Information literacy learning model for engineering students

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Abstract: This paper provides an overview of an information skills program integrated into the first year engineering subject “Documentation techniques”. This is a problem-based learning subject, which requires the students to work through and report on an engineering project. Over the past four years the program has transformed radically as a result of applying an action research framework which is primarily concerned with continuing improvement and change in practice. Currently, the information skills program consists of a student-led orientation tour, an integrated subject web page (developed using the RESEARCH AND WRITE tutorial).

Key words: engineering, information literacy, information resources, search strategies, search engines, invisible web.

1. Introduction
The anticipated learning outcomes of the information skills training are that the students can:
• recognize the variety of information sources
• the importance of information in engineering practice
• evaluate the information found
• cite the information used
• engineering students have a heavy workload and it is important that the information skills program should be available at times and in places that best suit the students. This program also needs to be closely integrated with the academic content of the subject, therefore a subject homepage was developed which contains information from the lecturers and the library.

2. Elements in delivery of information literacy
Information literacy combines skills or competencies that together ensure effective use of information. In an era of lifelong learning, this effectively means that information literacy has relevance to all ages from primary school to senior citizens. Information literate people understand more than how to find information, they understand its limitations and the need to examine how they use information, and they understand how to manage and communicate information.
Perhaps the most recent alternative definition to the one offered here by CILIP is that originating in the UNESCO-sponsored Meeting of Experts on Information Literacy in Prague:
"Information Literacy encompasses knowledge of one’s information concerns and needs, and the ability to identify, locate, evaluate, organize and effectively create, use and communicate information to address issues or problems at hand; it is a prerequisite for participating effectively in the Information Society, and is part of the basic human right of lifelong learning." (US National Commission on Library and Information Science, 2003)
"Information literacy is an understanding and a set of abilities enabling individuals to 'recognize when information is needed and have the capacity to locate, evaluate, and use effectively the needed information'." (CAUL, 2004).
3. Information literacy and higher engineering education

Developing lifelong learners is central to the mission of higher education institutions. By ensuring that individuals have the intellectual abilities of reasoning and critical thinking, and by helping them construct a framework for learning how to learn, colleges and universities provide the foundation for continued growth throughout their careers, as well as in their roles as informed citizens and members of communities. Information literacy is a key component of, and contributor to, lifelong learning. Information literacy is increasingly important in the contemporary environment of rapid technological change and proliferating information resources. In light of the above-mentioned competencies, the present article envisages to present the programs developed at “Transilvania” University Library along with the SEARCH AND WRITE TUTORIAL which was provided for student use.

4. “Transilvania” University of Brasov-model of engineering learning

RESEARCH AND WRITE TUTORIAL

Search and write tutorial is an online teaching model. The web pages of this tutorial are presented below and every theoretical page contains practical exercises.

Course 1: RESEARCH BASICS

- There are a number of ways to find reliable information sources:
  - Books which have been added to the library's collection have generally been evaluated by a librarian;
  - Articles published in peer-reviewed journals have been evaluated by other researchers;
  - Web pages recommended by a librarian have been evaluated for authenticity and reliability;
  - Web pages published by governments or organizations have the weight of the organization behind it;
- Asking some simple questions about the source can help you evaluate its reliability;
  - Recommendations:
    - Use our subject guides; the librarians have created subject guides for all disciplines by selecting and evaluating the most useful databases, web sites, journals & other resources http://www.unitbv.ro
    - Use peer-reviewed journal articles;
    - Use the library’s scholarly databases to find articles that have been evaluated by experts in the field, before being published. You can get database suggestions from the subject guides above or go to the databases page http://www.unitbv.ro/biblioteca;
      - search techniques; you can do more successful searches by using the search techniques
        - "phrase searching "
        - ", truncation * ? ,"
        - boolean and, or, not
- A domain search allows you to limit your search to web sites with a specific domain such as .ro (Romanian sites), .edu (educational institutions), or .gov (government sites).

Course 2: EVALUATION OF RESOURCES

Anything can and will be published on the Web, so critical evaluation skills are essential to determine the value of the information before you use it in your research.

There are six criteria to consider when evaluating a web site: authority, currency, accuracy, coverage, objectivity, purpose.

Course 3: SEARCHING OPAC LIBRARY

Select your topic:
- a good topic should be interesting, controversial, current or familiar
  - state it as a question
  - do preliminary research - textbook, reference book

Define the key concepts and terms;

Determine how much detail you require;

Determine what type of information you need;

Determine which information sources to use;

Locate the information sources;

Course 4: FINDING ARTICLES

What is a journal?
Why should I use a journal article?
What are the types of periodicals?

Course 5: RESEARCH ETHICALLY

"Transilvania University defines plagiarism as the presentation of the work of another author as to provide its reader reasons to think it to be one's own. Plagiarism is a form of academic fraud. Plagiarism is considered a serious academic offence which may lead to loss of credit, suspension or expulsion from the University, or even the revocation of a degree. In its grossest form plagiarism includes the use of a paper purchased from a commercial research corporation, or prepared by any person other than the individual claiming to
be the author."

