



2007-01-01

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Original Publication Citation

Betsy Hopkins. "Utilizing Focus Groups to Evaluate an Information Literacy Program in a General Biology Course," *Science & Technology Libraries*, Volume 27, Issue 3, 2007.

BYU ScholarsArchive Citation

Hopkins, Betsy S., "Utilizing Focus Groups to Evaluate an Information Literacy Program in a General Biology Course" (2007). *All Faculty Publications*. 1216.

<https://scholarsarchive.byu.edu/facpub/1216>

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**Using Focus Groups to Evaluate an Information Literacy
Program in a General Biology Course**

Utilizing Focus Groups to Evaluate an Information Literacy Program in a General Biology Course

Elizabeth Spackman

Abstract:

The Harold B. Lee Library at Brigham Young University (BYU) recently implemented a number of information literacy strategies to help students in Biology 100, a large general education class, find resources for their term assignment. The library's services for Biology 100 students were evaluated using focus groups composed of both teaching assistants and students. This paper will describe the class and the assignment, discuss the impact the class had on library staff, detail the efforts of the staff to meet the needs of Biology 100 students, and present results of focus groups used to evaluate the library's outreach and teaching efforts.

Keywords: Information literacy, library instruction, disciplines, assessment, focus groups

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The author wishes to thank Janae Lunt, Ashley Theodore, Adam Folkman, and Sirish Thapa for their valuable assistance with conducting the focus groups and transcribing the tapes.

Background

About the Class and the Poster Assignment

Biology 100 is a general education course at Brigham Young University in which 1,500–2,000 students enroll each semester. The class is team taught by two professors in the integrative biology department. Students attend lectures twice a week and a discussion section once a week. Lectures are in groups of nine hundred, and discussion sections consist of twenty-five to thirty students led by teaching assistants (TAs). Approximately thirty TAs teach one to three sessions each. The TAs are undergraduate and graduate students studying biology, and they attend weekly training meetings with the course staff and professors. Two part-time staff members manage the course: the Biology 100 course coordinator and the student issues specialist.

Originally, students attended lectures and were graded on tests and on a short research paper. Professors wanted to incorporate a more rigorous writing assignment, with several goals in mind. They expected students to become familiar with scientific literature, learn how to extract information from technical primary and secondary papers, and gain experience conducting research with the library's resources. In fall 2002 the professors implemented a term assignment in which students are required to create both an individual and a group poster on an assigned topic, citing only sources in peer reviewed scientific journals.

Although the overall structure of the poster assignment has remained the same since it was instituted, specific details and requirements have changed slightly since the assignment was implemented. Every semester there is an overall topic, with four major divisions. Students gather into groups of three or four in their discussion sections, and each group is assigned one of the four divisions. Each student in the group chooses a narrower subject to research within the group's assigned topic. In the fifth week of the semester, students must turn in a thesis statement

and list of sources, which is worth 5 points out of the total 100 points possible on the personal poster. The personal poster itself is due several weeks before the end of the semester. Once the students have completed their individual posters, they work with their assigned group to create a group poster that they present at a poster session in the BYU student center. The group presentation and peer evaluation are worth an additional 85 points. When the library information literacy program was implemented in fall 2004, students were required to use at least one primary source and two additional primary or secondary sources.

The Biology 100 poster assignment is challenging for students on several levels. The majority of Biology 100 students are freshmen, completely new to the university experience as well as to library databases and resources. Upperclassmen who have postponed taking the class are often well versed in information literacy and library use in their major areas, but many are not familiar with the resources and techniques of searching for information in biology. Students are required to understand the structure of information in biology; search for sources in databases; find full articles in the library or online; read and synthesize technical, scientific articles into a coherent text; and combine their writing with graphics in an aesthetically pleasing poster. Biology 100 professors define primary sources as articles in peer reviewed journals that report on original research. Secondary sources are articles in peer reviewed journals that summarize, compile, and discuss original research. The students are not allowed to cite any tertiary sources, articles or other resources that have not been peer reviewed. Tertiary sources are found on the Internet and in books, encyclopedias, textbooks, newspapers, and magazines. Although tertiary sources may not be cited, they are appropriate and necessary for students to use for background information and narrowing their research topics.

The course itself provides varying levels of support for students on the poster assignment. Information about the class and the assignment is found in a forty-page packet that each student is expected to read. Professors do not discuss the assignment in lectures, but teaching assistants usually spend one discussion session talking about the poster assignment and the structure of information in biology, including primary, secondary, and tertiary resources and the peer review process. Students may receive additional help during scheduled TA office hours or by appointment.

Impact on the HBLL

Because of its large student enrollment, Biology 100 has a significant impact on the library. Since the introduction of the poster assignment in 2002, students have sought help from the library through every service point possible. Students ask questions in person and by phone at reference desks throughout the library, mostly at the science/maps, general, and periodicals desks. They also contact library personnel via e-mail, both directly and through the “e-mail-a-librarian” web form. Before its discontinuation, the library’s chat reference service received a number of Biology 100 inquiries each semester. The two life sciences librarians are contacted directly, in person, by telephone, and by e-mail. Most Biology 100 students request assistance from the library during the week their assignments are due, creating a strain on library personnel. This strain is most evident at the science/maps reference desk during the week the thesis and sources are due, when reference personnel spend the great majority of their time helping Biology 100 students.

