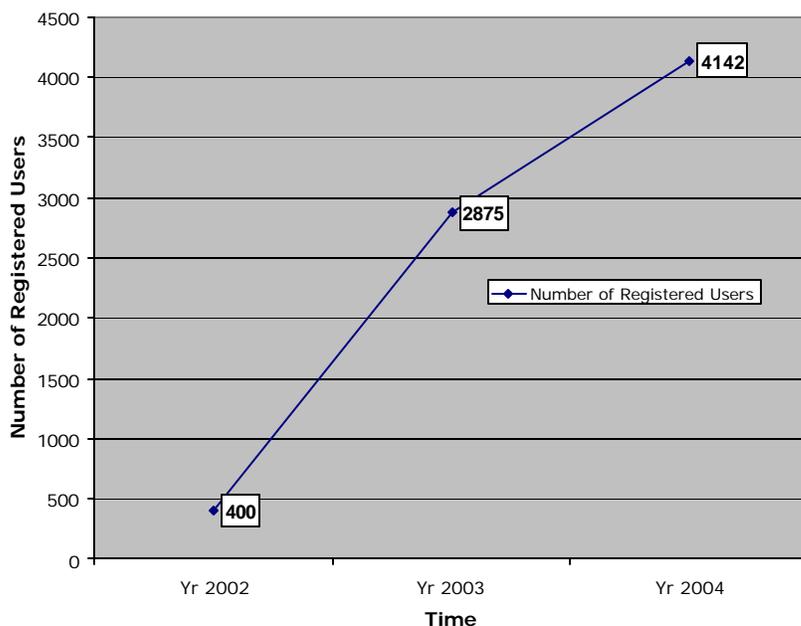


I Came, I Found It, I Used It, and It Made a Difference

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Background. Founded in 2000 the BiosciEdNet (BEN) Collaborative sponsors a portal www.bioscienet.org/portal/ offering an ever-expanding library of peer-reviewed teaching and learning resources in biology education. As of October 2004, the library contained more than 3100 resources. The BEN portal became available in May 2002 with approximately 400 initial registered users. Since that time, the number of registered users has grown to 4142 (Figure 1).

Number of Registered Users



The Collaborative, spearheaded by the American Association for the Advancement of Science (AAAS) and including professional societies and coalitions for biology education (partners), has developed a revolutionary approach for transforming undergraduate biology education. It serves as a catalyst for individual biology educators to improve their teaching through resources, collaborations, and network building. In addition, it has mobilized biology research and education-based organizations to form partnerships, offering improved pedagogy, authentic assessment, multidisciplinary resources, and development of individual library collections. The BEN serves undergraduate educators including faculty, curriculum developers, and researchers.

The BEN Collaborative addresses two primary challenges in undergraduate biology education. First, there is an inherent fragmentation when teaching life sciences due to the many subdisciplines involved. BEN's interdisciplinary approach addresses this

fragmentation in a positive way, pointing out connections and relationships within and among the subdisciplines. Second, in the electronic age of overwhelming information of mixed quality, BEN has developed strategies and standards for both maintaining high quality resources and managing content from diverse libraries. Both of these issues are explored in this study in regard to their impact on users.

Purpose. The purpose of the current study was to conduct an initial evaluation of the use and impact of the BEN portal. The evaluation questions being explored included the following:

1. Who is using the BEN portal?
2. How did they find the portal?
3. What was their purpose in coming to the portal?
4. Did they find what they were looking for at the portal?
5. Did they use the resources they found?
6. Did the unique aspects of the BEN portal make a positive contribution to the user's experience?
7. Did BEN have an impact on the user in terms of teaching and learning?
8. Did BEN have an impact on the user in terms of developing and advancing professionally?

Methodology. In September 2004, 4,142 BEN registered users were contacted by email and asked to complete an eight question survey about the BEN website. During a three-week period, the BEN users were reminded three times via email to complete the survey. No incentives or prizes were provided to respondents. Three hundred and thirty messages were not delivered due to incorrect email addresses. An additional 39 respondents were deleted from the final results because they indicated that they did not visit the BEN site (22) or were students (17). Thus, the total number of possible responses was 3,775. Five hundred and fifteen responses were returned within the three-week timeframe, representing a 14% return rate.

"I Came." The first two research questions focused on investigating who the BEN users were and how they found the BEN portal.

