GUIDELINES FOR AUTHORS OF
LEARNING OBJECTS

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NMC: The New Media Consortium

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INTRODUCTION

Learning objects. What are they? We hear the term often, but is the meaning clear? Perhaps you've been using them in your courses, and now you want to create some. But where to start? What issues should you consider? What promising practices should you be aware of? There is a bewildering array of material on the topic of learning objects, but sorting through the ongoing research to find practical tips is daunting.

This guide explores the what, why and how of learning objects. It offers practical advice for designing for usability — and reusability; for keeping your learning objects learner-centered and learner-driven; for aligning with current metadata standards; and for making your objects accessible. It includes tips for "marketing" your finished work and points you to resources for follow-up information.

A companion website, the Guidelines Resource Website, is available at *www.nmc.org/guidelines.*

PLACING LEARNING OBJECTS IN CONTEXT

What is a learning object? Why and how are they used? Who makes them, and why? If you're new to the world of learning objects, this section will answer your questions. Perhaps you've been using learning objects and are now thinking of making your own. The final part of this section, "Should You Create a Learning Object? Some Pertinent Questions," will help guide your thinking as you begin to envision the learning objects you might design yourself.

Defining Learning Objects

Much work has been done to define and describe learning objects, and a variety of definitions exist. Learning objects vary so much in terms of size and scope, content, design, and technical implementation that pinning down the essence of "learning-objectness" is not an easy task. One thing that most descriptions have in common is that they focus on how learning objects are created, used, and stored, rather than on what learning objects look like.

For example, in 2002-2003, the National Learning Infrastructure Initiative (NLII) formed a Learning Objects Working Group. This group has created an Ontology of Learning Objects which seeks to identify the issues surrounding the creation and use of learning objects (Metros et al., 2002-03). The Learning Objects Ontology places learning objects in the center of a web of activities that range from developing educational objectives to technical implementation.

Another perspective compares learning objects to LEGO™ building blocks: small units that can be fitted together any number of ways to produce customized learning experiences (Hodgins & Conner, 2000). In still another model, learning objects are likened to atoms: they are made up of smaller pieces which by themselves are not as useful as the whole; they can be combined, but only in certain ways (atoms can only join with certain other atoms, not with any atom that happens along); and they form compounds which can then be combined or deconstructed again (Wiley, 2000).

OUR WORKING DEFINITION

For the purposes of these guidelines, we will use the definition adopted by the New Media Consortium (NMC) as part of its Learning Object Initiative: a learning object is any grouping of materials that is structured in a meaningful way and is tied to an educational objective (Johnson, 2003). The "materials" in a learning object can be documents, pictures, simulations, movies, sounds, and so on. Structuring these in a meaningful way implies that the materials are related and are arranged in a logical order. But without a clear and measurable educational objective, the collection remains just a collection.

The learning objects discussed in this guide have one additional characteristic: they are digital in nature. These learning objects can be delivered or accessed over the Internet or across a network.

The techniques outlined in this guide apply specifically to digital learning objects. Many of the more interesting and engaging digital learning objects also include activities that invite the learner to experiment and interact with the content. These activities should also be directly tied to the educational objective of the learning object.

At the minimum, a digital learning object consists of content and an interface. The content is made up of assets, which are the materials or "blocks" that make up the learning object: images, text passages, videos, etc. The *interface* is the part of the learning object with which the user interacts. It includes the graphic design, navigational elements, and other controls that the user sees. An interface may be as simple as a single web page that presents text and images, or as complicated as a screenful of controls to set the parameters of a simulated chemistry experiment.

Learning objects, especially digital learning objects, can also include metadata, which is information about the learning object itself (as opposed to the information in the learning object that is part of the learning experience). Including metadata with a learning object is useful because that is how search engines and online repositories like the Multimedia Educational Resource for Learning and Online Teaching (MERLOT, *www.merlot.org*) locate and identify learning objects. Metadata is like a wrapper that specifies details such as the general subject area and educational level(s) for which the learning object is most appropriate, the copyright and use terms, the author and his or her affiliations, technical compatibility details, cataloging information, and so on.

Why Do People Use Digital Learning Objects?

Digital learning objects open up possibilities that traditional materials may not offer. Within a single learning object, information can be presented in several different ways, allowing students to explore a topic from various perspectives. Engaging interactive elements give learners a chance to practice what they are studying. Three of the most compelling reasons for using learning objects are that they are flexible, they are cost effective, and

they can be combined in customized ways.

Flexibility. A well-designed learning object — or a combination of several that deal with the same topic — can offer access to knowledge through multiple modes of learning. Students who learn particularly well by auditory means, for example, may find an interactive learning object with voiceover instruction to be effective.

Cost effectiveness. As non-consumable resources, learning objects can be used in a course from one semester to the next. Some can be repurposed for different courses or even different disciplines. Many are available free of charge.

Customizability. Professors may select learning objects to suit their course material and particular instructional style. With a bit of online research, faculty can assemble an array of ready-made support materials to offer to their students.

How Do People Use Learning Objects?

When you imagine learning objects being used in a course, what do you envision? Students in a computer lab, working through a set of exercises while the professor offers help? A student working at home on her own computer to complete an assignment posted on the course website? A group of students using a simulation to perform virtual experiments, recording the results in their group lab book? All of these scenarios, and many more, are common.

If learning objects are included as course materials, the professor usually provides a list of what they are and where to find them, such as a page on a course website with links to the objects. Sometimes the links are provided in the context of an assignment. Sometimes they are gathered on a course resources page where they are always available.

Faculty may select a single learning object to reinforce or provide practice for a topic; sometimes several conceptually related learning objects are provided to explore a topic from different angles or in greater depth. A common way to "combine" learning objects is to provide an assignment that includes a list of links to the different objects and guidance as to the order in

which they should be accessed. Learning objects may also be integrated into a course using a learning management system (LMS) to create and manage the links between objects.

Students click the link to access the learning object (the technical details vary here depending on the technology used to create and deliver the object). If the professor has given them an assignment, they work through the assignment using the learning object. Some learning objects include built-in assignments that offer a single path from start to finish. Others are more open-ended, and require more guidance on the professor's part to be used effectively.

At this point, once students have started the learning object, the scenarios diverge, as each object is unique. Sometimes the professor requires a written report or other record of the experience. Some learning objects include quizzes or other forms of assessment (some learning objects are quizzes) that can be printed, emailed, or otherwise transmitted to the professor. Some are assigned simply for practice and no physical record is requested.

Why Do People Make Learning Objects?

Learning objects are often created by faculty, technology support staff, instructional designers, and other professionals who have an educational goal in mind but cannot find an existing learning object that suits their needs. There may be few objects on the topic, or they may be of poor quality, or they may simply not mesh with a professor's teaching style. If the educational goal is compelling enough, and a person is prepared to put in the time and effort, he or she may decide to create a new learning object.

