BiosciEdNet (BEN)

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Abstract
Established in 1999 by the American Association for the Advancement of Science (AAAS) with 11 partners, the BiosciEdNet Collaborative portal (BEN Collaborative) provides access to digital teaching and learning resources in the biological sciences. Initially focused on providing free curricular support for undergraduate biological sciences education, the BEN Collaborative expanded its offerings in 2006 into high school education because of the “significant educational commonalities” between these two different levels. The Collaborative’s mission “to provide seamless access to e-resources” and “to serve as a catalyst for strengthening teaching and learning in the biological sciences” is both idealistic and purposeful. With more than 18,000 review resources available for use, the BEN Collaborative is, indeed, a significant educational tool for teachers seeking thoughtful, tested, and engaging classroom activities and curricular support. As a portal, the BEN Collaborative advances discovery through its extensive subject list, its various search features, and brief summary of the individual resource’s content; because the objects are stored on the partners’ sites, each has a separate interface that at first use disrupts the “seamless” pass-through from search to object. Each object is embedded in two containers, which means drilling down through multiple metadata layers. Overall, the portal meets its objectives and honors its contributors.

Pricing Options
BiosciEdNet is a primarily free resource. Registration is not required, though it is encouraged so a user (presumably an educator) can be contacted by the AAAS with “no more than eight e-mail messages annually” about resources, activities, and teaching. Also registration is required to view resources from the American Physiological Society (APS) and the Ecological Society of America (ESA). Finally registration allows access to articles in older issues of Science magazine; access to recent articles is through subscription only.

Product Description
BiosciEdNet is in many ways a simple resource—a unified, single-purpose portal. As a National Science Digital Library (NSDL) Pathway for biological sciences education, the BEN Collaborative allows users to browse by subject, resource type, and audience/educational level. Other key features include both simple and advanced keyword searching and a few delimiters. The landing page is unexceptional with left-handed navigation links, quick links above the banner, and a text box just below the banner. The portal interface itself is clean and utilitarian.

Because this resource is devoted to biological sciences education, there are no extraneous resources, false hits, or overly abundant search results.

As a collaborative resource, the means of discovery using metadata standards, organizing content, and archiving resources were crucial issues for the product’s development and growth. Detailed in a white paper available through the BEN technology wiki (<http://www.biosci ednet.org/docs/BEN_White_Paper.pdf>), the BEN collaborators agreed to use the IEEE Learning Objects Metadata (LOM) April 2001 draft standard 6.1 as the underlying technical schema rather than the more ubiquitous Dublin Core. The IEEE LOM provides “many more fields that support pedagogical and education-related information” than Dublin Core and “is better suited to supporting metadata about learning objects.” Because of the strong underlying metadata structure, each learning object is coded using required elements and each collaborator has the option of using additional optional elements. Required metadata elements are housed on the BEN portal itself and are used for discovery by its search engine.

Any successful schema must be flexible, and the IEEE LOM is no exception. One element that has been customized by the BEN collaborators is the Learning Resource Type field, which is the basis for the browsing search, Resource Type. As the white paper indicates, the vocabulary used in this element was based on existing resources in the partners’ collections as well as how “potential users think about resource types.” The list is both extensive, about 56 terms, and specific; identifiers range from dataset to index, from 35 mm slide to photograph, from laboratory manual to laboratory exercise. With such a rich variety of identifiers, discovery is enhanced and allows users to search for specific media types.

Two other notable metadata elements that affect a user’s ability to browse the site are Context and the classification taxonomy. Context is equivalent to audience type. The vocabulary developed by a working group of the initial collaborative partners is not exact because learning objects may be applicable for more than one group of learners or adapted to suit the needs of students at different grade levels. The terms are fungible and not based on any universal educational framework. For instance, the term “Continuing Education” is both idealistic and purposeful. With more than 18,000 review resources available for use, the BEN Collaborative is, indeed, a significant educational tool for teachers seeking thoughtful, tested, and engaging classroom activities and curricular support.

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Perhaps the most significant adaptations of the IEEE LOM made by the BEN Collaborative partners were to the Classification section of the schema because “not all purposes ... were considered appropriate for BEN users. Thus, BEN established its own specific set of purposes: Discipline, Content/Curriculum Standards, and Pedagogical Use.” Each purpose is significant and meaningful. For instance, the taxonomy for disciplines was developed only after considering and rejecting such options as the Library of Congress subject headings and the Digital Library for Earth Science Education (DLESE) schema. The list of terms is considered “natural” to biological sciences faculty and teachers.