Fifty-five percent of the respondents identified themselves as either post-secondary educators or teaching assistants and 14% as teachers in kindergarten through high school (Table 1). Nineteen percent of respondents identified themselves as researchers or post-doctoral scholars. Thus, the data suggest that BEN is developing and targeting correctly its resources to its primary audience, post-secondary educators.

Response	Percentage of Respondents
Postsecondary educator or teaching assistant	55%
Researcher or post-doctoral scholar	19%
K-12 teacher	14%
Curriculum developer	6%
Other	5%
No Response	2%

When asked how the user first learned about resources available from BEN and the BEN partner sites, one-half of respondents indicated that they first learned about BEN electronically, either through another webpage (32%) or an Internet search (18%) (Table 2). This suggests that the BEN target audience is using the World Wide Web as a major avenue for locating information. The remaining respondents learned about the site from an article (16%), another person (13%), or at a workshop (6%). A small proportion of respondents (5%) indicated that they had heard about the site from the National Science Digital Library (NSDL) initiative; which may not be surprising because many of the NSDL efforts are directed at digital library developers. Table 2 provides a comparative analysis.

Response	Percentage of respondents*				
	P	K	C	R	T
Followed a link from another webpage	28%	35%	38%	42%	32%
Followed a link from a search on the Internet (e.g. Google or Yahoo)	19%	24%	17%	13%	18%
Read an article or review	15%	17%	3%	10%	16%
Heard about site from another person	14%	17%	3%	10%	13%
Attended a workshop or exhibit about site	9%	6%	3%	2%	6%
Other	9%	1%	3%	5%	6%
Heard about site through National Science Digital Library (NDSL)	4%	8%	10%	2%	5%
No Response	1%	1%	0	0	2%

*Key: Postsecondary Educator: P; K-12 educator: K; Curriculum Developer: C; Researcher: R; Total: T

When asked how frequently do you visit the BEN resources or BEN partner sites, 38% of all respondents come at least every other month, 24% once a month, and 15% more than once a month (Table 3). This shows that three-quarters of the respondents are visiting the site at least every other month suggesting that there are helpful and valuable resources to be found.

Response	Percentage of respondents				
	P	K	C	R	T
Less than 6 times per year	40%	39%	48%	38%	38%
Once a month	25%	32%	21%	18%	24%
Once	14%	13%	7%	15%	15%
More than once a month	17%	10%	21%	16%	15%
Once a week or more frequently	3%	4%	3%	12%	7%
No response	0	1%	0	0	1%

*Key: Postsecondary Educator: P; K-12 educator: K; Curriculum Developer: C; Researcher: R; Total: T

"I Found It." Biology educators can search or browse the BEN portal for resources from 12 partners who have contributed materials. Thus, the BEN portal provides a single entry or clearinghouse to 12 partners' resources. In October 2004, 3,131 resources were catalogued at the portal. Table 4 lists the contributing partners and their current inventories.

BEN Partners	Partner Inventories
MicrobeLibrary (America Society for Microbiology)	1,113
Botanical Society of Americas Digital Resources	948
APS Archive of Teaching Resources (American Physiobgical Society)	331
Human Anatomy and Physiology Society Digital Resources	256
Sciences Signal Transduction Knowledge Environment (AAAS Science's STKE)	156
EcoEdNet (Ecological Society of America)	154
ActionBioscience (American Institute for Biological Sciences)*	110 ²
Association for Biology Laboratory Educators (ABLE) Digital Library	72
American Phytopathological Society (APSNNet) Digital Resources	57
BioMolecules Alive (American Society for Biochemistry & Molecular Biology)	24
Faculty for Undergraduate Neurosciences Digital Resources	14
Society of Toxicology Digital Resources	9

¹The total number of resources from BEN partners that are catalogued at the BEN portal is 3131.
²ActionBioscience.org's catalogue is currently in development and has not been added to the database. However, BEN visitors learn about ActionBioscience.org through the partner's webpage link at the portal.

A major challenge of the biological sciences is the fragmentation of the life sciences' subdisciplines. The BEN portal helps bridge the subdisciplines by providing a system for organizing disparate resources from multiple partners spanning the breadth and diversity of the life sciences. The BEN portal streamlines the dissemination of multidisciplinary resources through an online clearinghouse. Although the size of the partner libraries varies significantly from less than 25 resources to more than 1,000,

BEN respondents visit the BEN partner libraries almost equally as shown in Table 5. Thus, participation as a partner in the BEN Collaborative is a mechanism to raise successfully the visibility of a partner's site and resources to the post-secondary teaching community.