Perhaps you are one of these people yourself. You may have specialized knowledge about a topic that you care about and want to share with others. Perhaps you want to supplement the course materials you typically use, or perhaps you want a more in-depth exploration of a topic than is available elsewhere. You may have come up with a new way to teach your topic that can be facilitated by creating a custom learning object.

Technology support staff are sometimes available to help faculty plan and develop learning objects. Instructional designers may work with groups of faculty to create learning objects that can be used across a department or on all the campuses of a distributed institution. Some institutions have media centers where teams of faculty, technical staff, and instructional designers collaborate on learning object development projects.

What Are the Issues?

With all those compelling reasons to create learning objects, why do some people decide not to? There are weighty issues to consider, and resolve, before jumping in with your favorite authoring tool: lack of technical experience, incorporating effective pedagogy, intellectual property and copyright questions, author workload, and the scope of the desired object, to name a few.

Lack of technical experience. This is one of the most common barriers to creating learning objects. You may already be familiar with an authoring tool like Macromedia Flash or a web page development tool like Macromedia Dreamweaver. If not, take heart: the issue of technical experience is slowly shrinking. New tools are constantly being developed, some of which require no more special technical knowledge than the ability to fill out a form on a web page.

Incorporating effective pedagogy into the learning object. Although it seems obvious that learning should occur when a student uses a learning object, that is not always the case. Sometimes a well-planned, thoughtful educational experience is intended, but the result falls short — especially in situations where the author of the object is simultaneously trying to learn the software that's being used to create the learning object. The educational objective is occasionally lost in the excitement — or frustration — of discovering the features that can be created with the authoring tool. Effective pedagogy can also be lost when the author does not have a clear educational goal in mind when designing the learning object.

Intellectual property and copyright issues. Authors choosing materials to include in their learning objects face a host of questions: Who

owns that photograph? Does the author have the right to include it in a learning object that will be freely distributed to anyone and everyone? What if the learning object is placed in a secure location that requires a password to access, and only students in the class get the password? Is it covered by fair use? Is a learning object considered a derivative work or a redistribution of the original? Does the author own the completed learning object, or does it belong to the school where s/he works? The questions get more complicated as more materials, or assets, are incorporated into a learning object.

Author workload. Creating a high-quality learning object is a serious undertaking, requiring time to plan the project; gather and/or create assets; and develop, test, and release the finished product. Authors who are working alone will need to plan longer project schedules or arrange for release time to devote to learning object development.

Scope. It can be difficult to decide how much content to include in a single learning object, but the decision will have a major impact on the results. A learning object with too much content can be difficult to navigate. Depending on the technology, it may also take an unreasonably long time to download. On the other hand, if the content is sparse, learners may find that the outcome is not worth the time invested in using the learning object.

Should You Create a Learning Object? Some Pertinent Questions

Before creating a learning object, take some time to consider a few key questions:

- What educational problem are you trying to solve?
- How do you envision your learning object being used?
- What rights issues can you identify?
- What resources do you have available for development?

Armed with the answers to these questions, you will be able to focus your development efforts more efficiently. Your time will be better spent because you will avoid needless backtracking and reworking of what you have already done.

Let's take a closer look at each question in turn.

WHAT EDUCATIONAL PROBLEM ARE YOU TRYING TO SOLVE?

First of all, identify your learning goal. Is there a concept that is troublesome for learners using traditional methods? If so, perhaps using a well-developed learning object will help them understand it better. Or is it that you have supplemental resources you wish to share, but don't have time in class to show them all? A learning object in the form of a self-guided tour could serve this purpose. Whatever your goal is, write it down and keep it as a focus as you create your learning object.

Think about whether there is a clear advantage to using your planned learning object to reach the educational goal you have named. Can learners easily get an equivalent experience in some other way? If so, the advantage of using a learning object is slight. However, if your learning object will give learners an opportunity to explore something they otherwise could not, or to explore it in a completely different way, the benefit of using your learning object is stronger.

Ask yourself whether your solution is worth the time and effort involved. Answering this question honestly can save you from spending time and resources creating a learning object that is not likely to be used. If your initial answer is "No, it's not worth the time and effort," but you still think there is value in the learning object you imagine, consider how you might revise your plan to create a learning object that is worth the time and effort.

HOW WILL YOUR LEARNING OBJECT BE USED?

List the most common ways you envision learners using it. For example, imagine an art module that showcases five artists and their major works, including biographical information and a matching exercise. Your list might look something like this:

- Learners become familiar with five artists, their biographies, and their major works.
- Learners pair artists with corresponding artworks.
- Learners pair artists with corresponding biographical details.

Those are the most common uses that come to mind immediately. Now think of *uncommon* ways that your learning object might be used. A sample list for the same imaginary object might include these activities:

- Learners compare artworks by two or more artists and note similarities and differences.
- Learners use biographical information about the artists to make inferences about possible influences on the works pictured.
- Learners make inferences about other works the artists have made which are not pictured.
- Learners drag components of artworks onto a virtual canvas to create a derivative work in the style of one or more featured artists.

The activities described in the second list begin to open up new possibilities for learner interaction. You may come up with ideas in this second list that you cannot implement due to technical, time, or budgetary constraints; implementing the last item in the list above, for example, could easily double your development time all by itself. However, your second list is more likely to spark ideas that will result in a stronger learning object with greater potential for reusability.

Check your lists against your written educational goal; do the activities support the goal? If not, revise your lists. Keeping these lists in mind throughout the development process will help you make choices about design and content that will keep your learning object focused on the educational problem you want to solve.

You should also consider how your learning object will relate to other existing learning objects and to other educational materials you are aware of. If someone else has created a learning object that could serve as a perfect introduction to yours, keep that in mind as you develop. The same is true for other companion materials that are not digital learning objects (textbooks, videos, and other traditional materials). Knowing that you can link your object to one or more existing objects or materials can help you refine your focus. When you publish your learning object, you might suggest that it be used in company with the other objects or materials you have identified.

WHAT COPYRIGHT AND INTELLECTUAL PROPERTY QUESTIONS SHOULD YOU CONSIDER?

Copyright issues are perhaps more pertinent than ever before in this age of easy access to digital materials. Clearly, if you are using materials created by someone else in your learning object, you must obtain permission and provide correct attribution. An exhaustive treatment of the rights and issues involved is beyond the scope of this work, but the guidelines presented below should get you started. See the resources section of the Guidelines Resource Website *(www.nmc.org/guidelines)* for more information.

Copyright clearance. Make sure you have copyright clearance for each asset you use, and make sure that clearance specifically covers use of the asset in a digital learning object like the one you will create. Contact the creator of each item, explain what you wish to do with the work, and ask for permission to use it. There is a letter template on the Guidelines Resource Website *(www.nmc.org/guidelines)* which you may adapt.

