The Right Stuff: How to Find Good Information

David D. Thornburg, PhD
Executive Director, Thornburg Center for Space Exploration
dthornburg@aol.com

One of the most frustrating tasks you can have as a student is finding reliable information about something you are studying. Back in the old days, we didn't have the Internet, and we got our information from lots of places – books, magazines, newspapers, radio and television. We also got a lot of information from personal conversations with our parents, teachers, and (if we were lucky) from experts we were introduced to. As you can imagine, this process often took a long time. Once you decided what resource to search (books, for example) you made a trip to the library and worked your way through a catalog that was kept on cards where you could identify books on the subject of your interest. Often, a librarian could help you find what you needed, but a lot of the time you were on your own. One result of the difficulty in finding information on a particular topic was that we relied heavily on textbooks since we thought they had all the information we needed in one place. If our question related to something we were studying in school, then we could ask our teacher or see what our textbook had to say about the topic. In some cases, we might give up if it was too hard to find what we wanted. In other cases we might only get a little information, but not have any guidance on how to find more. In those days the idea that you could be in a classroom where you got to choose your own questions to explore was very rare indeed!

The old methods of looking for information were really challenging when we were interested in something that happened after our textbooks were published! Then we had no choice but

to look through a variety of paper resources of many kinds, or to write letters or make phone calls to experts for help. Sometimes our friends could be counted on to help locate resources, but if you were interested in something that no one else thought was worth exploring, well, you had a lot of work to do.

The reason I just spent so much time telling you about the "old days" is because it is quite possible that you do almost all your research on topics using the Web as a primary source. Today, it seems, we are never more than a few mouse clicks away from anything we'd want to find. And, there are lots of tremendous Web-based resources to use: Online encyclopedias like Wikipedia (www.wikipedia.org), powerful search engines like Google (www.google.com) and Yahoo (www.yahoo.com) and others, and sites we've found in the past that we keep in our bookmark list (*e.g.*, www.nasa.gov, www.free.ed.gov) Sometimes these specialized sites are so filled with content that they have their own search engines you can use to get exactly what you are looking for.

Yes, it is now so easy to get information online that it seems that we don't need to worry about using libraries, or wading through back issues of newspapers and magazines. The Web has everything – or does it?

The fact is that the Web is filled with a tremendous amount of information. This does not mean that it holds everything of interest to us. Books (and libraries) still have a very important role today, and we should never forget that all the "old" ways of finding information may come in handy from time to time.

No matter where you get your information, it has seemed to me that there are several key questions related to skills you should have:

1. How do you find the information you are looking for?
2. Are you sure the information you found is relevant to your search?
3. How do you figure out if the information you received is accurate?

These three questions apply to any search using any tool, whether it is your fingers typing on a keyboard, or your feet walking through a library. Students in years past didn't need to understand these skills as much as you do because they didn't have such powerful resources as you do at your fingertips!

Let's start with item 1, finding information.

When you want to learn something new (seeing if your favorite band is going to be coming to

a theater near you, for example), what do you do? Do you ask your friends? Look at the newspaper? Search your band's Web site? Listen for announcements on the radio or TV? All of these are useful ways to get information. For example, if your friends don't know the answer, maybe they will start searching for it themselves. My point here is that, while the Web might be a fast way to find what you are looking for, there are lots of other ways you already use to find information every day!

But let's suppose that you really want to use the Web as your primary tool for finding information. What then?

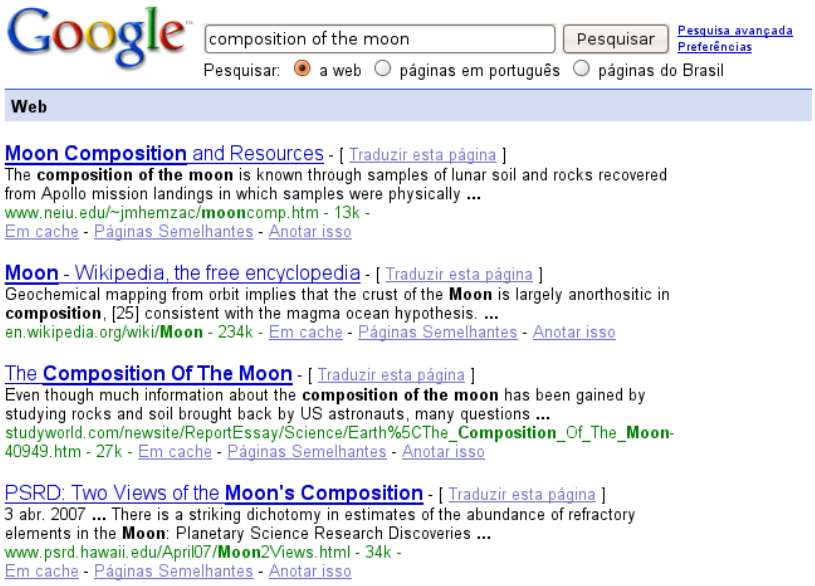
Depending on the kind of information you are looking for, you may use a general search tool like Google, or, if you already know the address, visit a specialized site that you think might have the information you want. Because search tools have indexes that are huge (Google, for example, has links to well over over twenty five billion pages of information), you need to learn how to phrase your search so your desired information shows up quickly. For example, suppose you wanted to find out what the Moon is made of. Here's how Google responds to several searches:

what is the moon made of	14,500,000 hits
composition of the moon	555,000 hits
moon composition	551,000 hits
lunar materials	259,000 hits
moon rocks	521,000 hits

What do you notice about the results of these searches? Since Google is looking for pages that include the words you used in your search, you can conclude that the first search has produced a huge number of results because of extra words. We used the word “made” to represent “composition”, but “made” has other meanings (as in “man-made objects”). This trick is to create a search request that includes the most relevant words you can find related to your search. After all, as powerful as computers are, they can't think the way you can, so Google or any other search engine needs all the help it can get. Multiple searches only take a few seconds, so you should try out a few different ways to ask your question to see what kinds of information shows up. In our case, I'd probably start with the second or third search in our list. (By the way, by the time you do this search, you will probably get even larger numbers of “hits” or links to pages your search tool has found.)