Another difficulty for the library has been availability of adequate resources. In early semesters, poster topics were not vetted through the library, and sometimes the library’s

collections did not include enough information on the selected topics. Some topics presented difficulties finding primary sources, whereas others were challenging because of the dearth of overall information on the subject. Finding primary sources students could understand was also a challenge for library personnel, because these resources are highly technical and detailed.

Information Literacy Program

Realizing the effect of the course on the library, life sciences librarians have tried a number of different information literacy and library instruction strategies, including twenty-minute lessons in the lecture sections and mandatory sessions in the library's instruction rooms. A variety of reasons, including technical difficulties, made these attempts unsuccessful.

The author (hereafter referred to as the biology librarian) was employed by the BYU library in 2003 and experienced a year of Biology 100 student inquiries before contacting course professors in 2004. The issue of how to handle the needs created by the poster assignment was first raised during a get-to-know-you interview with one of the biology professors in April 2004. The impact of Biology 100 on the library was discussed as well as possible strategies for improving the experience for the students, class staff, and the library. The discussion was continued throughout the summer and culminated in an effective collaboration between the Biology 100 staff and the library staff during fall 2004. The biology librarian worked with professors and the course coordinator to:

- select topics well supported by the library's collections,
- create and promote a research guide specifically for Biology 100,
- train TAs in two separate sessions, and

- provide several first-come, first-served information literacy and library instruction classes.

The biology librarian, Biology 100 professors, and course coordinator worked together during summer 2004 to develop appropriate poster topics for the fall. The professors chose an overall topic and suggested ideas for four major subject divisions that then went through several iterations as the librarian did searches and the group considered possible sub-topics for the divisions. The biology librarian played an integral role in the process of searching and creating the list of sub-topics. (See Appendix 1 for a list of poster topics.)

The biology librarian also created an online research guide that was linked from the Biology 100 Web site. A paper version of the guide was included in the course packet. To help students understand the basics of information literacy and library research, the guide began with a terminology section, covering such terms as *peer review*, *scholarly journals*, and *journal article databases*, in addition to *primary*, *secondary*, and *tertiary resources*. The second section of the guide explained that although the students could not cite Internet sources, they could use online databases and peer reviewed electronic journals because these sources were reliable. The third section, on how to find articles, comprised the majority of the guide. This section provided resources for finding background information, conducting searches in databases, and locating the full text of an article from a citation. Examples of background sources and search techniques were included. The guide concluded with a short table delineating the differences between primary and secondary sources and a listing of how to find help in the library.

Because teaching assistants work closely with Biology 100 students, the biology librarian worked with the course staff to train the TAs in two separate fifty-minute sessions. The first session focused on terminology and background research; differences between primary,

secondary, and tertiary resources were delineated, and the peer review process was explained with examples of how to recognize a peer reviewed journal. Library resources available for background research were highlighted, including appropriate encyclopedias and handbooks in the science reference collection and examples of other books in the library's holdings. In the second session, the TAs took a quiz on types of resources: they identified ten examples of resources as either primary, secondary, or tertiary. Then the group discussed strategies for searching periodical indexes for the semester's topics. Search techniques such as truncating, using Boolean operators, and brainstorming other search terms were demonstrated. The teaching assistants were given several minutes to try searching on their own.

Although library instruction for students was not part of the summer 2004 information literacy plan, the biology librarian offered classes in an attempt to determine student interest. Because previous attempts to require students to come to information literacy and library instruction classes were unsuccessful, the course staff decided against either requiring attendance or offering any extra credit. The life sciences librarians started by offering two sessions in the Harold B. Lee Library's large instruction rooms, which each hold thirty-one students. Students signed up for the classes in the Biology 100 office. The first two sessions filled up quickly, so additional classes were scheduled. Then several TAs contacted the biology librarian requesting instruction for their students. The life sciences librarians taught thirteen information literacy classes during fall semester 2004.

Literature Review

Library Instruction in Biology Classes

Librarians at a number of institutions across the country have provided information literacy and library instruction support to introductory biology classes, utilizing a number of

strategies. Bowden and DiBenedetto (2001) described collaboration between biology faculty and librarians that resulted in face-to-face instruction for approximately 260 students at Villanova University. The authors, a librarian and a biology professor respectively, evaluated the success of this instruction by assessing the quality of the related assignment and administering a student survey. Tufts University implemented an information literacy Web site for their introductory biology course, as documented by Orians and Sabol (1999). This team also evaluated the quality of students' work and administered student questionnaires to assess their instruction program. More recently, Lee and MacMillan (2004) combined face-to-face instruction with a Web-based tutorial, and found both student and staff satisfaction with the program. All of the above researchers found that their information literacy strategies were advantageous to students.

Sinn (1998) conducted a literature review on library instruction in biology and also conducted a study of academic libraries in Ohio. She found that the majority of library instructors taught students about specific biology research resources and the differences between journals and magazines. Surveyed librarians principally taught in one-shot sessions and rarely used evaluations or testing to assess their instruction.