Fair use. Fair use refers to a portion of copyright law that deals with commentary, criticism and parody. Although it is commonly cited as a way to use copyrighted works for educational purposes, fair use does not give unlimited license for use and distribution even if the purpose is purely educational. A key point of the fair use argument is that only a portion of a work is copied; fair use never applies to using a work in its entirety. Nor does fair use allow prolonged or repeated use of even part of a work.

Creative Commons. Creative Commons *(www.creativecommons.org)* allows authors and artists to select licenses for their works that specify how they can be used. Rather than choosing to include a traditional copyright statement, which typically describes what *cannot* be done with a work, Creative Commons artists include statements about what *can* be done with their creations. The site includes a search tool that locates works on a particular topic and by the type of license attached.

"Open" and "closed" learning objects. Learning object formats may be either open or closed

with regard to whether assets can be extracted. For example, a learning object that is essentially a website is an open learning object; text and individual images may very easily be extracted from it and saved to a viewer's own computer. A simulation written in Java is a closed learning object; it is difficult to extract text or images from a Java applet. You may be able to obtain permission to use an asset in a closed object which you would not be allowed to use in an open object, because the copyright holder may specify that his or her assets can only be used in ways that prevent them from being extracted.

Your own rights issues. You should also consider your own rights and those of the organization for which you work. If you are on the staff of an institution of higher education, for example, you may find that you do not own the rights to materials you create while at work; your institution may own them. You may be required to include a copyright notice on any materials you create to identify them as the property of your employer. If not, consider including a Creative Commons license statement with your learning object and/or any assets you create so others may use them, too.

WHAT RESOURCES ARE AT YOUR DISPOSAL?

The answers to the questions posed in this section will inform the choices you make to almost the same extent as choosing your educational objective.

Are you the sole developer, or do you have staff to assist you? What technical experience do you and/or your staff have? What software is available to you for creating or digitizing assets, and who knows how to use it? What software will you use to create your learning object? Do you have access to assets already digitized? What about content — are you the content expert, or do you have access to someone who is? And how much time do all of these people (including you!) really have available to spend on this project?

One of the major obstacles to creating learning objects is lack of time; a second is lack of technical expertise. If you have never created a learning object before, you may find it difficult to estimate the amount of time and experience that will really be needed. Not convinced? Just look at the credits list of any high-quality learning object. For instance, the credits page for *DNA from the Beginning (www.dnaftb.org),* a popular biology simulation, lists eight current staff people and eleven prior contributors, not to mention a host of others in the full list of credits and acknowledgements.

Answering the questions above will help you assess your situation and identify resources you need to obtain. There is a Resource Tracking Worksheet on the Guidelines Resource Website *(www.nmc.org/guidelines)* that may be helpful to you.

CREATING LEARNING OBJECTS: SOME PRACTICAL ADVICE

This section offers guidelines and tips for creating your learning objects organized into a sequence of discussions that outline the major areas to consider. Each guideline is highlighted by a special apple icon. You can also find a summary of all the guidelines on page 22.

The first of these guidelines focuses on designing to enable learning. Suggestions for ways to keep your objects learner-centered and learner-driven are provided to help you keep your target audience at the heart of your development plan.

Next, basic design and usability guidelines are offered to help you create a pleasant experience for your learners. You will also find tips for making your learning objects reusable, accessible by learners with different abilities, and interoperable with learning objects developed by others. Each of the above topics includes specific guidelines that you may use to evaluate your learning objects as you develop them.

Finally, a method for discovering and listing the development requirements for your particular learning object is presented; if you are developing your own learning object, the requirements list will serve as a map for your efforts. If you are lucky enough to have one or more developers working for you, the requirements list will also help to clarify your needs to them and allow them to more accurately estimate the time and resources they will need for your project.

Designing to Enable Learning

The key to a successful learning object is, naturally, whether it actually does facilitate learning. The question of whether learning is occurring as a student uses a given learning object can be difficult to answer even during direct observation. How can an author take it into account when planning a learning object that hasn't even been developed yet? Is it possible to ensure that learning will occur?

Part of the answer, of course, is that it is not possible to *ensure* that learning occurs. Even the most receptive student using the best-designed learning object imaginable may, for any of a variety of reasons, fail to learn the intended content in a given session on a given day. However, authors can certainly take steps to make it *more likely* that learning will occur when students use their learning objects.

The following guidelines should help you focus your development efforts in ways that are likely to enable learning.

Keep your educational goal in focus.

One of the most basic tenets of instructional design is that successful activities and tools must have an educational goal at the core. Return to the question raised above: What educational problem are you trying to solve? Every choice you make during design and development must refer to your educational goal so that your finished product will support it as well. As you decide what to add in the way of activities, assets, and content, consider the following points:

- Avoid adding unrelated activities or features just because your authoring tool "makes it easy." If the activity does not support your educational goal, omit or redesign it.
- Include only assets (images, text, video clips, sounds, etc.) that support your educational goal. Note that making the learning object attractive to the target audience does support the goal of getting learners to use it; throwing in distracting, flashy images and sounds does not.

Choose meaningful content that directly supports your educational goal.

You may find that you have access to more content than should be included in your learning object, especially for a topic that is of great interest to you. While it is important to be thorough, take care to preserve a feeling of unity throughout your learning object. Each part should relate to and support the others. Learners can become confused, distracted, or even lost in a maze of too much information. As you select and organize your content, consider the following strategies:

- Recognize and address common preconceptions learners may have about the content you are teaching.
- Where possible, use examples drawn from real-world data and case studies.
- Provide complex scenarios that invite a range of opinion and provoke thought.
- Make a connection between the content and the learner's own life or situation (or guide the learner in making such a connection).
- Demonstrate new knowledge to the learner in a memorable way.
- Provide a conceptual framework for facts and ideas.
- Choose content and examples that are concrete rather than abstract.
- Build on learners' existing knowledge.
- Keep the content focused on how the world works and demonstrate how the learner may use the new knowledge in his or her own life.

Present content in appropriate ways.

Keep in mind that different types of content are suitable for different formats of learning objects. If your content consists largely of images and text, a website may be a suitable model for you to use. If you envision activities that allow the learner to manipulate shapes or objects, a self-contained module created with something like Macromedia Flash would be a better format. If you are unsure what choices you might have, spend a little time browsing a collection of digital learning objects to get a feel for what's available. If you have access to a multimedia specialist, ask him or her to spend a few minutes showing you the possibilities.

Be aware that some types of content are not especially suited to learning objects. If your learning object is shaping up to be a linear, text-based (book-like) experience, reevaluate your educational goal. Unless your learning object can provide something that a book cannot, you may wish to reconsider investing your time in developing it.

Select appropriate activity structures.

The basic structure of the activities in your learning object will have a profound effect on whether learning occurs easily, with difficulty, or rarely when your object is used. Current theories of learning underscore the importance of student engagement, ownership of activities, and active involvement in the learning process. Your learning objects can be designed to encourage and support these kinds of activities.

