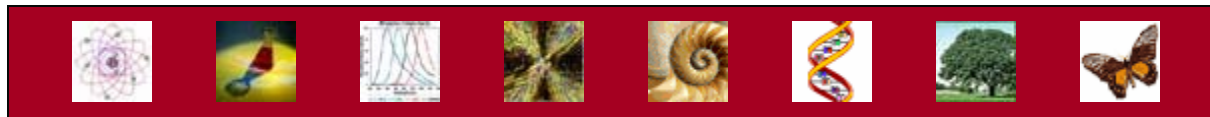


The Use of a Content Management System and Reusable Learning Objects to Develop an Integrated Suite of Instructional Materials for Scientific Information Literacy



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Abstract

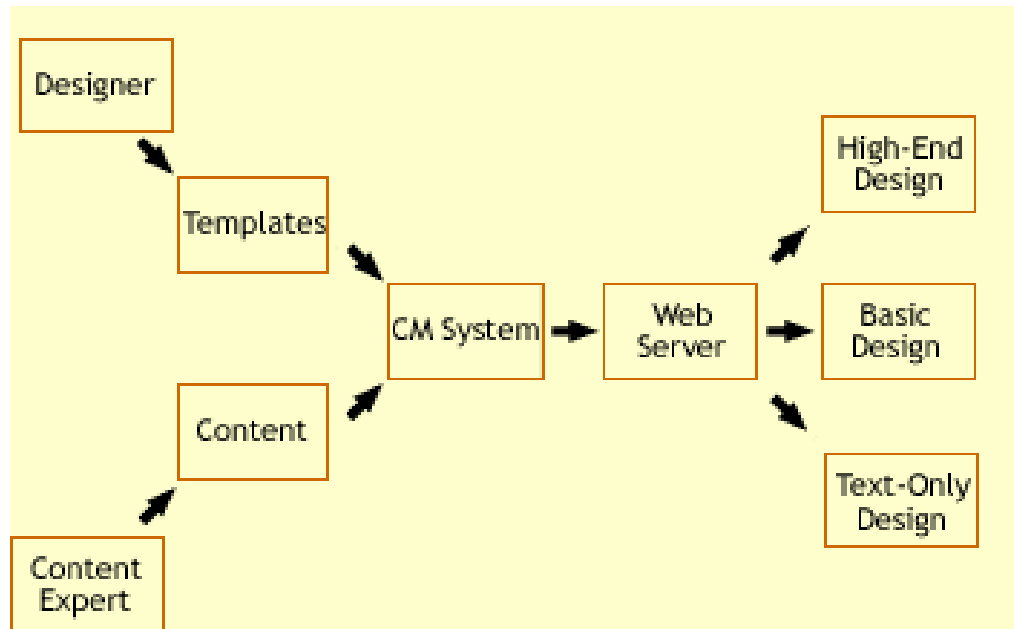
Content management systems (CMS) are receiving increased attention in the library world for managing the content of web sites. In the e-learning field, the development and use of reusable learning objects (RLOs) is intended to help manage a wide array of online instructional materials and systems. The combination of a CMS and RLOs offers advantages in terms of streamlining the maintenance and development of web-based materials, including developing and maintaining instructional content, in a variety of formats, for information literacy instruction in the sciences. For example, concepts such as the scientific information cycle and scholarly communication apply to many scientific disciplines. Other concepts, such as the use of Registry numbers in chemical searching and basic database search concepts, also lend themselves to incorporation as RLOs. One of the advantages of CMSs in this context is their use in managing these digital assets.

The research described here uses the example of information literacy in chemistry and related disciplines (e.g., toxicology, biochemistry, pharmacology) to demonstrate how a CMS, RLOs, and science information literacy concepts can be integrated to develop a suite of online instructional tools, whether in the form of online tutorials, subject guides, course pages, or database guides. While the system described involves RLOs, it also offers flexibility and is customizable for use with separate tutorials or other materials. Details of scientific content and the technology of these systems are provided.

What is a Content Management System?