**Paraphrasing**

Learn how to paraphrase so that you avoid copying an idea word for word. Restating the idea in your own words will help you understand the concept and avoid plagiarism at the same time.

**Citation**

Citations are an important form of scholarly communication. They formalize the origin of ideas and concepts so that anyone can trace the development of the research on a subject.

**Course 6: Standards and Patents**

**Standards**

**WHAT IS A STANDARD?**

A standard is a requirement established by user consensus that prescribes the best criteria for a product, process, test, or procedure. It provides safety, quality, interchangeability of parts or systems, and consistency across international borders.

**FIND A STANDARD**

There are three ways to locate standards:

**FULL-TEXT ACCESS**

- Military Standards: http://dodssp.daps.dla.mil

**UNIVERSITY OPAC**

- Standards are shelved alpha-numerically in the Standards section by Agency Number (e.g. ISO 9241 1998). Some standards can be borrowed for a period of three hours while others are available in-library only.

**DOCUMENT DELIVERY**

- Request a copy of a standard that is not available in the University Library collections through Document Delivery. A paper version of the document delivery form is available at the Free access collections

**CHOOSE AN INDEX**

**GLOBAL ENGINEERING DOCUMENTS**

http://global.ihs.com

This service indexes national, international and industry standards. Use keywords to identify standards or search for known ones to find currency and prices.

**API (AMERICAN PETROLEUM INSTITUTE) STANDARDS**

https://login.ihserc.com/login/erc

API Standards database indexes approximately 550 technical standards for petroleum engineers.

**THOMSON TECHSTREET**

http://www.techstreet.com

Thomson Techstreet indexes national, international and industry standards, and highlights New Standards and Codes directly from the Start Page.

You can search for specific terms or browse by organization (e.g. IEEE, CSA, etc).

**STANDARDS WRITING ORGANIZATIONS**

Most Standards Writing Organizations (ANSI, ISO, ASHRAE for example) maintain indexes to their own standards at their web sites. Remember to check Sexton’s collection before ordering a standard.

**A COMPREHENSIVE LIST OF THESE SITES IS AVAILABLE AT:**


**PATENTS**

**What is a Patent?**

A resource used to legally identify the owner of an intellectual property. An intellectual property consists of inventions, artistic expressions and other products of the imagination. Patents legally identify inventions as belonging to the inventor.

Patents are thus useful if:

- You have invented something and want to make sure no one steals your idea.
- To make sure your own idea is original— that is, no one else has already invented it.

**Obtaining a Patent**

Some patents are available on the Web. Order others through our Document Delivery Service. Patents are not collected by University Library.

**Directory of Intellectual Property Offices**

Available at:
http://www.OMPI.int/directory/en/urls.jsp

Browse a comprehensive list of international patent offices to find their web sites and/or contact information.

**Search for a European Patent**

http://ep.espacenet.com

European patent applications (with page images) published over the last 24 months. For patents older than 24 months select the Worldwide Database option in the drop down menu.

**Search for an American Patent** (1976-Present)

http://www.uspto.gov/patft/index.html

This provides the full text of United States patents. Updated weekly this site contains the full text and page images for each patent.

**GOOGLE PATENTS**

http://www.google.com/patents

This provides the full text of U.S. patents. Updated weekly this site
contains the full text and page images for each patent.

**Course 7: INTERNET SEARCH**

<table>
<thead>
<tr>
<th>YOUR TOPIC'S FEATURES:</th>
<th>SEARCH ENGINES</th>
<th>SUBJECT DIRECTORIES</th>
<th>SPECIALIZED DATABASES</th>
<th>FIND AN EXPERT</th>
<th>LUCK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distinctive or word or phrase?</td>
<td><strong>Enclose phrases in &quot;&quot;.</strong></td>
<td><strong>Search the broader concept, what your term is &quot;about.&quot;</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NO distinctive words or phrases?</td>
<td><strong>Use more than one term or phrase in &quot;&quot; to get fewer results.</strong></td>
<td><strong>Try to find distinctive terms in Subject Directories.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seek an overview?</td>
<td><strong>NOT RECOMMENDED</strong></td>
<td><strong>Look for a specialized Subject Directory focused on your topic.</strong></td>
<td><strong>Want data?</strong></td>
<td><strong>Fortune favors the bold!</strong></td>
<td></td>
</tr>
<tr>
<td>Narrow aspect of broad or common topic?</td>
<td><strong>Boolean searching as in Yahoo! Search.</strong></td>
<td><strong>Look for a Directory focused on the broad subject.</strong></td>
<td><strong>Facts?</strong></td>
<td><strong>Keep your mind open.</strong></td>
<td></td>
</tr>
<tr>
<td>Synonyms, equivalent terms, variants</td>
<td><strong>Choose search engines with Boolean OR, or Truncation, or Field limiting.</strong></td>
<td><strong>NOT RECOMMENDED</strong></td>
<td><strong>Statistics?</strong></td>
<td><strong>Learn as you search.</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Search Tools:**