Students who are solving problems, drawing conclusions, comparing options and thinking about what they are doing are likely to be actively engaged in the learning process. Activities like these exercise the higher-order thinking skills of synthesis, analysis, and evaluation. A well-designed learning object has a strong potential to enable these activities; this fact is one of the most appealing aspects of learning objects.

Of course, learning objects vary greatly in the degree to which they support these activities. As you might suspect, it can be technically challenging to create learning objects that offer the kinds of interactive features that support active engagement. Offering multiple paths, a range of activity types, and prompt and constructive feedback will help make your learning object more effective. Let's look at each of these strategies.

Offer the learner a choice of paths through the learning object. An object that presents content in an appealing setting, inviting learners to explore at will, is more interesting than a single-path, linear, "click here to proceed" format. If the only choice is when to click the "next" arrow, it is difficult for learners to feel ownership of the learning process.

- Offer multiple paths or branches for learners to explore.
- Allow the learner to choose which path(s) to follow rather than forcing him or her down a particular path.
- Draw a conceptual map of your learning object showing the relationships between ideas, content, or sections. As you create the object, make sure those connections are available as path choices.

Offer a range of activities that address different modalities of learning. One of the wonderful things about learning objects is that a variety of activities

can be included in one object. Everything from matching exercises to simulated seismological measurement tools is within the realm of possibility. Learners can explore a single topic — stars, for instance — from several angles: one activity might focus on measuring the temperature of several stars; another might invite the learner to recreate some of the constellations; a third might provide a vivid demonstration of the incredible distances between even the closest stars. Think about your educational goal and imagine creative activities to help learners achieve it.

- Invite access to content via multiple modalities of learning (visual, auditory, kinesthetic).
- Use your imagination to invent interesting activities.
- Provide opportunities for learners to make choices, make decisions, or manipulate elements.
- When learners are able to make choices, ensure that the choices are meaningful.

Keep in mind that presenting a learner with a choice that does not require any meaningful thinking does not support effective pedagogy. For example, asking a learner to choose her favorite color in order to continue does present her with a choice, but the choice is not a meaningful one.

Offer prompt and constructive feedback. As the learner completes tasks, answers questions, or achieves goals, provide immediate feedback that focuses specifically on his or her progress.

- Provide constructive feedback that prompts learners to take actions to correct errors.
- Avoid "canned" feedback ("Right! Good job," "No, try again").
- Avoid distracting the learner with pop-up windows, animations, or loud sounds, especially if he or she is in the middle of a task.
- Provide steady, unobtrusive feedback about progress through long or difficult tasks.
- Where possible, support learner contact with professors and/or peers.

Feedback given during the course of using a learning object can be gentle, almost understated, and still be effective. A progress bar off to one side that quietly fills up as the learner works through the activity gives positive reinforcement without interrupting the learner's train of thought. Sometimes it is desirable to attract the learner's attention more strongly; if an activity has just been completed, or a problem solved, offer feedback that clearly indicates what the learner has done correctly and what still needs improvement. If possible, build your learning object so that the learner can return to any problem areas and try to correct mistakes before being told the correct answer.

Supporting learner contact with professors and peers will emphasize the social aspect of learning, but this is not easy to build into learning objects. In general, this strategy is more effective when it becomes part of the "assignment" for using a learning object, rather than an integral part of the learning object itself. However, some learning objects do incorporate synchronous communication (chat, for example) or asynchronous communication (bulletin boards, email) as part of the objects themselves. This is a nontrivial issue in terms of development, unless the development tool you choose provides these features.

Consider assessment issues.

Assessment differs from feedback in that feedback is given during the learning process, while assessment happens afterward to determine how much learning actually took place. Assessment and learning objects is a complex topic; currently, learning objects typically do not include built-in assessment. Choosing a method of assessment is part of the problem: should it be comprehension indicators, like multiple-choice quizzes? Should it be a written product like an essay or research paper? Or should it take the form of a time-on-task report?

Another issue is the technical difficulty of implementing assessment measures. Multiple-choice quizzes are easy enough to develop, but if another teacher is using your learning object, how do her students' answers get to her for evaluation? How do you keep track of time spent on task for a learning object? And how do you know that the student actually did the work himself? The assessment issues that come up for learning

objects are not really new; many of them apply to other types of learning experiences as well.

Most learning objects are not assessment solutions, but tools for learning. They tend to work best when combined with external assessment options that allow for customization. There are several advantages to this approach:

- You will be able to choose a different means of assessment based on the activity/assignment your students were asked to do (if your learning object supports multiple activities or assignments).
- It is more likely that your learning object will be reusable if assessment is external, since assessment techniques vary over time and from one instructor to another.
- It is more likely that your learning object will be able to interoperate with other learning objects, since external assessments can be customized to capture material from more than one object.

Some learning objects *are* assessment modules. You may create one learning object that contains your content, and a second learning object that evaluates how well the content was learned. However, many course management tools include easy ways to build customized assessment modules (Blackboard's multiple choice test or discussion questions, for example) which can be used with any learning object you create or find.

If you do decide to create an assessment module, apply the same guidelines you would use to create an in-class assessment:

- Use constructive, appropriate assessment techniques. Avoid "point and guess" questions and aim instead for techniques that employ the learner's higher-order thinking skills.
- Select the type and nature of questions based on your stated educational goal.

Designing the Learner's Experience

Balancing the content you want to present with a pleasant experience for your learners is not always easy. This section presents some basic design and usability guidelines to help you choose how to present the content you have so carefully selected and digitized.

The part of your learning object that learners see and interact with is called the *interface.* The interface comprises the layout, the colors, navigational elements, user controls, — the "look and feel" of your learning object. The interface is separate from the *content* that you want learners to master; however, the interface defines how the learner may access your content. A well-designed interface is almost transparent to learners, while a poorly-designed interface distracts them at best and derails the learning process at worst.

GRAPHIC DESIGN GUIDELINES

How attractive is your learning object? Does it appeal to learners, visually speaking? Is the look of interface so distracting that learners have trouble focusing on the content? The answers to these questions indicate how graphically appealing your learning object is (or is not).

Have a graphic designer look over your work if you have no experience in that area yourself. A designer may be able to make a few simple suggestions to help you clean up and simplify your design without too much effort. Some learning object development tools include templates or default designs. If you are using one of these, you can take advantage of the pre-designed layouts.

Graphic design can be intimidating. Whether or not you have particular training in the visual arts, you can follow some basic principles of design to make your learning objects as appealing as you can. In general, keep your designs simple. Make sure any graphics you use are professional-looking, and avoid fuzzy text and blurry images. The following graphic design guidelines may be helpful to you.

Each page or screen should be visually balanced.

- Balance elements with "partner" elements: a large, light-colored element is balanced by a small, dark-colored element; a large element near the center of the screen is balanced by a small element near the edge, and so on.
- Imagine the screen or page divided into four quadrants. The visual weight of each

quadrant should be about the same. This does not mean that the *arrangement* of items in each quadrant should be identical; only that the sum of the visual weight should be about equal for each quadrant.