- A collection of business rules and editorial processes around content
- Supports the creation, management, distribution, publishing, and discovery of information
- Covers the complete lifecycle of the web pages, from providing simple tools to create the content, to publishing, and finally archiving
- Provides the ability to manage the structure of the site, the appearance of the published pages, and the navigation provided to the users

How Content Management Works



What are Reusable Learning Objects?

Wiley (2000) defines a learning object as “any digital resource that can be reused to support learning.”

[Wiley, David: (2000) Connecting learning objects to instructional design theory: A definition, a metaphor, and a taxonomy:
<http://www.reusability.org/read/chapters/wiley.doc>]

“..learning ‘objects’ are the fundamental building blocks of an entire e-learning content library. Each learning object is a ‘chunk’ of learning content designed to be interoperable with other chunks...Thus, it is not only a discrete learning object but also a reusable learning object. ... Such a reusable learning object could be combined with other RLOs to create a lesson or module, even an entire course. It can then be reused with other chunks to form part of a different lesson or course.”

[Shea-Schultz, Heather: (2002) Online Learning Today: Strategies that Work, pp. 127-9]

Reusing & Customizing Learning Objects for Science Information Literacy

- **Direct Reuse**
 - Ex: The parts of a scientific article
What is Citation Indexing?
- **Creating Lists of Resources by Subjects**
 - Ex: List of chemistry databases
List of biochemistry electronic journals
List of drug/pharmacology reference sources
- **Customizing: Mix Reusable Text with Subject-Specific Examples**
 - Ex: Using Registry Numbers: General Text + Example
Using MeSH: General Text + Example
Database descriptions: Replace a generic description with a subject- or discipline-specific description -- e.g., Web of Science

Science Information Literacy: Concepts and Applications for Information Management

- Information literacy and subject- and discipline-specific information literacy concepts provide a foundation for organizing instructional and reference information.
- Commonalities lend themselves to the creation of reusable learning objects.
- Learning objects/modules can be customized by adding course or subject specific examples.