The strategies are different for K-12 educators and college faculty. Teachers of biological sciences, there are links to Teaching Strategies. Applicant forms are available on the site. Because the tool is intended for teachers of biological sciences, there are links to Teaching Strategies. The strategies are different for K-12 educators and college faculty and, unfortunately, are not very robust. Clearly this is one tool whose purpose and intent are transparently described, its governance support structure explained at length, and its advocacy role meaningfully integrated as part of its core function. This portal is not a pedagogical tool for enhancing a biological sciences teacher’s depth of knowledge of classroom management, course development, or active learning strategies. It is, however, a fairly sophisticated tool for linking teachers to a variety of digital resources.

**Critical Evaluation**

The BiosciEdNet general site design is consistent within the portal itself. The header includes typical features such as the Collaborative’s logo, identity label, navigation links, and search box. The left scan column labels are simple identifying links to subsequent pages. The landing page is the most complex and visually diverse because it includes a right scan column (for New Resources), a main content column welcoming searchers to the site, a horizontal band with a slide show identifying each BEN partner, and a footer for contact information and links to related pages such as the National Science Foundation. All subsequent pages are more text-oriented and employ a two-column format. Searching the site is fairly simple since there are only five major search features: three types of browse links (by subject, by resource type, by audience/level) and two keyword text boxes (simple and advanced) with some delimiters.

The search results for the “browse by” features are divided into two tabbed columns—All Resources and Free Resources—and the number of available resources are indicated in parentheses. This simple structure allows for easy drill down to any group of like resources. However, the “browse by” links are sorted differently on various subsequent pages which indicates a level of inconsistency that is distracting. For instance, from the Home page the “browse by” links are ordered by subject, resource type, and audience/level; from the K-12 Educators page they are sorted by resource type, subject, and audience/level; from the College Faculty page they are sorted by resource type and subject with no audience/level “browse by” link. This is an odd oversight because among the Context indicators (see discussion above) there are a number used to describe college levels including “Undergraduate lower division 13-14,” “Graduate,” and “Professional (degree program).”

When browsing by subject, the results list taxonomy is alphabetized from “Agriculture & Aquaculture” to “Zoology” and the number of associated digital learning objects is noted. Even though this portal’s intended audience is teachers, most terms are familiar ones:
presentation (powerpoint)” [sic]. Two of the more perplexing types are “Webcast,” “Simulation,” “Animation,” and “Digital pre-

Course syllabus,” and “Lesson plan.” Some of the more intriguing puzzling. Typical resource types include “Diagrams,” “Datasets,”

down discovery options. Each has its merits and each has its detri-

As an open digital library, there is no contract and no use restrictions other than abiding by the copyright statements for each object.

Contract Options: N/A

Not all of the content is technically free, especially those digital objects in recent issues of Science. Registering as a user to access content in certain partners’ sites is simple. The terms of services and policy statements are clear and precise. A registered user can opt out of receiving a monthly newsletter. To contribute content to the site, a user must be registered.

User Interface/Searchability: ★★★ 1/2

Although the underlying metadata structure is impressive, searching the site is sometimes clumsy and lacks the sophistication needed for meaningful focused discovery. Natural language searching (both simple and advanced) requires using the Go button. On the Advanced Search page having a second button near the Title and Keywords text boxes would improve usability, otherwise users have to scroll down to discover the button.

Pricing: ★★★★ 1/2

The content of the portal is the metadata itself, which is explained in detail in the technical documents. The partners’ content, however, runs from the simple to the profound.

User Interface/Searchability: ★★★ 1/2

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“Cell biology,” “Eugenics,” “Mycolgy,” “Physiology,” and “Wildlife science.” The number of potential education resources ran the gamut from a scant few (21 for Exobiology) to the overly abundant (more than 4,200 for Education). Selecting one subject, “Microbiology” for instance, produces an alphabetized list of titles to more than 1,300 objects. There are jump-to-top links embedded in the title list, which offers some navigational assistance, and standard breadcrumb navigation links. Poring over long lists of titles is an inefficient means for discovering useful source materials. However, when a title is selected, one of the benefits of this product becomes apparent. Each object is described in summary format; each is classified by resource type and audience level; each identifies the digital library collection it is housed in; each has an icon to indicate whether it is free or requires subscription to the source site. Like other social media, this one allows registered users to comment on and rate the applicability of the individual resources discovered through the portal. (This does not appear to be a widely used feature.) Depending on which partner’s site the individual object is stored, one or two more pass-through links are required. The learning object “Artificial Wetlands” was discovered through four different subject terms: “Agriculture & Aquaculture,” “Botany & Plant Science,” “Ecology,” and “Microbiology.” Using multiple taxonomy terms enhances discovery; optimally, active links for each taxonomic term at the object summary level would allow educators to discover like topical resources and enhance navigation (Figure 1).