- Avoid creating perfect symmetry (mirror images, everything centered, etc.). While safe, it is also visually boring.

To test balance, try printing your screens. Turn each printout upside down. Does part of it seem top-heavy? Turn it 90 degrees and check again. Check from each angle, looking for any sections that are unusually heavy-looking. If you find any, rebalance the elements on that screen.

Use physical placement on the screen or page to establish and strengthen visual relationships between items.

- More important items should be larger, darker in color, and/or nearer the top or left edges of the page or screen.
- Conversely, less important items should be smaller, lighter in color, and/or nearer the lower or right edges.
- Organize elements logically: group similar controls together; group related content.
- Leave breathing space (white space) between groups.

To check placement, have someone who is not familiar with your learning object look at a screen for a few seconds. Ask him or her to point to the most important element on the screen. Have the person tell you which elements are closely related and which are less so. If the answers do not match your intentions, move your elements around, resize them as needed, and try again (with a different test subject!).

Select one or two visual elements and use them throughout the piece to create a sense of rhythm.

- Repeat an element from a logo or other motif throughout the various pages or screens; it will add interest and continuity.
- Keep colors and shapes similar from page to page or screen to screen.

Rhythm can be used to add a sense of fun to a piece. Like a tiny animal that appears in each illustration of a children's book, a familiar motif is reassuring and intriguing. It's easy to overdo this, though, so take care not to include too many of one motif on a screen, or too many different motifs throughout.

If elements in your design are not the same, then make them very different (not just slightly different) to create contrast.

- If you use more than one typeface or font, choose ones that are dissimilar enough that their difference is apparent.
- Make controls that do different things look very different.
- Make different sections of your learning object dissimilar enough that learners can tell where they are and/or what type of activity they can expect. For example, informational screens may have one layout and dominant color, while activity screens may have a different layout or dominant color.

Contrast should be used with care, as too much of it is unsettling. Use contrast to add visual interest and to help the learner differentiate quickly between elements that serve different functions.

Be careful with color contrasts. Colors that are too similar appear harmonious, but may be difficult for some people to distinguish. Colors that are too different will clash, giving the learner an uneasy or irritated feeling. The colors with the most contrast appear directly opposite each other on the color wheel (red/green, blue/orange, yellow/purple). Use these color pairs sparingly and with care. Colors that are adjacent on the color wheel contrast less (red/orange, orange/yellow, yellow/green, green/blue, blue/purple).

All elements should work together to create a harmonious whole.

- When choosing your color scheme, use colors that are close to each other on the color wheel for backgrounds. Select one color that is slightly farther away as an accent or emphasis color (see Contrast, above).
- Avoid strong patterns, except in very small areas.
- Too much harmony is boring; spice up your design by incorporating rhythm and contrast.

- Careful placement of elements (see above) will contribute to an effect of harmony.
- Create a basic layout for all screens that includes elements that are always present. Add elements as needed for individual screens.

To evaluate the overall harmony of your design, print out your screens (in color, if possible). Lay them out on a table. Do they seem to belong together? Are there any that look out of place, or that seem very different from the rest? If so, identify the elements that make those screens stand out, and try to bring them more in line with the rest.

USABILITY GUIDELINES

How easy is it to use your learning object? Can learners find the information they need? Do they understand what actions they can take, or what choices they can make, at any given point? Are instructions clear and easy to understand? Is the way the interface works so distracting that learners have trouble focusing on the content? The answers to these questions indicate how usable your learning object is (or is not).

Learners should focus on mastering the material they are trying to learn rather than on figuring out how to use the learning object. If you make your interface as simple and clear as you can, you will improve the learner's experience. Remove any obstacles to accessing the content and learners will be more likely to use your creations and will be more successful when they do.

Although the fields of user interface design and usability engineering are broad, there are some basic principles that you can follow to make your learning objects more usable. Consider using the guidelines below to check the finished piece as well as using them during development. Sometimes it helps to have someone else read the guidelines and compare your learning object to the key points; by the time your learning object is almost done, you may be so familiar with each screen that you don't really see some of the elements anymore.

Be consistent in the use of design elements, language, formatting, appearance, and functionality.

- Make sure all screens or pages have a consistent layout, color scheme, and overall look.
- Keep all navigational elements (buttons, links, etc.) in a consistent location on each screen.
- Keep the look of navigational elements (buttons, links, etc.) consistent from button to button and from screen to screen.
- Give each page, screen, or section an appropriate title.
- Use the same tone or voice in all instructions and text content.
- Use a limited number of colors and typefaces or fonts, and use them consistently throughout.

Creating consistency is one of the most powerful things you can do to improve the usability of your learning objects. Learners will have an easier time if, after going through only a few screens, they are confident that controls and information will always appear in the same place. They learn to use your object more quickly, and make fewer mistakes if controls function consistently. Interfaces that are not consistent tend to cause problems that interfere with learning, so pay particular attention to this guideline.

If you create a series of learning objects that are topically or otherwise related, consider applying the guideline of consistency across the series. Learners will come to recognize the similarities and will readily associate one learning object with another they have already used or seen.

One of the best ways to check for consistency is to watch someone try to use your learning object. Known as a user test or user observation, this technique is invaluable in providing unbiased feedback about your creation. Be careful to assure the tester that you are evaluating the learning object, not his or her performance. And although it may be extremely difficult, don't help or comment on the tester's progress unless he or she becomes completely stuck and cannot continue. It will spoil the test if you tell the person how things work. Just watch, and take notes. It is helpful if the tester will "think aloud," telling you before clicking

a button what she expects will happen afterward, and so on. See the Guidelines Resource Website *(www.nmc.org/guidelines)* for more information on think-aloud user tests.

Allow learners to control their interactions; give them the freedom to choose how to complete tasks.

- Make sure all screens or pages provide clear and consistent navigation to all other available screens or pages.
- Allow learners the ability to undo actions wherever possible.
- Make it clear how to quit or exit the learning object.
- Make sure the consequences of quitting or exiting are clear if the learner tries to quit while work is in progress.
- Allow the learner to select and sequence tasks when possible, rather than dictating a single path.
- Provide an easy way to stop, skip, restart, or revisit animations, videos, sounds, and other moving or audible elements.

People are more comfortable when they feel they are in control of a learning object. Students in particular may be more likely to explore a topic if they are confident that they can return to previously visited screens and find their way around easily. Avoid "lost" screens, which can be found once but then never revisited.

This guideline is not meant to imply that no direction should ever be given. Some tasks, obviously, have a particular sequence. Give clear guidance for sequenced tasks, but allow the learner to back up, follow side paths, or skip ahead when feasible.

Follow established standards of design and use conventions that are familiar to learners.

- Place main navigation elements either horizontally along the top or vertically down the left side of the screen.
- Place controls for quitting or exiting at the upper right or as the last item in the leftmost menu (if menus are present).