A Tiered Approach

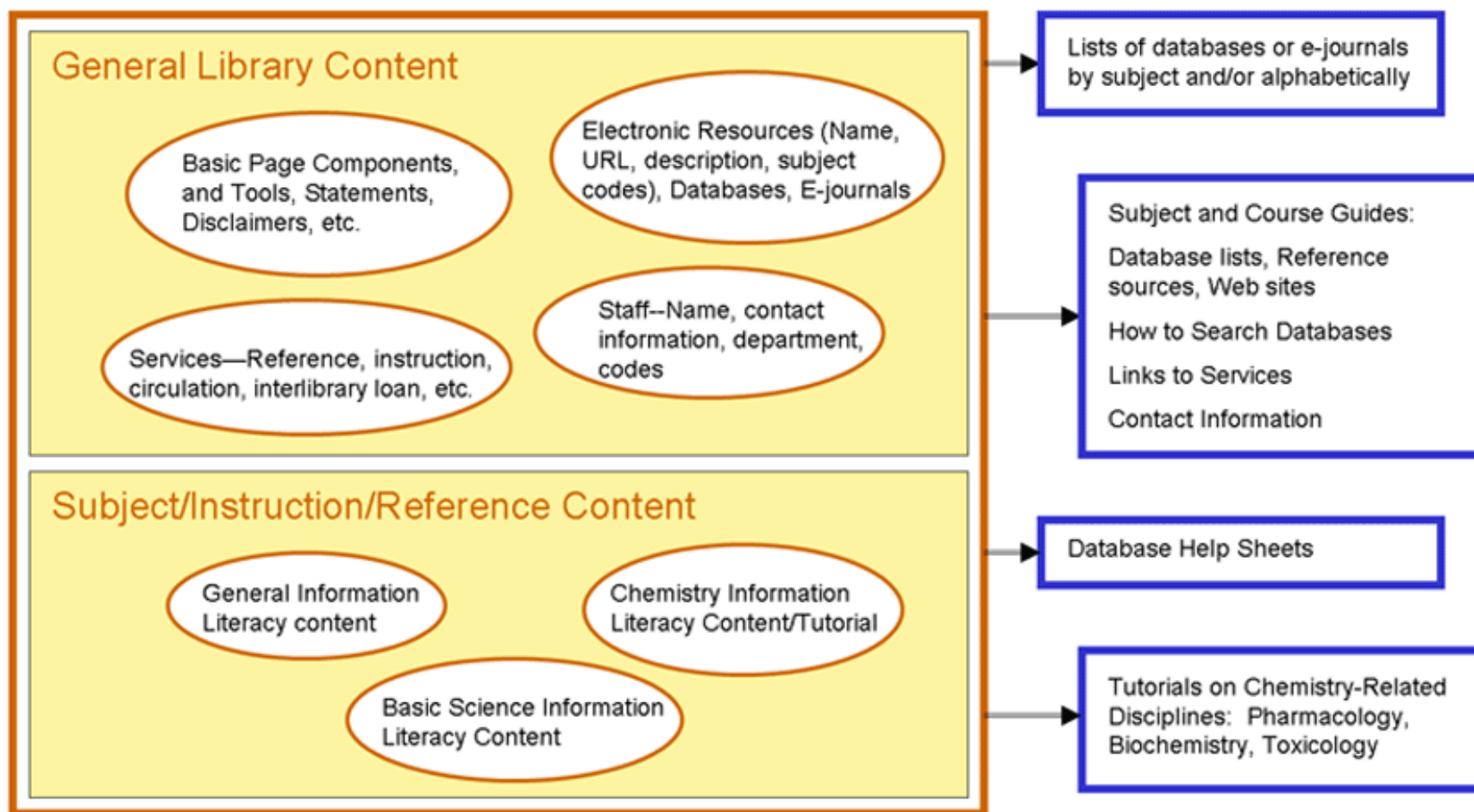
- Information Literacy—important principles, general concepts, processes
- Scientific Information Literacy—context, specific characteristics of research and publishing, concepts general to the sciences
- Disciplinary Clusters---more specialized concepts and resources, relevance and overlap with related disciplines