The “browse by” resource type and audience/level are similar drill down discovery options. Each has its merits and each has its detriments. The array of resource types is fairly extensive and somewhat puzzling. Typical resource types include “Diagrams,” “Datasets,” “Course syllabus,” and “Lesson plan.” Some of the more intriguing types are “Webcast,” “Simulation,” “Animation,” and “Digital presentation (powerpoint)” [sic]. Two of the more perplexing types are “35mm slide” and “Memo.” The former leads to one resource that is an article about using and creating 35 mm slides for teaching biology, not actual digitized slides; as a resource type, memos do not seem substantive enough to be used for classroom teaching, yet one on “Peristalsis in Esophageal Function” was rated “very useful.” Of the thirteen titles listed under “Maps,” at least nine were in recent issues of Science, which requires an institutional or personal subscription in order to view them. Identifying such objects as free resources is frustrating for those lacking such access and seemingly a disingenuous characterization. Perhaps the least successful “browse by” search type is by audience/level. Although there are only a dozen categories, the number of associated learning objects in most cases is overwhelming and daunting. For instance, there are 8,885 items identified as appropriate for “Graduate” education. Reviewing such an extensive list is impractical at best, especially with no options available for narrowing the results.

The search box for simple keyword strategies is embedded in the banner. As one navigates through the site, this search option is always available. Even simple searches can be narrowed by audience/level through a drop-down menu and two check boxes—one to search for free resources only and one to search for visual media only. Searching the term bioethics, which is one of the taxonomy subject terms, produces a slightly higher results list than by using the “browse by” subject discovery feature. This is not a surprising result. Searching the term global warming without delimiters produced almost 250 items; the results were the same when employing quotation marks to indicate phrase searching. The returned results are not in alphabetical order by title, date order (original publication date or date added to BEN), or other clear indicator. The results cannot be sorted, but they can be narrowed by using the three delimiters. The advanced search option is more sophisticated and simple instructions are noted below the page title. Search terms can be limited to title only, keyword only, by au-
The two most intriguing delimiters are “Collaborating Partner” and “Pedagogical uses.” The former is a complete list of the twenty-six partners; the latter identifies five practices: “Assess,” “Learn,” “Plan,” “Research,” and “Teach.” How to employ each feature individually or in combination successfully requires trial and error. Using the search term *global warming* in the “Title” field only returned six results; using the same term in the “Keyword” field returned sixteen results. This is not surprising, though it is not apparent where the term is located in the metadata elements or summary description for each item. Combining the same term with one of the “Pedagogical uses,” in this case “Learn,” optimized the search results. Using the advanced Keyword searching feature produced different results than using the simple search box. On the advanced search site, using Boolean operators (global and warming, global or warming, global not warming) returned no results; searching by each term separately produced different results. (As an aside, using these same terms in the text box returned 245 results with each search.) One useful radio button on the Advanced Search page allows a user to search for items that have no copyright restrictions on their use, which supports open and free use of the digital learning objects.

### Contract Provisions and Authentication

Although the vast majority (approximately 90%) of learning objects are available for use through this portal free of charge, access to some materials require a fee or a subscription to a particular collaborator’s site. For instance, to view recent articles from *Science* requires a personal or institutional subscription. Registration to the portal is required in order to view the free resources from the American Physiological Society (APS), the Ecological Society of America (ESA), and articles from older issues of *Science*. Funding for the portal is provided by the individual BEN Collaborators and grants from the National Science Foundation [DUE 0085840 / DUE 0226185 / DUE 0532797 / DUE 0734995].

### About the Author

Michael Somers is the director of Library Services at Bridgewater State University in Bridgewater, Massachusetts. As an academic librarian for more than 20 years, Mr. Somers is an advocate for open resources, the role of the library in digital content creation and management, the creative application of technologies to support teaching and learning, the importance of libraries as social communities, and the development of integrated models for promoting a wide variety of fluencies that help shape our ability to understand, analyze, appreciate, and shape perspectives meaningfully. Bridgewater State University was one of the earliest institutions devoted to teacher preparation, which is still one of its hallmark programs.