

ASK AN INTERESTING QUESTION: INSIGHTS FROM A REFLECTIVE SURVEY OF SENIOR BIOLOGY STUDENTS

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INTRODUCTION

At the University of Calgary, there has been a long-standing integration of information literacy (IL) skills into the Biological Sciences curriculum. As part of an ongoing process to assess the IL program, senior biology students were surveyed about their information skills, the resources they used for various aspects of their projects, and how their research habits had evolved over the course of their studies. The questions in the survey appeared to stimulate critical thinking and self-assessment, and many responses went beyond what was asked, providing additional information about the usefulness of the IL program. By asking interesting questions, the author got far more information than he anticipated!

There was a dual purpose to this study – to investigate student use of information resources, and to encourage students to reflect on their learning. The Librarian and the Biology IL program will benefit from a deeper understanding of patterns in information use, with study data informing curriculum development, and the marketing of the IL program to other professors. Students benefited from a chance to reflect on their skills and their development as scholars. The length and depth of many of the answers indicates that the students were engaged by the survey and that through answering the questions they had become more aware of their own learning and had started to integrate new knowledge from the library instruction class into their research strategies. A third, unforeseen benefit was the strong indication that students valued the IL instruction they had received throughout the program, and had successfully transferred learning from individual library classes to their approach to research throughout their studies in Biology.

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METHODOLOGY

In the fall of 2006, the author approached the instructor of a senior course in Biology and secured permission and ethical release to conduct the survey. This particular course was chosen as it included a review of key life sciences tools and an introduction to new resources. In addition, the librarian had established a good working relationship with this instructor. Some of the questions that the author hoped to answer in this study were:

- What resources were upper-level biology students actually using?
- How had their research habits changed over time and what factors caused the change?
- Do students use different sources for different stages of their research work?
- Is IL instructional content aligned with students needs?

Other foreseen outcomes of the study were obtaining information for program assessment and marketing purposes and, perhaps most importantly, to increase student reflection on and consolidation of their research skills.

The FAST (Free Assessment Summary Tool) online survey tool was used in order to ask students to reflect on their research process and what tools they used (e.g. Google, Biological Abstracts, PubMed, Web of Science, SciFinder Scholar, the Library catalogue, and Patents) for different stages of research, such as choosing and exploring topics, locating specific information and finding background information. Other questions asked students to reflect on their development as researchers, how their strategies had changed and how they learned about new tools. One of the most fruitful questions asked students what they wish they had known earlier. Final questions asked if the student intended to go on to postgraduate study and if so, in what field. All 25 students registered in CMMB 421 (Cell, Molecular

and Microbial Biology) completed the 16 question survey at the end of a 90-minute library class in which the librarian focused on PubMed, Web of Science, patents and Google Scholar, and briefly noted or reviewed the library catalogue, Biological Abstracts and Web of Science.

RESULTS

In questions 1-8, students were first asked to indicate their use of various resources, both whether they used them at

all and for what purpose. Students also had the option of adding any additional databases that they may have used. Table 1 shows the frequency of responses for these questions. PubMed was the most frequently used database by students with a total of 21 students or 84%, followed by Biological Abstracts, the Library Catalogue, Google or Google Scholar, Web of Science and Patent Databases. Other resources that students indicated they had used for their research included JSTOR, online textbooks, journals and Wikipedia.

Table 1
Resources used by Virology undergraduate students (N=25)

Resource	Number	Percentage
PubMed	21	84%
Biological Abstracts	20	80%
Library Catalogue	19	76%
Google/Google Scholar	18	72%
Web of Science	5	20%
Patent Databases	2	8%
SciFinder Scholar	0	0%

Table 2 illustrates the purposes students articulated for each resource. Students could articulate more than one type of use and some students that indicated they did use a source did not further specify how they used it. The author assigned responses to broad categories. PubMed again ranks very high as a resource for all stages of research, particularly exploring a topic. While there was low current usage for newly-introduced

resources, such as patents and SciFinder Scholar, many students commented they would consider using patents in the future. These comments are also tabulated – the two future uses for Google referred specifically to using Google Scholar. Other uses students noted were checking citations, and in particular, using the catalogue to locate specific journals.