In two other examples no formal evaluations were conducted, but positive comments and collaborations seemed to validate the efforts of librarians. Schmidt (1993) reported the creation of a separate course on research strategies in the life sciences. The course covered search strategies such as Boolean operators and truncation and described a number of electronic databases. At Emporia State University, librarians worked with biology faculty to provide tools and instruction for the general genetics course (Summey 1997). Librarians taught students how to use databases available through the Online Computer Library Center (OCLC) search interface

FirstSearch in a one-time session, and the author states that this collaboration improved the experience for students, faculty, and librarians.

Focus Groups and Assessment of Library Instruction

The literature in recent years reflects the increased interest of librarians in assessment. Several methods have been used to evaluate information literacy and library instruction, including pre- and post-tests, experimental and control groups, and analysis of student bibliographies (for recent examples, see Palmer & Tucker 2004; Larkin & Pines 2005; Orme 2004; and Ursin, Lindsay, & Johnson 2004). Focus groups are another tool researchers have used to evaluate library instruction and to elicit feedback from students on related subjects. Grant and Berg (2003) held a focus group with doctoral students to identify which Association of College and Research Libraries information literacy standards were implemented into their curriculum. Canning et al. (1995) found focus groups to be a cost-effective and successful tool for determining which library services were important to the problem-based learning cohort at the University of Missouri-Columbia School of Medicine. In another example, Carter (2002) employed focus groups with other research methods to evaluate library instruction and examine students' information-seeking behavior. Carter found that focus groups provided useful insights into the processes of student behavior in the library. The University of Notre Dame Australia also successfully determined the needs of faculty and students by assembling and conducting focus groups (Dickson 2004). Dickson reported that using focus groups was a particularly effective method for identifying areas for improvement and strategies for meeting customers' needs. All researchers determined that focus groups are an efficient and successful method for

eliciting constituent feedback and evaluating library services. Therefore, the author decided to use focus groups to evaluate the collaboration between the library and Biology 100.

Methodology

Focus groups were conducted with eight teaching assistants and eight students to evaluate the Biology 100 information literacy program. Focus groups were selected as research tools because they allow participants to explain their experience in depth, with more detail than a survey allows (Langford & McDonagh 2003). Four focus groups were held, two groups of TAs and two groups of students. TAs were asked about the TA training session, the online research guide, the student library classes, and the assistance they rendered to the students on their posters. Students were asked about the research guide, the instruction sessions, and other assistance they received with their posters. (Please see Appendix 2 for a complete list of focus group questions.) The fifty-minute focus groups were held in a library conference room, conducted by the author, and tape-recorded for subsequent transcription.

Participants were recruited in person; TAs in the weekly TA training meeting and students during one of the Biology 100 lecture classes. The author explained the purpose of the focus groups, asked for volunteers, and informed the group that they would receive a \$10 BYU Bookstore gift certificate for their participation. Students and TAs indicated their availability and their attendance of Biology 100 library classes on a signup sheet.

Focus group participants were selected from the lists to ensure a variety of experiences and viewpoints and according to schedule availability. Equal numbers of male and female TAs were invited to participate, but equal numbers were not possible in the student focus groups, since more female students volunteered than male students. Groups were selected to include some participants who had attended a library class and some who had not.

Table 1 lists the demographics of the focus group participants. A total of eight TAs and eight students participated in focus groups, with four TAs in each of the two TA focus groups and three and five students in the two student focus groups. Of the TAs, five were seniors, one was a sophomore, and two were graduate students. Three TAs were male, and five were female. Six TAs had attended library classes associated with BYU English courses filling the First-Year Writing and Advanced Writing university core requirements. Seven students were freshmen, and one was a senior. Of the two male and six female students, six had taken a First-Year Writing course and one had taken an Advanced Writing course.

Table 1: Focus Group Participant Demographics

	TAs	Students
<i>Class Standing</i>		
Freshman		7
Sophomore	1	
Junior		
Senior	5	1
Graduate Student	2	
<i>Sex</i>		
Male	3	2
Female	5	6
<i>Library Experience</i>		
First Year Writing	6	6
Advanced Writing	6	1
Total Number of Participants	8	8

Results

Feedback from the participants was both broad and specific, leading to philosophical conclusions as well as concrete suggestions for improving the Biology 100 information literacy program. TA and student comments are listed below in separate sections and are divided by topic. Positive feedback on each aspect of the information literacy program is described first, and then suggestions for improvement are detailed.

Teaching Assistant Focus Groups

At the beginning of the discussion the TAs were asked for general comments about their experience helping their students find resources. Overwhelmingly, they responded by describing the weak research skills of their students. Most TAs reported that their students did not know where to start and that the poster assignment was asking them to do something they had never done before. Several postulated that many of the students did research in high school using books and the Internet but that they had never used primary sources and were not familiar with the term. TAs also mentioned that their students had difficulty understanding the importance of doing background research before searching databases for primary articles. One reported that students knew where to go for research but that they needed help narrowing their topics. Another TA said that “all [my students] needed help [doing research].”

In addition to describing the research skills of their students, several TAs mentioned problems they encountered with the resource CQ Researcher, which is a collection of reports on “hot topics” in the news, written by journalists. According to definitions used by Biology 100 professors, CQ Researcher is considered a tertiary source because it is not peer reviewed. A number of students cited this source as primary or secondary and were confused about the difference between primary, secondary, and tertiary sources. Other TAs reported that they encountered only a few CQ Researcher citations.