Now we can start reading the summaries of the pages we found. Here are the first few results

from our search:



As you can see, the first results seem to be addressing our question quite nicely. In fact, if you scroll down the first page of search results, you will find many (but not all) of the sites listed seem to provide the answers you may be looking for. It is important, though, to avoid the temptation of only looking at the first few sites. You may find even better resources a few pages down in the search results, so be patient.

Now let's look at item 2 of our list of skills: making sure that the results you found are relevant to your search. In our example, this is pretty easy to do. For example, sites containing poetry about the Moon, while interesting, are probably not going to answer your main question. The problem with sites that are not relevant to your interests is that they can take a lot of your time if you allow yourself to get distracted by them. Instead of spending hours exploring sites that are interesting but not relevant, just bookmark them for looking at later, when you have the time to spare.

I have to be honest, this is tough for me to do. I will often start searching one topic, find myself distracted by another topic mentioned in a site I found, and then waste hours prowling around the Web looking at information that does not address my original question. To be sure, there is nothing at all wrong with having broad interests, and in pursuing these interests when you get the chance. It is just that if you are working against a deadline, you need to make the most efficient use of your time possible, and avoid getting distracted.

Our third topic, evaluating the accuracy of the information you have found, is probably the

most important of all. Just because something shows up on the Web does not mean it is accurate. This is true for print resources as well. Newspapers, magazines, books, news reports on TV or radio all have some information that is true, and some that may not be. Usually the errors come about by accident, or because the person writing the information down did not research the topic well enough, but errors happen no matter what.

How can you establish that the information you found is accurate? Unless you have first hand experience with the information itself, you have to establish a level of trust in your sources. Let's suppose, for example, that you found a site, www.yummycheese.com, that said the Moon is made of Green cheese, just like the kind made by the Yummy Cheese corporation. Would you accept this as a true statement? Probably not. First, you would ask yourself, "Why would a cheese company have a site related to the composition of the Moon?" As you think about this, and look at the site, you might conclude that this is just a way to advertise the products made by a company, not a serious site.

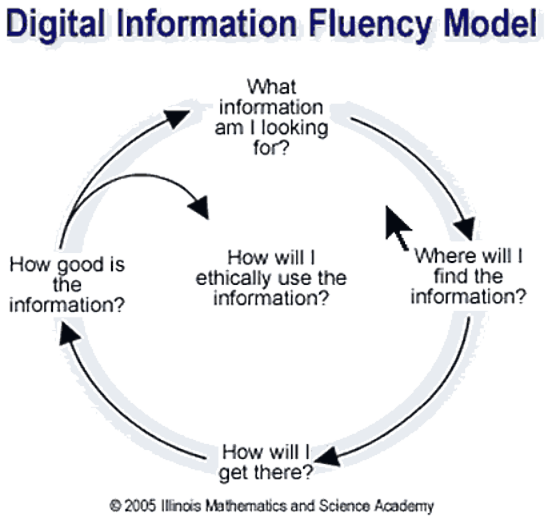
On the other hand, if you find information related to the composition of the Moon from a site like NASA's (www.nasa.gov), then you will be safer in trusting the results since NASA actually sent missions to the Moon, and the information that is posted references the scientists who did the analysis themselves.

The more research you do, the better you will become at being able to separate fact from fiction, not just on the Web, but from any informational source you use. But, no matter how careful you are, there is still the possibility, through no fault of your own, that you'll rely on some incorrect information. For this reason (among others) it is essential that every time you write or create a presentation about your studies, you provide references to all your data. This way, if someone says the data is wrong, you can simply point the blame to the people who posted it in the first place.

A second (and very important) reason for providing references is to give proper credit to those people who did the work that made your project possible. Even if they never see your presentation they should be referenced. Providing "citations" (references) to the work of others on which you rely is the cornerstone of all scientific reporting. Many articles have long lists of references showing not only who provided the data, but where the original sources can be found. This increases the value of your own work because, if someone is interested in the same subject, your reference list provides a good starting point for their own exploration of the topic. The scientific community makes tremendous advances because of the openness of researchers to share their data with each other and the world at large. In your own way, you are building on a tradition that dates back many hundreds of years.

As for how you should list your citations, there are several methods in common use. Your teachers can tell you the ones they think are most appropriate. But, no matter how you do it, be sure to give credit to your sources. Who knows, you may find someone giving you credit for *your* work someday. How cool is that!

So far, we've just scratched the surface of finding information. IMSA (the Illinois Math and Science Academy) has a very elegant project in this area you can explore. The IMSA 21st Century Information Fluency Project (21cif.imsa.edu) is built around the following framework:



As you can see, this model operates as a cycle that includes not only the skills we've already explored, but the ethical use of the information you found as well!

You should explore the IMSA information fluency site. In a short time, you will become an expert at gathering and evaluating information. These skills will truly last a lifetime, and place you at a tremendous advantage as your studies continue!