed?
• Is the module flexible and easy to navigate? Can users return to start, exit, and go where they choose? Is the interface is intuitive and/or are clear instructions provided?
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- Does the design apply Universal Design for Learning principles
- Is text legible, concise, and clearly written? Are graphs and charts labeled? Do color, music, design support learning goals and instruction?
- Design and interface attractive and consistent throughout?

**Effectiveness as a teaching tool.**

MERLOT cautioned that evaluating actual effectiveness for teaching and learning requires actual use by students and faculty. This will be addressed later. But a checklist can evaluate potential effectiveness.

- Are learning goals and objectives declared within the content? Are the learning goals appropriate for the learners? Do the learning object’s activities, content and assessment align with the goals and objectives?
- Does the LO provide timely feedback and tailor instruction and activities according to learner needs? Is the feedback encouraging, letting learner know how to improve performance?
- Does the LO motivate? Is the content relevant to the learner? Is it realistic?
- Does the learning object provide engaging and interactive learning? Does it offer chances to increase understanding, knowledge, and skills? Will the materials improve teaching and learning of materials?
- Is the learning object reusable? Can it be used in different learning contexts and by learners from various backgrounds?
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- Is the learning object comprised of one or more learning experiences, each addressing a single learning objective? Can it stand alone as a learning resource?

This evaluation process does not include the actual assessment of learning.

Evaluation of learning

For a learning object to be successful there should be assessment of student learning. Many studies assessing patron learning from an online information literacy tutorial make use of pre- and post-tests to measure skills. (Anderson & May, 2010; Armstrong and Georgas, 2006; Kraemer, Lombardo, & Lepkowski, 2007; Lindsay Blakesley, Cummings, Johnson & Scales, 2006; Nichols, Shaffer, & Shockey, 2003; Silver & Nickel, 2005). In addition, some studies asked students to rate their confidence in their research skills following completion of the tutorial (Lindsay Blakesley, Cummings, Johnson & Scales, 2006; Silver & Nickel, 2005). While a valuable source of information, confidence ratings should not be the sole measure of learning; Lindsay Blakesley, Cummings, Johnson, and Scales (2006) noted vast discrepancies between student confidence level in their skills and their post-test performances.

When designing an assessment, it is important to pay attention to adequate sample size (Anderson & May, 2010) and how samples are selected (Silver & Nickel, 2005). One study allowed students to select their group, tutorial versus classroom instruction; 216 chose the tutorial as opposed to 79, perhaps an indicator of student preference for online instruction (Silver & Nickel, 2005). Pre-and post-test questions should be tied to learning outcomes and performance objectives (Nichols, Shaffer, & Shockey, 2003).
LEARNING OBJECTS AND INFORMATION LITERACY

How can learning objects benefit information literacy instruction? Before delving into the use of learning objects and instruction, it is helpful to review information literacy. The Association of College and Research Libraries (ACRL) defines information literacy as “the set of skills needed to find, retrieve, analyze, and use information” (ACRL, 2000, p. 2). There are specific standards. An Information literate person can

- Determine the nature and extent of information needed
- Access the needed information effectively and efficiently
- Evaluate information and its sources critically and incorporate selected information into one’s knowledge base and value system
- Use information effectively to accomplish a specific purpose
- Understand the economic, legal, and social issues surrounding the use of information, and access and use information ethically and legally (ACRL, 2000, 2-3).

The ACRL standards emphasize the importance of critical thinking skills, yet most information literacy instruction does not improve critical thinking, due to the short duration of a class (Anderson & May, 2010). Learning objects could supplement information literacy classes taught by a person; using a learning object to expose students to definitions, concepts, and procedures could free up valuable class time (Shank, 2003). Each of the standards comes with a variety of performance indicators along with several outcomes for each indicator. Librarians could examine the outcomes, pinpointing those that can easily be incorporated into a learning
object, reserving higher order thinking skills for in class instruction. Each learning object would include an interactive practice activity and an assessment.

CONCLUSION

Adapting some of the principles and practices of learning objects can save time in the long run for libraries developing online instruction modules of any sort; these need not be restricted to information literacy, but can be about any number of things, such as how to use a web-based service, such as online renewals, requesting a book, etc. Libraries can create individual repositories of learning objects to be used in online modules, tutorials, etc. Jackson and Mogg (2007) described such efforts, where their library developed learning objects that could be repurposed to help with information literacy instruction. Creating personalized instruction requires that there be an understanding of learning differences as well as instructional design (Martinez, 2000). If one adopts the view that that learning objects not be viewed as artifacts but as a process or a strategy, it is likely that the use of learning objects will increase (Parrish, 2004). Revisiting the search for a metaphor to describe learning objects, Parrish offers the following: “...Films are composed of temporal segments, similar to music, but they are also composed physically of photographic frames that in various combinations become shots, scenes, and sequences. As in instruction, the components of film can be combined in any number of ways, each with a unique effect on the viewer (2004, p. 62).” Tempelman-Kluit, when writing about multimedia theories and online instruction, recommends that a learning task be segmented to reduce cognitive load, allowing time between each segment so that the learner can process information before moving forward. Pauses are recommended to permit interactive tasks, such
as practice and assessment (2006). Learning objects fit this bill perfectly. Learning objects offer
the potential to convey learning to learners with multiple modalities in an environment that is
convenient and accessible. Libraries serving not only large groups of distance learners but any
type of learner should consider adopting utilizing the theories and practice of learning objects in
designing online instruction.
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References