All of the TAs asserted that the TA training session was beneficial, although responses to more detailed questions varied. One said that he knew everything taught in the training session but that it was “nice to have a refresher.” Another reported that the session was essential, since he had not conducted research before. TAs felt the introduction to databases and search strategies were the most helpful aspects of the training. They also appreciated the review of the new library

Web site and the introduction to the online research guide for students. One TA said that the library's "resources are so tremendous that we sometimes get lost if we don't do [research] every day." TAs also responded positively to the quiz on resources; one said that although the quiz was difficult, it was useful to test the teaching assistants' skills. Perhaps most affirming, several TAs mentioned that they would attend the training session again if it were offered another semester.

Despite overall positive comments about the training session, the TAs pointed out some confusing areas and made suggestions for improvements, the majority of which were requests for covering more material. Several participants suggested that it would help to make sure TAs are familiar with the poster assignment and its requirements before teaching the session. Some TAs felt that one hour was sufficient, but others felt overwhelmed and reported that the sessions covered an overabundance of information at once. Several wanted more instruction on primary, secondary, and tertiary resources, particularly instruction on how to help their students understand the differences among the types. One TA desired more information on how to find the full text of an article from a citation. Another suggested that the training session include a list of common journals on the assigned topics for the semester. It was also suggested that new TAs be paired with experienced TAs during the session for searching assistance.

After a discussion on the training session, the TAs provided feedback on the Biology 100 research guide. The TAs reported on their use of the guide, commended its merits, and identified a number of areas for improvement. Some used the guide regularly with their students; others either did not know about the guide or taught the students themselves. One participant said, "I need to emphasize [the research guide] a little bit more." Several praised the terminology section as the most useful for their students; others reported that they appreciated the database listing and search strategies.

Much of the discussion about how to improve the research guide focused on students' understanding of background research and its place in the research process. The TAs reported that their students didn't know what background research was or how it would help them. Participants also noted that some students were confused by the background research section and therefore did not read the remainder of the guide. Other students thought they could cite the sources listed under background research on their posters; they didn't comprehend that books and encyclopedias were tertiary sources. One TA quoted a student as saying, "Why can't we use an encyclopedia as a reference since [the research guide] tells us here to look them up?" Most TAs reported that few students used the listed reference sources. One TA instructed students to use the Internet for background information, wanting to lessen the students' confusion about background sources. Another repeatedly encouraged students to do background research but believed students thought it would be easier to start in the databases. One reported a different experience: this TA had several students report back about what they learned from background research every day for several days. Most TAs agreed that the number of background research sources listed in the research guide (approximately five each of books and reference sources) was sufficient for their students.

In addition to giving feedback on the background research section, the TAs identified other problematic areas in the research guide and suggested specific improvements. TAs reported that the flowchart on finding full-text articles from a citation confused their students, as did the explanation of the peer review process. One TA said that students thought "peer review" meant that researchers got a friend to look at their articles before submitting them for publication. The TAs also suggested that the guide include more information about databases and their features and have instructions prohibiting students to cite databases.

Before one group ended their discussion of the research guide, the TAs mentioned their students' difficulties with writing thesis statements. The library received a number of questions from Biology 100 students about writing a thesis statement, and, for the most part, library personnel referred students to their TAs for help. When asked if the research guide should include information on thesis statements, most TAs said no, feeling that teaching the students how to write a thesis statement was the responsibility of the professors and the TAs. Several TAs taught their students about thesis statements during a reading comprehension lecture, and one TA was particularly frustrated to see no changes in student work after having taught the concept a number of times. One student told a TA, "Before I came to this class I had a completely different concept of what a thesis was." This student reported that an English 115 instructor confirmed what Biology 100 taught about writing a thesis statement. TAs suggested that they themselves could show examples of thesis statements in class and that perhaps the BYU Writing Center could provide some material to help the TAs teach their students.

The next topic of discussion was the information literacy classes offered by the library for the students. The response to the library classes was overwhelmingly positive. All of the TAs whose students attended felt that the class was extremely valuable because students learned where to find resources. One TA reported that the most important aspect of the class was that students learned they could get help from library personnel trained both in the sciences and in library resources. Another TA related that the library classes resulted in a significant improvement in quality of research and in the type of questions asked by the students; for example, those who went to the library classes brought articles to their TAs and asked if they were appropriate, whereas those who did not come to the class did not know where to start. One TA said that the biology librarian "explained [the research process] far better than I could," and

another said that the class helped students understand that these skills and resources are important and significant, not merely a requirement for Biology 100.

Although the TAs praised the library classes, they also identified problems and proposed improvements. Some of the comments mirror the feedback about the research guide: students felt confused about background research and didn't grasp the peer review process or its importance. One TA reported that most students guessed on the peer review status of their sources. The TAs also commented that some students didn't understand how to navigate the multiple sites shown during the class, which included the library catalog, the research guide, the databases, and the library's print and electronic journal finders. Some students were bewildered by the process of finding the full text of an article, and others felt hampered when BYU did not have access to particular journals. TAs postulated that students became frustrated because they expected immediate results; many students did not understand that research takes time. To address these problems, the TAs suggested that library instructors spend more time explaining primary, secondary, and tertiary resources and include more examples. TAs also thought library instructors should emphasize the process of finding full text. Several TAs suggested that after the lecture students could go on a short tour of the science reference desk and the periodicals room. Others wondered if library research session materials could be covered either by the TAs or during the regular discussion section meeting time.