- Limit the number of icon types.
- If web links are present, do not disable link underlining.
- Make sure web link colors contrast sufficiently with text (both visited and unvisited links).
- If your design significantly breaks convention, be sure there is a solid reason for doing so.

Learners should be allowed to focus on the content of your learning object rather than constantly having to learn how to use it. Take advantage of what they already know; if your learning object is web-based, build on the skills learners bring to the experience. Visit websites that are popular with your audience and use techniques they are familiar with. Be especially careful not to surprise learners with elements that look familiar but have totally new consequences.

Simplify the design wherever possible, and stick to basic principles of aesthetics.

- Minimize the amount of text on each screen or page; only include necessary text.
- Write clearly, using simple and natural language.
- Leave white space around headers and between text sections.
- Use graphics only where they add meaning.
- Use color with discretion: choose a palette of five to seven colors and stick with it.
- Make the design visually pleasing.

As a general guide, consider the following phrase: *when in doubt, leave it out.* Too many elements, themes, or colors will distract and confuse learners. Likewise, edit and re-edit your text. Make it as simple as possible to understand; don't use overly complex sentence structure or language.

Designing for Accessibility

Accessibility refers to whether people who require assistive technology, or who have visual, aural, physical, or other impairments, can perceive and use the content in your learning object. The technical structure of your learning objects should support assistive technology like screen readers and alternative input devices (pointers, voice recognition software, etc.) for learners who require it.

One result of the recent legislation enforcing accessible Internet content has been the development of a wealth of resources and tools that can help during development. See the Guidelines Resource Website *(www.nmc.org/guidelines)* for pointers to development checklists, accessibility evaluation tools, and further information about accessibility.

While not exhaustive, the guidelines below may serve as a common-sense starting point. Many accessibility improvements can be made regardless of which development tool you are using, though some tools make it easier to design accessible resources than others. If you are selecting a new development tool, look for one with strong support for accessible content.

Design for device independence.

Learners should be able to use your learning object with a variety of input (or output) devices (mouse, keyboard, voice, and so on). For instance, provide text-only alternatives to graphical navigation buttons for learners using screen readers.

Provide alternative formats for visual and auditory content.

Include a text description or transcript of pertinent images, diagrams, sounds, video clips, and so on for learners who don't have the ability to access those types of media directly. Include brief but descriptive "ALT" tags with images.

Allow learners to control moving content.

Learners should be able to start, stop, pause, and control the pace of scrolling text, animated images, video clips, and other moving content. Avoid content that moves too fast or is too distracting for learners with cognitive disabilities to follow.

Designing for Reusability

Considering all the effort that you will be putting into the development of your learning objects, there is an obvious value in being able to reuse them. A digital learning object is not consumed when it is used, so some form of reusability is built in; many learners can use the same learning object at no additional development or distribution cost.

However, there are other aspects of reusability to consider.

A well-designed, flexible learning object can be reused not only by different learners working on the same task, but in other ways as well:

- By the same learner working on different tasks or activities, or solving different problems.
- By learners at various levels in knowledge or skill acquisition (different academic levels, for example).
- By learners in different courses within a discipline.
- By learners in different disciplines, where the content in the learning object applies to each discipline, though perhaps in different ways.
- As part of a more complex learning object or series of objects.
- By developers who may borrow "widgets" or functions of one learning object for use in another.
- By developers who may borrow content for use in another learning object.

A few very basic guidelines for reusability are described below. An excellent resource for learning more about reusability is the Eduworks Reusable Learning website *(www.reusablelearning.org).* Funded in part by a grant from the National Science Foundation, the Reusable Learning site includes a set of guidelines and checkpoints that are more detailed than those included here.

Guidelines in a checklist form can be printed from the Reusable Learning site and used during development to ensure that your learning objects are created to be as reusable as possible. The site also contains information for digital collections wishing to support reuse of learning objects.

Solve the copyright problem for others who want to reuse your materials.

- Get copyright clearance for all assets or components that are not created by you.
- Use Creative Commons or a similar licensing structure to clearly inform others how your work may be used. Attach this information to your learning object.
- Make sure your use license clearly indicates which parts of the resource (if any) are not

reusable because they are copyrighted by others or for other reasons. Be aware that including assets that are copyrighted by others may severely limit the reusability of your object.

- Include contact information for the copyright holder(s) so that others can ask for permission if needed.

Specify that your object may be used for educational purposes in your license statement, but make sure that any assets not owned by you may be licensed in this way. Copyright issues present a significant barrier to reuse; when you remove this barrier, others are more likely to use your materials.

Make sure your learning object is self-contained and can stand on its own.

- Refer to your educational goal; include only content that supports that goal.
- Break large resources into smaller sections which can be used independently of each other.
- Eliminate dependencies on other learning objects.
- If you include links to outside materials, do not require access to those materials in order for learners to complete tasks within the learning object.
- Include only as much contextual setting as is required to support the content.

Each object you make should be usable by itself. While there is value in sequencing learning objects, any sequence should be chosen by professors rather than enforced by the design of the objects. Links to outside resources should be used with care. Even including such links in a reference section is risky as websites are notoriously likely to change or even disappear. It is better to omit external links from your learning objects and provide them instead on an easily updateable web page.

The audience for a learning object becomes more narrow as more context is added. For example, an anthropology course might include a learning object component about methods of forensic analysis. The same component might also be useful in a criminology course. However, if the material in the component is too specific to anthropology (has too much context), it will be less appropriate for repurposing in another discipline.

Design your learning object so that it may be used by a diverse audience.

Adhering to basic usability and accessibility guidelines will help you implement this guideline. Other strategies include the following:

- Write text-based content in simple, natural language.
- Deliver your learning objects via technology that is available on a variety of computing platforms (Macintosh, Windows, Unix/Linux, etc.).
- If special equipment or instruction is absolutely necessary to complete or understand the learning object, clearly state these requirements up front.
- Present content in multiple languages where appropriate.

Obviously, it is not possible, or even desirable, to design a learning object so that anyone, anywhere, can use it. Your educational goal and specified target audience will limit the field a great deal. However, be sure to consider differences in educational level, culture, technical experience, and access capability when you design your learning objects.

Designing for Interoperability: Adding Metadata

Including appropriate metadata in or with your learning object can help ensure that it is:

- *Interoperable* — that it can work with other learning objects and with learning management systems (LMS).
- *Reusable* — that others can use your object, perhaps in different ways than you use it.
- *Discovered* — that your object can be found by users who need it at the time that they need it.
- *Properly attributed* — that your ownership and attribution rights remain attached to your learning object, no matter where it goes or how it is used.

■ *Durable* — that the useful lifespan of your learning object will be extended because it conforms to metadata standards.

But what is metadata? How does it get attached to learning objects? Who decides what kind of data to collect?