Table 5. Responses to question "Indicate all BEN resources or BEN partner sites that you visited in the last 12 months (choose all that apply)".					
Response	Percentage of respondents*				
	P	K	C	R	T
BiosciEdNet (BEN) (American Association for the Advancement of Science)	50%	55%	45%	48%	50%
MicrobeLibrary (America Society for Microbiology)	29%	17%	31%	22%	25%
Association for Biology Laboratory Educators (ABLE) Digital Library	21%	34%	31%	15%	22%
ActionBioscience (American Institute for Biological Sciences)	15%	31%	48%	22%	20%
BioMolecules Alive (American Society for Biochemistry & Molecular Biology)	21%	25%	21%	18%	21%
APS Archive of Teaching Resources (American Physiological Society)	20%	17%	28%	21%	20%
Human Anatomy and Physiology Society Digital Resources	19%	24%	10%	15%	18%
Signal Transduction Knowledge Environment (STKE) (American Association for the Advancement of Science)	13%	8%	14%	34%	16%
EcoEdNet (Ecological Society of America)	16%	18%	31%	7%	15%
Botanical Society of Americas Digital Resources	6%	7%	10%	11%	8%
Faculty for Undergraduate Neurosciences Digital Resources	4%	3%	3%	6%	4%
Society of Toxicology Digital Resources	3%	3%	0	7%	4%
Other digital library sites	8%	10%	7%	5%	7%
No Response	0	1%	0	3%	1%

*Key: Postsecondary Educator: P; K-12 educator: K; Curriculum Developer: C; Researcher: R; Total: T

"I Used It." The survey asked respondents about their reasons for visiting BEN. The majority of respondents (67% of all respondents) seek resources for lectures. Resources for non-lecture presentations are also in demand (35% of all respondents). Browsing for additional information is a common activity at the BEN portal and partner sites (45% of all respondents). Analysis of the responses by group indicated that the different groups had different needs and uses for the information available at the BEN portal. Analysis of the responses from just the post-secondary and K-12 educators showed that 79% of post-secondary educators seek resources for lectures and 80% of K-12 educators seek resources to enhance their own teaching and learning. A majority of researchers (63%) use the website to conduct research, whereas only 20% of post-secondary and K-12 educators use the site for research. Table 6 describes the comparative responses.

Response	Percentage of respondents*				
	P	K	C	R	T
Seeking resources for lectures	79%	63%	52%	56%	67%
Seeking resources to enhance my own teaching and learning	66%	80%	59%	39%	60%
Browsing the site to learn more	44%	44%	59%	50%	45%
Seeking resources for student assignments or independent projects	43%	56%	48%	20%	39%
Seeking resources for non-lecture presentations	36%	39%	34%	37%	35%
Conducting research in my field of study	12%	8%	28%	63%	23%
Reading reviews before I purchase and/or assign books and other resources	8%	7%	17%	15%	10%
Did not have a specific purpose for visiting	2%	6%	10%	7%	5%
Other: see list below	4%	1%	0	2%	4%
No Response	0	0	0	0	0

*Key: Postsecondary Educator: P; K-12 educator: K; Curriculum Developer: C; Researcher: R; Total: T

"It Made A Difference." When BEN users were asked what actions, if any, they had undertaken as a result of visiting the BEN portal and/or partner sites, more than half of all respondents indicated that they downloaded a resource and used resources in teaching or research (57%). Confidence in the BEN portal was evident because nearly one-third of respondents sent a student, colleague or another person to the site, and one-quarter shared information about the site with a colleague. About half of both post-secondary and K-12 educators (51% and 49% respectively) indicated that they had incorporated new ideas and thinking gained from the site into their teaching or research. This data suggest that BEN is having an impact on the users with regard to teaching and learning.

A critical step for sustaining expansion, growth, and quality in digital libraries is the participation of the educators in building and vetting the resources. Seven percent of the post-secondary educators were already contributing and/or reviewing resources for one or more of the BEN partners and another 16% were contemplating such action. Thus, a significant portion of respondents went merely beyond downloading and using resources to incorporating new ideas, sending people to the site, and considering becoming involved as a contributor or reviewer (Table 7). This data suggest that BEN is having an impact on the users with regard to developing and advancing professionally.