An interesting discussion occurred when the focus group participants were asked about the best-case scenario for their students' learning as facilitated by the library. The TAs agreed that if there were no restrictions on resources, the most desirable situation would include one-on-one assistance from the biology librarian for each student. The next best scenario for Biology 100 would be mandatory classes with the biology librarian in a thirty-one-computer instruction

room where students could follow along. Others suggested holding the library research sessions in the discussion section classrooms and at the regularly scheduled time, with both the librarian and the TA present. Some TAs, however, preferred optional information literacy classes because this would distinguish between hard-working students and those who are less motivated. To encourage students to attend library classes, TAs suggested the possibility of extra credit or informing students that poster grades are much higher for students who attend library classes.

The concluding discussion topic in the TA focus groups included details of assistance that TAs provided to their students. TAs helped students individually and referred students to the library for assistance. Although most TAs referred their students to the science reference desk, several referred students directly to the biology librarian. One TA reported that he had the biology librarian's phone number memorized and would give it to any students with questions. Another TA appreciated the library's help "because in semesters past we have had to do it all ourselves, and it's been very hard."

Finally, TAs were asked if there were other ways the library could help them and their students. The discussion focused primarily on ideas for class assignments, such as expanding the thesis and sources assignment to help students understand how to use databases. TAs reiterated previous suggestions, such as including teaching plans for TAs to help them teach their students how to do research. One TA praised the library's efforts and said, "This is more help than we've ever gotten in any of the semesters. I thoroughly appreciate it immensely, immensely, very, very much."

Student Focus Groups

At the beginning of the student focus groups, the participants were asked to describe their experience with the Biology 100 poster assignment. Students shared the details of how they

found sources, reported on the difficulties they encountered, and mentioned assistance they received from the library. The freshmen reported that they didn't know where to start on the assignment. One said, "I didn't even know that we had databases." All of these students received instruction or assistance from the library, directly or indirectly. Some attended the Biology 100 library class; some were instructed by library staff in their English classes; some went to reference desks; and one was helped by a friend who had met with a librarian. After receiving library instruction the students found the sources they needed, with a few minor complications. One student was frustrated when finding references to journals not held by the BYU library; another found it difficult to distinguish between primary, secondary, and tertiary sources.

The student focus group participant who was a senior reported that he went through a different process. He didn't seek help from the library because he was familiar with the research process in the social sciences. However, in hindsight, he wished that he had attended a Biology 100 library class. Describing his experience, he said, "Research in [biology] is very different than research in the social sciences. They're so similar on the outside, but when you actually get into it and finding stuff, it's very, very different. I wish I had taken the class because I ended up spending three to four hours finding a few sources that might have taken me twenty-five to thirty minutes if I had known what to do."

After the students described their overall experiences with the Biology 100 poster, they were asked about the research guide. Approximately half of the students said they used the research guide at some point as they worked on their posters. One said he was not aware of the guide, and another referred to the guide used in an English library instruction class. Several students reported that the terminology section was the most useful part of the guide, and another student said he appreciated and used the search techniques section. Most students preferred using

online search engines for background research instead of using the encyclopedias listed on the research guide. One successfully utilized the books listed on the guide for background research and reported that the books confirmed information found on the Internet. Student recommendations for improving the guide included clarifying the full-text flowchart and expanding the terminology section to include more information on peer review. Finally, students desired increased advertising of the guide; many did not know about it and thought that perhaps their TAs should have directed them to it.

The next topic of discussion was the Biology 100 information literacy and library instruction classes, about which students made a number of comments, both general and specific. Students who attended classes in the library instruction rooms appreciated being able to follow along on computers, but students who attended a session in the library auditorium took notes and were able to navigate the tools successfully on their own. One reported that the Biology 100 library class reiterated information taught in her First-Year Writing library session, but that she appreciated the combination of the two. Another felt that the classes covered information too quickly and that he wanted a more detailed step-by-step guide.

Several students found some aspects of the library classes confusing. One was annoyed that a topic where resources were easily found was used as an example and felt that more realistic and complex examples should have been demonstrated. Another said that students don't understand what a database is and that "they think of it as searching the Internet, like a search engine" and that students think "the article will be right there." The peer review process was also a difficult concept for the students to understand. Some thought that all articles in the databases are peer reviewed; others understood during the class but forgot how to identify sources as peer reviewed when they started working on the assignment.

Most of the comments about improving the information literacy class were related to the logistics of signing up for and attending the library sessions. The students cited scheduling conflicts as reasons they did not attend and asked for more sessions at different times, including after the thesis statement and sources were due. Some students reported that they felt intimidated by the manner of signing up for the class—they felt uncomfortable signing up for the class on a sheet posted on the wall because other people could see them. Others felt overwhelmed by having to find the Biology 100 office as well as the room for the library session; being so new to campus, they felt intimidated by the challenge. One said, “As a freshman I was kind of scared to go and find out about all these new things about all these different crazy classes.” The students also requested that the instructors slow down and that the classes include more time for searching.