Table 2
Purpose of use for each source

Resource	Choosing a topic	Exploring a topic	Finding specific information	Finding background information	Will use this source in future
PubMed	7	15	8	5	3
Biological Abstracts	5	10	7	2	
Library Catalogue	4	8	5	1	
Google/Google Scholar	8	9	3	5	2 (scholar)
Web of Science		2	1	1	4
SciFinder Scholar					2
Patent Databases			1		4

Results for question 9-16 are summarized below, with student responses in bullet points.

Question 9 - How do you decide which source to check first?

Most students begin their searches with Biological Abstracts, followed by PubMed and Google or Google Scholar. The selection of Biological Abstracts is no surprise as most students in this class would have participated in a first and/or second year information literacy session which included the completion of a class-based assignment using Biological Abstracts. Some selected, illustrative statements:

- Usually I use Biological Abstracts and then PubMed.
- I was using Biological Abstracts because I was most familiar with it, but now I think PubMed and Web of Science might be better because there are a lot of useful features on these databases that I wasn't aware of.
- Depending on how much I already know on the topic, I will decide to search a database to either further familiarize myself with the topic or to directly find articles to use in writing my paper.
- I use general sources such as Google Scholar to browse general topics in the field of interest before searching for specific articles.
- From the library sessions in first and second year, I usually check bio abst first once I have a little bit of background info on what I am looking for.

Question 10 - Which source do you find most useful for your research purposes?

Most students cited PubMed (12 responses) or Biological Abstracts (9 responses) as most helpful, with some students using Google Scholar. Students often articulated more than one source.

- I find PubMed usually very helpful as well as Google Scholar.
- Up to this date, Biological Abstracts has been the best source for my projects.
- I think PubMed will become my most useful tool.
- I anticipate PubMed, Web of Science and the Patents databases will be very useful.

Question 11 - Has the way you do library research changed as you have progressed through your studies? If so, how?

Respondents indicated that they now use more sources and use those sources in more depth. Students also indicated that earlier information literacy sessions have helped by introducing them to different sources as well as the advantages of each system.

- I have gone from not really knowing what I'm researching and blindly typing in topic headings into anywhere that would allow me to, to knowing where to

type in topics and knowing what to look for in exploring a topic.

- I have learned to use a broader range of sources.
- More information has become available and more links. Library sessions have been very informative.
- The library seems more organized and also the information sessions have gotten more specific and are quite helpful.
- I often use multiple search engines/data bases now to ensure that I have received a more complete picture on my search topic. Before, I would only use one search engine.

Question 12 - What factors caused the change?

17 students specifically refer to formal instruction as the reason for the change in their research behavior. Some students learned from professors and friends and others by trial and error.

- Library tutorials have given me a lot of useful information, as well as advice from profs and TA's.
- Tutorials for Ecology, Biology and now CMMB.
- Professors, personal research and playing around, informal and formal instruction.
- Formal instruction such as this session changed my research strategies.
- Mainly library sessions from first and second year.

Question 13 - What do you know about library research now that you wished you had known earlier?

This question provoked a wide variety of responses. Some students mentioned different tools such as Web of Science and Patents while others referred to database features such as controlled vocabulary (e.g. PubMed's Preview/Index), tips and tricks and the proliferation of online journals.

- I like how the index on pubmed works to break down searches into specific categories.
- Patent searches - especially in Biotech.
- The Web of Science background information. That would have helped alot during the past two years.
- The google scholar link through the University.
- The idea of "index" I learned today in Pubmed. Given a very general topic, Pubmed was provided more specific topics for me to explore.
- That there is so much available online. I would far rather be at home searching for a topic with a cup of tea at my side than wandering through the aisles of a library for hours.

Question 14 - How did you learn about the various sources?

Most students indicated that they learned about resources in earlier library instruction sessions.

- CMMB421 tutorial!
- Library sessions. I would honestly recommend them to

- anyone who has do to any kind of research.
- Biology 231, 313
- Blind luck and of course this tutorial.

Question 15/16 - Do you plan to pursue an advanced degree? If so through which avenue (graduate program in biology/life sciences, medical program, graduate program in another subject, a second Bachelors degree, other)?

Fourteen students indicated they would be pursuing advanced studies in biology or life sciences, 10 selected medicine and one selected 'other'. The focus of the course, virology might attract a disproportionately high number of students interested in careers in medicine, and this may account somewhat for the popularity of PubMed. Medical students articulated slightly higher use of PubMed for background information, but otherwise there was no clear difference in the usage patterns for this resource between those students who were going on in medicine and those pursuing studies in biology/life sciences.