Ways to Get Started

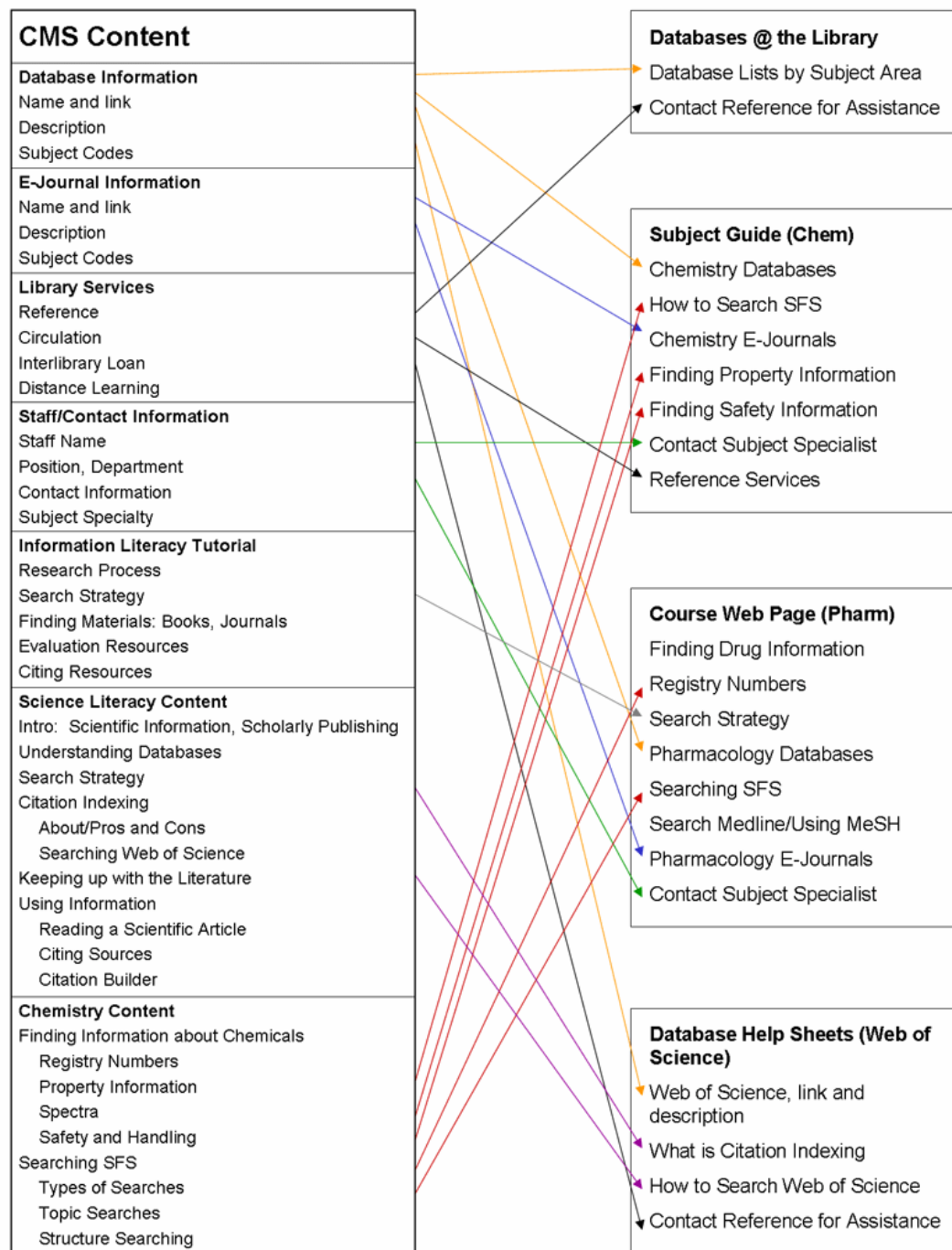
- Adapt existing principles of scientific information literacy for a specific discipline
- Curriculum-integrated instruction can provide a framework for identifying key concepts and ways to add or adapt methods, processes, and resources at higher levels
- An online tutorial in a core subject can be a good way to start
 - Aids in identifying key concepts
 - Create quality content to illustrate basic concepts
 - Content adaptable to related disciplines

Content Management System: Content

Instruction and Reference Outputs



Using a CMS to Generate Reference & Instructional Materials



Using Reusable Learning Objects to Create Tutorials in Chemistry & Related Disciplines

Examples of **Reuse** and **Reuse with modifications** (e.g., subject specific examples)
Un-highlighted text would be new or modified material

Basic Science	Chemistry	Pharmacology
Scientific Information Scientific Information Cycle Research Process & Information Types	Introduction to Chemistry Information Scientific Information Cycle Research Process & Information Types	Intro to Clinical & Drug Information Scientific Information Cycle Research & Information Types
	Finding Information about Chemicals Identifying Chemicals Using Registry Numbers Properties Spectra Safety and Handling	Finding Information about Drugs Identifying Drugs Using Registry Numbers Properties Safety and Handling Company Information
Understanding Databases Overview Science Databases	Understanding Databases Overview Chemistry Databases	Understanding Databases Overview Pharmacology Databases
Search Strategy Steps in the Process Keyword Searching Improve your Search Subject Searching	Search Strategy Steps in the Process Keyword Searching Improve your Search Subject Searching	Search Strategy Steps in the Process Keyword Searching Improve your Search Subject Searching
		Searching PubMed/Medline Types of Searches Topic Searches Using MESH
	Searching SciFinder Scholar Types of Searches Topic Searches Structure Searching	Searching SciFinder Scholar Types of Searches Topic Searches Structure Searching
	Special Topic: Patents and Patent Searching	Special Topic: Patents and Patent Searching
Citation Indexing What is Citation Indexing Pros and Cons of Citation Indexing Searching Web of Science Subject Search Author Search Cited Reference Search	Citation Indexing What is Citation Indexing Pros and Cons of Citation Indexing Searching Web of Science Subject Search Author Search Cited Reference Search	Citation Indexing What is Citation Indexing Pros and Cons of Citation Indexing Searching Web of Science Subject Search Author Search Cited Reference Search
Keeping Up with the Literature Saved Search Alerts Table of Contents Alerts Other Techniques	Keeping Up with the Literature Saved Search Alerts Table of Contents Alerts Other Techniques	Keeping Up with the Literature Saved Search Alerts Table of Contents Alerts Other Techniques
Using Information Evaluating Resources Reading a Scientific Article Citing Your Sources Citation Builder	Using Information Evaluating Resources Reading a Scientific Article Citing Your Sources Citation Builder	Using Information Evaluating Resources Reading a Scientific Article Citing Your Sources Citation Builder
For Assistance Reference Services	For Assistance Subject Specialist Reference Services	For Assistance Subject Specialist Reference Services