Students were also asked about the best-case scenario for learning how to conduct research for Biology 100. In a situation of unlimited personnel and resources, some students said they would like the library to teach research skills during their normal discussion section with their TA present. Some disagreed, saying they preferred the voluntary classes. One said, “This comes down to the student’s initiative.”

Because thesis writing was discussed in TA focus groups, the issue was intentionally raised with the students. There was no clear consensus in their feedback. Several students liked the idea of defining a thesis statement in the research guide and perhaps including examples. Another preferred no examples because it left the field completely open. One student understood the concept of a thesis statement from her English class. Yet another felt confused about writing a thesis statement, and didn’t work on the thesis and sources assignment until the last minute—and even then she guessed at the right way to complete the assignment.

When students were asked about help they received on the assignment, they responded in large part by disparaging their TAs. The overwhelming majority reported that their TAs did not help them and that the TAs didn't know the answers to their questions. One student said, "I didn't bother asking my TA because he never really knew what was going on." Another reported that she felt "dumb" asking her TA questions because the TA acted like she should know the answers already. One had a positive experience, receiving help with narrowing her thesis statement from the TA via e-mail and in person. Several students also commented that the discussion section felt disconnected from the classroom lecture, that it seemed like two separate classes.

Students were chiefly positive about library help they received. Two students reported that reference desk personnel were helpful as they walked students through the steps of finding primary resources. Others did not come to reference desks because they were scared or they didn't think the desk personnel could help. One student said, "I was too scared to ask around. I didn't ask anybody. I just tried to figure it out, and it took a long time." Another commented that his doubt about the helpfulness of desk personnel came from an earlier, unsuccessful experience of asking a question and not getting an answer. One student praised the involvement of the library in Biology 100, saying that "I was just amazed . . . that the library was that closely involved in the class" and that the library offered "more help than I ever expected."

Discussion

The library implemented a number of specific improvements in the Biology 100 information literacy program based on feedback from the focus groups. The improvements included modifying the research guide and administering an online registration system for Biology 100 library classes. The most significant change to the online research guide was the

creation of a new section on how students can determine if a journal is peer reviewed. This section is comprised of scanned images from print journals listing an editorial board or stating that the journal is peer reviewed as well as giving a link to the periodicals directory Ulrichsweb. Instructions about using Ulrichsweb direct the students to look for the “refereed” icon next to the journal title. Also, because of the confusion surrounding the resource CQ Researcher, a note was added to the terminology section of the guide specifically stating that CQ Researcher is a tertiary source. The flowchart guiding students through the process of finding an article from a citation was also revamped and improved because focus group participants reported that they didn’t know where to start on the original version.

Several interesting trends are apparent from the focus groups. Perhaps most important, TAs and students were impressed with the library’s involvement in the class. These TAs and students needed to learn how to navigate scientific literature, find reliable information, and use what they learned to create their Biology 100 posters. They thought that the information literacy skills taught in the research guide, training session, and library classes were meaningful, even essential for them to learn, and they wanted more and improved access to library expertise. Focus group participants affirmed that the library’s efforts to support Biology 100 were needed and effective and provided evidence in support of the program’s continuation.

Both TAs and students confirmed suspicions of library personnel that Biology 100 students have weak research skills. The great majority of students enrolled in this course do not know how to find resources for their poster assignments. They are not familiar with the structure of information in science, nor do they understand what primary, secondary, or tertiary resources are. Finding three peer reviewed journal articles on a specific topic is a challenging assignment,

especially for freshmen new to the overall university experience. The library seemed to be the students' main source of information and assistance with this project.

Comparing freshmen students with the senior student in the focus groups provides insights about instruction on subject-specific information literacy skills. During his college career, the senior had taken English classes with associated library instruction components: First-Year Writing and Advanced Writing. He reported that he did not seek the library's help because he knew how to do research in the social sciences. He discovered, however, that research in the life sciences is distinct. Both general and social science information literacy skills were not enough for this student in his biology class. The implications of his experience demonstrate a need for stronger instruction on subject-specific information literacy skills.

Of particular interest are the problems the students experienced with background research. Many skipped background research, jumping right into the databases to find articles. It was no surprise to the author that when the students actually did background research, most used Google or other online search engines exclusively. This finding seems to fit with the data of previous studies indicating that students rely on the Internet for information (Lippincott 2005; Frand 2000), and it highlights an issue that is of consequence to and is problematic for many librarians. Did the students learn what they needed from the Internet? Is it the role of librarians to teach students to use more traditional sources? Since the majority of students completed the poster assignment, perhaps they learned enough online to narrow their topics and understand at least part of the primary and secondary literature they cited. It is difficult to know what sources were used and how students learned without doing further research. However, the organization and authority of reference books and encyclopedias are valuable assets that will improve students' research. Therefore, although most students will probably use the Internet for most of

their background research, Biology 100 library classes and the research guide will continue to emphasize encyclopedias and other reference material as well-organized sources of high-quality background information.