Response	Percentage of respondents*				
	P	K	C	R	T
Used a resource in my teaching or research	63%	68%	59%	45%	57%
Downloaded a resource	63%	56%	55%	49%	56%
Incorporated new ideas and thinking in my teaching or research	51%	49%	55%	36%	46%
Sent students, colleagues, or another person to the site	31%	25%	45%	27%	31%
Shared information from and/or about the site with a colleague	26%	13%	45%	30%	26%
No action taken since visiting the site	14%	7%	10%	23%	14%
Considered contributing a resource	13%	0	14%	11%	10%
Considered being a reviewer	6%	1%	10%	8%	6%
Became a reviewer	6%	0	3%	5%	4%
Submitted a resource	5%	0	3%	1%	3%
No Response	2%	1%	0	1%	3%
Other: see below	1%	3%	0	0	1%

*Key: Postsecondary Educator: P; K-12 educator: K; Curriculum Developer: C; Researcher: R; Total: T

A major challenge for all users of digital resources is discerning quality resources from the explosion of mixed-quality Internet resources and sites. BEN addresses this challenge by providing peer-reviewed resources backed by professional societies. This editorial service is paramount, and the current survey results indicate that four-fifths of the respondents felt this was a very important component of the BEN library (Table 7). Between 80 and 90% of all respondents noted that it was "important" or "very important" that BEN resources are updated (90%), reviewed regularly to minimize broken links (89%), peer-reviewed and backed by professional societies (85%), and original and authoritative (81%). Table 8 illustrates the importance of BEN's unique features.

Response	Percentage of respondents answering "Very Important" or "Important"*				
	P	K	C	R	T
Original teaching resources that are not reproduced from other sources	83%	84%	79%	79%	81%
Resources that are peer-reviewed	86%	91%	56%	87%	85%
Resources that are periodically updated	92%	94%	86%	90%	90%
Resources that are authoritative	82%	88%	79%	74%	81%
Websites are free of pop-up ads and other non-related ads	81%	89%	82%	81%	83%
Websites that are reviewed regularly to minimize broken links	91%	93%	82%	88%	89%
Websites that are backed by professional scientific societies	86%	92%	72%	86%	85%

*Key: Postsecondary Educator: P; K-12 educator: K; Curriculum Developer: C; Researcher: R; Total: T

One respondent summarized the overall feedback of respondents, stating, "I feel no compunction quoting BEN material to students, and used these sites as examples of reputable Internet publications."

Summary. This initial evaluation of the users and impacts of the BEN portal and partner libraries sought to address a number of key questions:

- Who is using the BEN portal?
- How did they find the portal?
- What was their purpose in coming to the portal?
- Did they find what they were looking for at the portal?
- Did they use the resources they found?
- Did the unique aspects of the BEN portal make a positive contribution to the user's experience?
- Did BEN have an impact on the user in terms of teaching and learning?
- Did BEN have an impact on the user in terms of developing and advancing professionally?

Although the current study received feedback from only a limited number of the overall group of BEN users, the data provide an initial snapshot of the current BEN users. Users include not only postsecondary educators – the primary target audience for the portal – but also a sizeable group of researchers and K-12 teachers. BEN users found the portal primarily through links from other websites, but also via their own web searches, and through referrals from articles and colleagues. They came to the portal primarily to find lecture resources and to enhance their own teaching and learning but they also sought resources for student assignments and non-lecture presentations. The users accessed all the BEN partner sites almost equally, offering a first indicator that the BEN goal of promoting interdisciplinary aspects of life science teaching is being realized. Most importantly, the BEN users found what they sought...they downloaded and used resources in their teaching or research and they incorporated new ideas and thinking into their teaching. The users expressed how important it was to find resources that were peer-reviewed and backed by professional societies. Finally, the BEN library helped build the professional community, with users sharing information about and/or sending colleagues and students to the BEN site, and expressing interest in participating in BEN as a contributor and/or reviewer.

The BEN Collaborative provides searchable and seamless access to the digital library collections of its partners, providing accurate and reliable biology education resources. The BEN resources seek to improve the teaching and learning of the biological sciences engaging all students with diverse interests and career aspirations. The materials are collected and maintained by respected professional societies representing a broad and diverse spectrum of biological sciences. This initial evaluation suggests that these broad goals are being met, as indicated by feedback from BEN users. As one respondent stated, "The resources I have accessed have always met, and sometime exceeded my needs. I hope these resources will continue to expand and improve."

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