Customizing and Reusing Learning Objects: An Example

Template Components	Chemistry	Pharmacology
Title	CAS Registry Numbers	
Content	<p>Many chemicals have multiple synonyms; this may be due to variations in the nomenclature system used, historical precedents, common names, and commercial product names. This can make it difficult to accurately search for chemicals in handbooks and databases.</p> <p>Registry Numbers are numbers assigned to chemicals. Like social security numbers for people, a Registry Number is unique for each chemical.</p> <p>Using Registry Numbers helps streamline the process of searching for chemicals because the Registry Number will account for all variations in a chemical's names.</p>	
Notes <i>(Optional; can appear seamlessly as part of content, or with its own subheading.)</i>	(blank)	Registry Numbers are particularly useful when searching for drugs, which frequently have a variety of common, research, and commercial names.
Example	<p>Example: Methanol Registry Number: 67-56-1</p> <p>Synonyms: Bieleski's solution; carbinol; methyl alcohol; methyl hydroxide; methylol; monohydroxymethane; wood alcohol</p>	<p>Example: Aspirin Registry Number: 50-78-2</p> <p>Aspirin has over 100 synonyms. Some other names for aspirin include: 2-(acetyloxy)-benzoic acid; rhodine; salicylic acid acetate; 2-Carboxyphenyl acetate; AC 5230; acetosalic acid, Aspro; Bayer; Entiricin; Salacatin; Xaxa; o-Acetoxybenzoic acid.</p>

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CHEMISTRY

- ▶ **Chemistry Information**
- ▼ **Finding Chemical Information**
 - Identifying Chemicals
 - Using Registry Numbers
 - Properties
 - Spectra
 - Safety and Handling
- ▶ **Understanding Databases**
- ▶ **Search Strategy**
- ▶ **Searching SciFinder Scholar**
- ▶ **Citation Indexing**
- ▶ **Keeping Up with the Literature**
- ▶ **Using Information**

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CAS Registry Numbers

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Registry Numbers are numbers assigned to chemicals. Like social security numbers for people, a Registry Number is unique for each chemical.

Using Registry Numbers helps streamline the process of searching for chemicals because the Registry Number will account for all variations in a chemical's names.

Example:

Methanol
Registry Number: 67-56-1
Synonyms: Bieleski's solution; hydroxide; methylol; monohydroxymethane



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- ▶ **Introduction**
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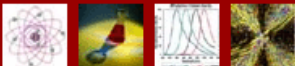
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Challenges and Cautions

- Think big, work small: implementing a CMS with information literacy RLOs can be overwhelming—carefully analyze programs and subjects to select an appropriate starting point. Don't try to do everything at once!
- Good collaboration between technical and reference/instruction staff is invaluable.
- Focus on content first; don't try to make everything reusable at the expense of learning and context.
- Not everything can or should be part of a CMS or a RLO.

Resources

Managing Life Sciences Content: A Unified Content Strategy White Paper, April 5, 2003, The Rockley Group Inc.

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Thank you!

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