Despite expressing concerns about student understanding, most TAs reported that library classes improved student research. Before the library was involved with Biology 100, many students cited inappropriate sources. After the information literacy program was instituted, the quality of the sources improved, particularly for those students who attended the research sessions. Although this improvement was not measured quantitatively, the library can assume that the information literacy classes were successful and that students learned what they needed to complete their assignment. This finding confirms that one-shot information literacy classes are effective when associated with specific assignments.

The finding that Biology 100 TAs preferred to send their students to the library instead of teaching them themselves is both interesting and problematic. Although most TAs helped students individually, many asked for support and ideas on how to teach their students. In the focus groups TAs stated that librarians teach the material much better than they could, and they reported that if there were no restrictions on resources, they would like to have each of their students taught by library staff individually. When the Biology 100 information literacy program was first conceived, the library trained TAs with the expectation that they would go on to teach the students. However, as the library began to teach a few classes for students, the demand increased until library classes for students became the main effort of the program. The TAs were not teaching information literacy to the students in any formal way, and the students seemed to want instruction directly from the library. Since there was not a class period set aside for research skills or information literacy instruction in the discussion sections, TAs did not have

time to teach it in class. Because so many students want information literacy instruction, the Harold B. Lee Library may need to revisit the issue of leveraging and training TAs. Most Biology 100 teaching assistants are undergraduates, and even those who are graduate students prefer that the library teach research skills. These skills are in the library's area of expertise, whereas biology is the expertise of the student TAs. In a way, this finding is gratifying to librarianship as a profession. If librarians expect TAs to be able to teach their students how to do research, the library may need to provide more explicit teaching outlines or lesson plans to TAs.

Several findings identified problems of particular interest to Biology 100 faculty, staff, and TAs, including thesis writing and lack of TA support. Neither the library nor the course staff had considered that writing a thesis statement was an information literacy need or a weakness in Biology 100 students. Thesis problems might reflect either a lack of understanding of the material in peer reviewed resources or a deficiency in writing skills. Both professors and TAs believe it is their responsibility to make sure students write appropriate thesis statements, perhaps rightly so. In the general education curriculum, students receive instruction about thesis writing from their English classes, not from the library. However, many Biology 100 students are either concurrently enrolled in First-Year Writing English classes or take the class later, and so they don't learn about thesis statements until after their Biology 100 theses and sources are due. Since some students don't receive instruction elsewhere, the Biology 100 curriculum needs to include some content on writing a thesis statement.

Problems with thesis writing are a curriculum issue; the other finding relevant to the course staff is a personnel problem. Almost all of the students in the focus groups reported that, for various reasons, their TAs did not help them with the poster assignment. Some TAs expected the students to have research skills already, whereas others were unsure of their own research

skills. As a result of this finding, the library worked with the course coordinator to develop a research competency quiz for TAs for fall 2005. All TAs were required to pass the quiz.

The timing mismatch between thesis writing instruction in First-Year Writing courses and Biology 100 parallels a similar problem with the timing of general and subject-specific information literacy instruction. The poster assignment is particularly difficult for students because most are completely unfamiliar with the library. As part of First-Year Writing courses, students take a library tour and attend two library classes in which they learn about the research process, how to search the library catalog and other databases, and how to find articles from citations. Biology 100 information literacy sessions teach similar skills, including information about the structure of information in science and the use of life-sciences periodical indexes. Does the repetition of information help the students, or is it a waste of their time? In the focus groups, one student commented that the combination of general and subject-specific information literacy instruction strengthened her understanding and improved her information literacy skills. How can libraries coordinate information literacy instruction to make it as effective as possible? These are issues that libraries will have to work out as subject-specific information literacy instruction increases.

Another consideration in the interaction between general and subject-specific information literacy is curriculum requirements. Depending on each institution's curriculum, subject-specific instruction may be able to fill information literacy requirements. BYU recently added an information literacy competency requirement to the general education curriculum, so that those who test out of the First-Year Writing requirement still have to meet the information literacy requirement. Discussions about Biology 100 information literacy instruction meeting the general

education requirement are in the preliminary stages and will continue as the library works out the details of the information literacy curriculum requirement.

The Biology 100 poster assignment and associated information literacy program demonstrate how a targeted assignment can be used to help students learn subject-specific research skills. At BYU the assignment was in place before the library became involved. Based on reference desk experience, librarians saw a need and developed a program to meet the needs of Biology 100 professors, TAs, and students. Subject-specific information literacy instruction should be implemented where opportunities arise; it is easier to convince faculty to support library involvement for an existing part of their class than it is to convince them that they need to add another assignment and then include library involvement. Also, student learning is increased when students are required to use the skills they have been taught.

Conclusions

The focus groups conducted with Biology 100 TAs and students gave the library important insights about student behavior and needs with respect to the challenging poster assignment. Students have weak research skills and need assistance and instruction to complete the project. They do not understand the peer review process or the structure of information in science. The great majority of students use online search engines for background research and don't know how to write a thesis statement. Teaching assistants are not equipped with the time, resources, or expertise needed to teach their students how to do research. These results confirm that there is an important role for the library in Biology 100. Both TAs and students felt that the library's assistance was necessary and that it improved the process for all involved.