In the context of digital learning objects, *metadata* refers to information about the learning object: what the content is about, who the authors and developers are, who the target audiences are, who owns the object, how it may be used, and so on. The MASIE Center provides this definition:

> What should metadata mean to you? It is the means to fully describe and identify every piece of content and every resource useful for learning, and enable you to efficiently find, select, retrieve, combine, use, and repurpose these resources. ("Making Sense of Learning Specifications & Standards," 30).

Learning object metadata may be objective information (such as the size of a file in megabytes) or subjective (such as a professor's opinion of the quality of content). Some metadata is attached to learning objects by their authors, but metadata can also be added by librarians, other faculty, students, and many others. Metadata can be added manually by filling out forms or automatically by using special software.

METADATA SPECIFICATIONS
In order for systems produced by different vendors to interact with learning objects created by different authors, a specification of what metadata to collect and how to represent and access it is required.

Specifying what metadata to collect and how to represent it. Research groups like the Dublin Core and CanCore have developed standard lists of metadata fields and guidelines for the type of information to include in each field. These standards do not specify which fields should be used for any given learning object or whether the metadata should be included inside the learning object or attached externally. Instead, they provide a reference for authors and vendors to use when adding or accessing metadata.

Describing how to access metadata. In recent years, groups like the Aviation Industry Computer-Based Training (CBT) Committee (AICC), the IMS Global Learning Consortium, Inc., the Institute of Electrical and Electronics Engineers (IEEE), the Alliance for Remote Instructional Authoring and Distribution Networks for Europe (ARIADNE), the Dublin Core, and CanCore have developed specifications or guidelines for various aspects of learning object development and use.

Building on this work, the Advanced Distributed Learning (ADL) initiative of the U.S. Department of Defense has created a unified collection of core specifications, the Sharable Content Object Reference Model (SCORM). SCORM refers specifically to content, technologies, and services for online educational application (e-learning). SCORM is not a standard; it is a detailed implementation reference which, if followed, allows systems, content, and technologies to "talk" to each other. SCORM is still being developed and refined by ADL and other government, academic and corporate groups.

SCORM currently includes specifications for describing, sequencing, and joining learning objects; enabling communication between learning objects and learning management systems; and data tracking. Vendors of products that create and manage learning objects can use the SCORM specifications to ensure interoperability among their products.

BENEFITS OF METADATA
Metadata is used for three purposes related to learning objects: cataloging and searching for learning objects; tracking ownership and attribution information and handling rights management issues; and communicating with learning management systems.

Cataloging and searching. When you enter search terms to find objects in collections like the National Science Digital Library, it is the metadata attached to the objects that is being searched. Fields from standards like Dublin Core and CanCore are used to describe the learning object, and the search engine examines the data in those fields to come up with a list of objects that match the search criteria.

Ownership, attribution, and rights management. There are fields in the Dublin Core and CanCore lists to describe who owns a resource, who should be credited when it is used, and how it may be used. Including this kind of metadata can help ensure that your resources are used as you intend and that you are given credit for your work.

Communicating with learning management systems. Developers of systems like Blackboard and WebCT refer to the SCORM specifications when they create functions that allow course creators to track student progress, sequence learning objects, and so on. Although the products are different, they can interoperate with learning objects that also follow the SCORM specifications.

METADATA GUIDELINES

The tangible benefits of metadata efforts are beginning to be revealed as products start to provide "hooks" to connect learning objects and enable functionality which was previously unavailable. When you create learning objects, make an effort to include appropriate metadata.

Include appropriate metadata in learning objects you author.

- Choose development tools that support SCORM-compliant tags.
- If you hire a developer, select someone who is familiar with metadata requirements.

When you add learning objects to a collection or library, provide requested metadata information.

- Be as complete as you can.
- Check your listings periodically to update any information that has changed.

Where to Start?
Gathering Requirements

Requirements gathering is a process used to capture information about why a product is needed and what the finished product will be like. Requirements for learning objects include specifications for how the learning object should work, descriptions of included elements, and constraints placed upon the development process. Generally, requirements are statements of *what* a system should do rather than *how* it

should do it; *how* questions are usually answered during the design phase.

Requirements come from end users, from customers, and sometimes from developers. End users tend to state requirements in descriptive or narrative terms ("I'd like to be able to choose which topic I want to study right away when I open the learning object") that might need to be broken down into individual requirement statements. Customers, who may well be different from end users, are the people who are paying for the development of the system. Their requirements will often be stated in terms of costs or scheduling issues. Developers might have requirements related to system performance and other technical topics.

When possible, all these groups should contribute to the requirements-gathering effort to create a fuller description of the learning object. The practice of including these groups also helps to ensure that everyone is in agreement about what is to be done before development begins.

METHODS FOR GATHERING REQUIREMENTS

Requirements engineering is a field in its own right, and large software development companies devote entire departments to gathering and writing requirements. However, there are some low-cost methods that can be used to gather requirements for smaller projects.

User interviews. Identify specifically who you are creating the learning object for; not just *students* but *first-year biology students*. Contact some members of your identified audience and talk to them about what you plan to create. Ask whether the idea is of interest to them. Would they use a learning object like yours if it were assigned as part of a class? What about for extra credit? What kinds of activities would they expect to be able to do? What would they *not* expect to be able to do with it? Write down their answers, and you have a source for requirements.

Scenarios. Scenarios are short stories about specific, imaginary people using your finished learning object. They don't need to be very long — a paragraph or two — but they should be very specific. *Jenny opens the learning object and is asked to type in her name. The next thing she sees*

is a question: Jenny, would you like to learn about bugs or snails? Jenny selects "bugs" and sees a screen with pictures of six different bugs… Once you have written several scenarios, it's a good idea to have someone from the target group read them to see if they make sense and sound like real activities. Then you can use those as a source for requirements.

Project documents. If you have a project proposal, grant proposal, or similar document, check it for requirements. These documents may include a description of the envisioned learning object, a discussion about technical issues, and other useful information.

Check the Guidelines Resource Website *(www.nmc.org/guidelines)* for more information on gathering requirements, writing a requirements document, and related topics.

Choosing a Technology and Development Tools

What is the best tool to use for developing learning objects? To answer this question, you will need to consider both the software you will use and the development language or technology with which you will work. As you have gathered, learning objects can be anything from web pages to mini-applications. They can be created with anything from a simple text editor (for HTML-based objects) to specialized programming software. Your selection will depend on the developer's technical expertise, features supported by the technology, whether you can get technical support, and expense or availability of the chosen technology and the equipment required to run it.

Choose a technology and a tool your primary developer is comfortable using (or learning).

- If you are the primary developer, be honest about your time and ability to learn a new software package or programming language.

Assume you will need to complete at least one or two test projects before you can create a high-quality learning object.

- One technology your primary developer is already familiar with is, so to speak, worth two in the box.

Choose a technology that supports the features you want to include in your learning object.