DISCUSSION

The survey results provide insight into the research habits of senior biology students. With almost all students indicating they would be continuing their studies beyond the Bachelor's level, one can assume that the students are highly motivated, and are academically successful. Students are using a variety of strategies to achieve various research goals, and throughout their studies they have integrated new tools and more advanced techniques introduced primarily through library instruction sessions. Student comments were both reflective about the development of their research practices and forward-looking, with many responses indicating changes they would make to their strategies in the future. This development of skills over the course of a degree program indicates the benefits of integrating IL instruction in courses throughout the student's academic career in tandem with assignments that required immediate use of the skills and reinforced by ongoing course requirements such as the integration of external material in lab reports. The high number of comments that directly and positively referenced library instruction and/or the subject librarian signals the value students place on the sessions. While this affirmation was not a prime purpose of the study it has become a useful tool in marketing the program to new instructors.

While it was not surprising to see the majority of students using Biological Abstracts, as it is the focus of first-year IL instruction, the number of students who preferred PubMed for various aspects of research was surprising. PubMed has so far been only briefly mentioned in first and second year, and taught in some third-year classes, ones that not many of the students in the study would have attended. While the number of students from this class going on to medical school might have been a factor, there was no real difference in PubMed usage between students bound for medical school and those for postgraduate degrees in life sciences. It is possible that students utilize PubMed because it is freely available, relatively easy to use, includes helpful search features and links to gene, protein and nucleotide databases, has links to the online fulltext of most

journal articles and is recommended by their instructors. Students who indicated that they used PubMed were nevertheless pleased to learn more advanced search techniques in the session. Results from this survey will lead to incorporating PubMed earlier in the IL curriculum for biology.

Although many students used Google, no real surprise, many were not habitual users of Google Scholar. Comments about Google indicated a lesser degree of trust, and an appreciation for the more advanced searching and sorting features available in proprietary databases. Google was most often used as a place to find and/or explore a topic, perhaps because it works well for searches using very new terminology, and interdisciplinary studies.

While 19 of 25 students reported using the catalogue, very few referred to books in their comments. The catalogue was used mainly to access electronic journals and locate articles. This likely reflects the emphasis on current information in the life sciences, as well as general trends in student research habits. Many of these students would have learned how to use Biological Abstracts before the University purchased SFX (a linking tool that facilitates access to full text articles licensed by the library) and so would be more used to using the catalogue to follow up on citations and find full text.

CONCLUSIONS AND FUTURE DIRECTIONS

The study was intended to provide the researcher with information about students' use of resources and development of information skills. It was also meant to encourage students to reflect on their own learning, their strategies, and their evolution as researchers. It is clear that the survey accomplished both aims. The results not only illustrated how students used different tools for different purposes, they showed that students felt their range of strategies and tools had both broadened and deepened. They had learned about more resources and how to use those resources more efficiently as they progressed through their studies. Throughout the survey students made reference to the value of IL sessions to their research processes. The meta-learning and reflection encouraged by the questions encouraged students to value their information skills, to see where they might need further development and to assess their own strategies.

As so often happens, in answering the researcher's questions, the survey results lead to new avenues of inquiry. It is clear that students could benefit from an earlier introduction to PubMed – but how best can we integrate it into an already crowded curriculum? In the next iteration of the survey, the use of Google and Google Scholar will be disaggregated – what patterns of use might this show, in part as Google Scholar continues to improve in depth and usability? And finally, did the students who indicated they would add new resources to their search patterns, for example patents and Web of Science, actually do so? A follow up survey administered after the students had completed their research projects might provide useful information on the impact of teaching these resources at an advanced level.

Above all the survey proved the utility of asking interesting questions. The time and effort students put in to answering the researcher's questions indicated their engagement with the process. The survey worked equally well as a tool to prompt reflection and a tool to gather data, benefiting both the students and the librarian.

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NOTES

More information on the research project, including complete survey results and copies of the presentation can be found on the author's website at: <http://library.ucalgary.ca/subjectpages/science&engineering/biologylibrarian/conferences.php?admin=1&test=0>

More information on the FAST survey tool can be found at: <http://www.getfast.ca>.

The materials developed for the class can be seen at: <http://library.ucalgary.ca/subjectpages/science&engineering/courserelatedinstruction/cmmb421-virology.php?admin=1>