Some general conclusions are also clear from BYU's experience. First, librarian-faculty collaborations are critical to information literacy projects; without the support of the Biology 100

faculty, this program could not have been implemented. Second, subject-specific information literacy instruction has an essential role in the education of undergraduates and is particularly effective when combined with an appropriate assignment. Third, students appreciate the substantial resources and skills that libraries and librarians contribute to their education. TAs and students alike were effusive in their praise of the library's involvement in Biology 100.

The Biology 100 information literacy program has been successful, at least in its essentials; however, focus groups raised a number of issues and questions. What is the best way to teach two thousand new students every semester how to conduct research in the life sciences? How should the library coordinate subject-specific and general information literacy programs on campus? What is the most effective way to leverage limited resources? To answer these and other questions, the library would like to gather more information about student learning and information literacy in Biology 100.

Since focus groups provide valuable qualitative data but do not provide a complete picture, the library would like to implement a longitudinal, comprehensive evaluation program. The evaluation would include the analysis of existing data, including reference statistics and grade data, as well as gathering additional information through surveys and pre- and post-tests. The library began keeping separate reference statistics for Biology 100 in winter 2005, noting the number of Biology 100 questions received at three reference desks: science/maps, periodicals, and general reference. Analyzing trends in the number of reference inquiries as compared to changes in the assignment and information literacy efforts will provide valuable information about student behavior. In addition, poster grade data is available from the course coordinator. Comparing grades for students who attended a library research session and those that did not will assess the practical effects of the library research sessions. Overall grades before the information

literacy program implementation and after will also be compared, to see if the program had an overall impact. Variations in TA grading will be considered, and appropriate statistical tools will be used to assess the relevance of differences.

Additional quantitative data is needed to fully assess the effectiveness of the research guide and the library research sessions. In particular, pre- and post-quizzes will help assess the amount and depth of student learning. Quizzes will include terminology and conceptual questions about the flow of information in science, as well as more practical questions on identifying parts of a citation and how to search a database to find articles. Each student's previous coursework will also be considered. Student performance on the quizzes will assess the pedagogical effectiveness of the library sessions and research guide. Surveys on student and TA perceptions of the information literacy program will provide additional data. Focus groups may be conducted in addition to the more quantitative analysis, to elucidate particular aspects of the data. The combination of quantitative data and qualitative feedback about student learning of research skills in biology will help the library determine where to expend limited resources to best serve the patrons.

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Appendix 1: Poster Topics, Fall 2004

Overall Topic: Products of the Evolutionary Process

1. Evolution of Resistance

- Antibiotic Resistance
- Insecticide Resistance
- Herbicide Resistance
- Disease Resistance (viral, bacterial, parasitic)

2. Transgenic Species in Agriculture

- Transgenic crop plants
- Transgenic domesticated animals

3. Breeding Programs

- Fruits
- Vegetables
- Livestock
 - Cattle (dairy or beef)
 - Pigs
 - Sheep
 - Poultry

4. Conserving Genetic Variation in Agriculture

- Crop Plants
 - Wheat
 - Rice
 - Corn (maize)
- Domesticated Animals
 - Cattle
 - Pigs
 - Sheep
 - Poultry

Appendix 2: Focus Group Questions

Biology 100 Focus Group Questions: TAs

Overall Experience

Tell me about your experience helping your students find sources for their posters.

TA Training

What was helpful about the training sessions?

What part of the class, if any, was confusing?

Do you have any suggestions for improving the training?

Research guide

Did you use the research guide with your students?

Which parts of the guide were particularly useful?

Which sections of the guide were not useful?

Were any sections confusing? Which sections and why?

Were any sections not complete? Which sections and why?

Which listed sources were helpful to your students?

How did they help your students?

Would you like more books listed as examples for your students' background research?

Do you have any other suggestions for improving the research guide?

Library classes

How were the library classes helpful to your students?

What part of the class, if any, was confusing to your students?

How easy was it for your students to find sources after the class? What made it difficult?

How well did your students understand the peer review process?

How well did your students understand how to tell if a journal is peer reviewed?

How comfortable did your students feel with searching in the databases?

Do you have any suggestions for improving the class?

Other assistance

How did you help your students find resources for their posters?

How often did you refer students to the library?

What other ways can the library help you and your students?

Biology 100 Focus Group Questions: Students

Overall Experience

Tell me about your experience finding sources for your poster.

Research guide

Did you use the research guide?

Which parts of the guide were particularly useful?

Which sections of the guide were not useful?

Were any sections confusing? Which sections and why?

Were any sections not complete? Which sections and why?

Which listed sources were helpful to you?

How did they help you?

Would you like more books listed as examples for your background research?

Do you have any other suggestions for improving the research guide?

Library classes

What was helpful about the library classes?

What part of the class, if any, was confusing?

How easy was it to find sources after the class? What made it difficult?

How well did you understand the peer review process?

How well did you understand how to tell if a journal is peer reviewed?

How comfortable did you feel with searching in the databases?

Do you have any suggestions for improving the class?

Other assistance

What assistance did you receive from your TAs?

What additional assistance did you receive from the library? How helpful was it?

What other ways can the library help you with this assignment?

Do you have any other suggestions?