- Identify your educational objective and plan the major features of your learning object early in the process.
- Review your requirements document. Will you be able to implement all your requirements with the technology you are considering?
- Be flexible about your feature list. You may need to rethink some decisions about features if any of them prove to be difficult to implement due to the limitations imposed by your choice of platform or technology.
- Check for features that support accessibility compliance.

Choose a tool that is supported by your institution's instructional technology staff, if applicable.

- Find out whom you can turn to for technical support if something goes wrong.
- Look for online forums for people who are using the technology you have selected.

Choose a tool you can afford.

- Consider open-source alternatives to commercial software if cost is an issue.
- Check to see if your organization already has a license for any software you are thinking of purchasing.
- Look for educational discounts.

Consider the machine that will run the software. Will you need to buy a new one or do you have one that is compatible?

MARKETING LEARNING OBJECTS

Once you have created a learning object and decided to share it with other educators, the question arises: how do you let people know about your creation? You can reach a wide audience by placing your learning object in one or more digital collections, known as *repositories* or *libraries.* Educators looking for learning objects visit these collections, where they can search by topic (or other criteria) to find learning objects that will suit their needs.

Before you place your learning object in a collection, be sure you decide what sort of copyright and use statement you want to use. Check Creative Commons *(www.creativecommons.org)* for quick, free license statements.

Repositories & Libraries

If you are not familiar with a particular collection, visit it and read the "About Us" section of the site. This will help you understand what kinds of learning objects the collection is interested in listing. Some collections are more specialized than others, and some have selection criteria that must be met for any learning object that will be listed. Others are open to any learning object at all. Bear in mind that people other than the author can list learning objects in some collections.

It is even possible to find collections of collections. The University of British Columbia maintains a web page, "Find Learning Objects," which lists many current collections of digital learning objects *(careo.elearning.ubc.ca/cgi-bin/wiki.pl?FindLearningObjects).*

Care and Feeding of Your Learning Objects

If you do provide general access to your learning objects, you should be aware of some issues that may arise. If your object is very popular and many people access it, the computer that houses it must be stable and secure. People using your learning object may wish to contact you to ask questions or make suggestions. As new technologies are developed and older ones fall out of use, you may wish to update your learning objects accordingly.

House your learning objects on a secure, stable computer with permanent Internet access.

- Do not use a personal computer to host public learning objects.
- Stay on good terms with the system administrator by respecting storage limits and software requirements.

Provide contact information, copyright and use licenses, technical requirements, and version information. Keep these current.

- Maintain a web page for your learning object. Use the web address for this page, rather than a direct link to the learning object, when you register with collections.
- Provide at least one reliable means of contact (email, postal mail, telephone) and make sure it is up-to-date.
- Provide a list of changes made to the learning object, such as new features, new technical requirements, and bug fixes.
- Decide on a copyright statement and usage license. State them prominently.
- Provide both a technical contact and a content contact (assuming they are different people).

Provide sample assignments, usage tips, links to related resources, and other support material.

- If you develop worksheets, assignments, or other materials to be used with your learning object, keep them general enough that others can use them. Link to them from the object's web page.
- Provide a frequently asked questions (FAQ) document or list of suggestions and tips, especially if your learning object is complex.
- Keep in mind that not all learners who find your object will be taking part in a course. Provide suggestions for independent study as well.

EVALUATING FOUND LEARNING OBJECTS

When considering whether to include a learning object in the curriculum, how can you find and select an appropriate one? A common way to find learning objects is to visit an online collection or digital library such as MERLOT or the National Science Digital Library (NSDL). Resources like these usually provide a means for searching by topic, author, and so on. Some collections offer user reviews and/or peer reviews, which can help guide you in choosing the learning objects you would like to consider.

Before choosing a learning object, you might find it helpful to write down the educational purpose you would like it to serve. What concept or skill should it teach your students? What kinds of activities do you imagine a learning object might offer that other course materials do not? With the answers to these questions in mind, you will be better able to evaluate whether a particular object will suit your needs.

Once you have located a few likely learning objects, try each one and compare your experience with the one you envisioned for your students. Ask yourself the following questions:

- Is the learning object appealing overall?
- Is the experience of using the learning object a pleasant one?
- Are the technical requirements easily understood and easily met?
- Is it easy to find your way around the learning object?
- Is the content complete and correct?
- Are the activities appropriate to the content?
- Is the scope of the learning object suitable: neither too limited, nor too general for your purposes?
- Does it meet the educational goal you decided upon?

If you answer yes to each of the above questions, you've found a pretty good learning object. If some of the answers are no, you might consider continuing your search. You can use the guidelines presented in previous sections of this document as a checklist to evaluate found objects.

PARTING THOUGHTS

Now that you understand some of the issues surrounding learning objects, you should be ready to decide if authoring is for you. If so, the practical tips presented here can help guide you along the path to successful learning object development. Remember to identify your educational goal and keep it in focus throughout the development process. Design for your learners. Create a memorable experience. The process of authoring learning objects is really not so different than that of creating other curriculum materials: only the tools have changed. By now, we hope you are brimming with ideas and enthusiasm for new learning objects of your own.

SUMMARY OF GUIDELINES

Designing to Enable Learning
- Keep your educational goal in focus.
- Choose meaningful content that directly supports your educational goal.
- Present content in appropriate ways.
- Select appropriate activity structures.
- Consider assessment issues.

Designing the Learner's Experience:
Graphic Design Guidelines
- Each page or screen should be visually balanced.
- Use physical placement on the screen or page to establish and strengthen visual relationships between items.
- Select one or two visual elements and use them throughout the piece to create a sense of rhythm.
- If elements in your design are not the same, make them very different (not just slightly different) to create contrast.
- All elements should work together to create a harmonious whole.

Designing the Learner's Experience:
Usability Guidelines
- Be consistent in the use of design elements, language, formatting, appearance, and functionality.
- Allow learners to control their interactions; give them the freedom to choose how to complete tasks.
- Follow established standards of design and use conventions that are familiar to learners.
- Simplify the design wherever possible, and stick to basic principles of aesthetics.

Designing for Accessibility
- Design for device independence.
- Provide alternative formats for visual and auditory content.
- Allow learners to control moving content.

Designing for Reusability
- Solve the copyright problem for others who want to reuse your materials.
- Make sure your learning object is self-contained and can stand on its own.
- Design your learning object so it may be used by a diverse audience.

Designing for Interoperability:
Adding Metadata
- Include appropriate metadata in learning objects you author.
- When you add learning objects to a collection or library, provide requested metadata information.

Choosing a Technology and
Development Tools
- Choose a technology and a tool your primary developer is comfortable using (or learning).
- Choose a technology that supports the features you want to include in your learning object.
- Choose a tool that is supported by your institution's instructional technology staff, if applicable.
- Choose a tool you can afford.

Care and Feeding of Your Learning Objects
- House your learning objects on a secure, stable computer with permanent Internet access.
- Provide contact information, copyright and use licenses, technical requirements, and version information. Keep these current.
- Provide sample assignments, usage tips, links to related resources, and other support material.

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