Search engines have become somewhat standardized, allowing us to use some common search techniques in all of them:

**Table 2**

<table>
<thead>
<tr>
<th>Things You CAN Do in Google, Yahoo!, and Ask.com</th>
<th>Things NOT Supported in Google, Yahoo!, or Ask.com</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Phrase Searching</strong> by enclosing terms in double quotes</td>
<td><strong>Truncation</strong> - use OR searches for variants (airline OR airlines)</td>
</tr>
<tr>
<td><strong>OR</strong> searching with capitalized OR <strong>- excludes</strong>, <strong>+ requires</strong> exact form of word</td>
<td><strong>Case sensitivity</strong> - capitalization does not matter</td>
</tr>
<tr>
<td><strong>Limit</strong> results by language in Advanced Search</td>
<td></td>
</tr>
</tbody>
</table>

Some Ways the Recommended Search Engines Differ:

**Table 3**

<table>
<thead>
<tr>
<th>Search Engine</th>
<th>Google</th>
<th>Yahoo! Search</th>
<th>Ask.com</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Links to help</strong></td>
<td>Google help</td>
<td>Yahoo! help</td>
<td>Ask.com help</td>
</tr>
<tr>
<td><strong>Size, type</strong></td>
<td>HUGE. Size not disclosed in any way that allows comparison. Probably the</td>
<td>HUGE. Claims over 20 billion total &quot;web</td>
<td>LARGE. Claims to have 2 billion fully indexed,</td>
</tr>
</tbody>
</table>
Noteworthy features

- Popularity ranking using PageRank™ emphasizes pages most heavily linked from other pages.
- Many additional databases including Book Search, Scholar (journal articles), Blog Search, Patents, Images, etc.

Boolean logic (what's this?)

- Partial. AND assumed between words.
- Capitalize OR.
- ( ) accepted but not required.
- In Advanced Search, partial Boolean available in boxes.

+Requires/ - Excludes (what's this?)

- excludes + will allow you to retrieve "stop words" (e.g., -in)
- excludes + will allow you to search common words: "+in truth"

Truncation, Stemming (what's this?)

- No truncation. Stems some words.
- Search variant endings and synonyms separately, separating with OR (capitalized):
  airline OR airlines

Subjects directories: Table comparing some of the best human-selected collections of web pages:

<table>
<thead>
<tr>
<th>Web Directories</th>
<th>Librarians' Internet Index</th>
<th>Infomine</th>
<th>About.com</th>
<th>Google Directory</th>
<th>Yahoo! Directory</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><a href="http://www.lii.org">www.lii.org</a></td>
<td>infomine.ucr.edu</td>
<td><a href="http://www.about.com">www.about.com</a></td>
<td>directory.google.com</td>
<td>dir.yahoo.com</td>
</tr>
<tr>
<td>Phrase searching (what's this?)</td>
<td>Yes. Use &quot; &quot;</td>
<td>Yes. Use &quot; &quot;</td>
<td>Yes. Use &quot; &quot;</td>
<td>Yes. Use &quot; &quot;</td>
<td>Yes. Use &quot; &quot;</td>
</tr>
<tr>
<td>Boolean logic (what's this?)</td>
<td>AND implied between words. Also accepts OR and NOT, and ( ).</td>
<td>AND implied between words. Also accepts OR, NOT, and ( ).</td>
<td>No.</td>
<td>OR, capitalized, as in Google's web search engine.</td>
<td>Yes, as in Yahoo! Search web search engine.</td>
</tr>
<tr>
<td>Truncation (what's this?)</td>
<td>Use *. Also stems. Can turn off stemming (&quot;fuzzy search&quot;) on Advanced Search page.</td>
<td>Use *. Also stems. Can turn off stemming. Use &quot; &quot; or</td>
<td>Use *. Not accepted consistently.</td>
<td>No.</td>
<td>No.</td>
</tr>
<tr>
<td>Field searching</td>
<td>Advanced Search allows Boolean searching within subject, titles.</td>
<td>Select options under search box to limit to Author, Title, Subject, Keyword,</td>
<td>No.</td>
<td>Same as in Google's web search engine.</td>
<td>As in Yahoo! Search web search engine.</td>
</tr>
</tbody>
</table>
Meta-search engines: Use at your own risk: not recommended as an alternative to directly using search engines:

<table>
<thead>
<tr>
<th>Meta-Search Tool</th>
<th>What's Searched</th>
<th>Complex Search Ability</th>
<th>Results Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clusty</td>
<td>Currently searches a number of free, search engines and directories, not Google or Yahoo.</td>
<td>Accepts and &quot;translates&quot; complex searches with Boolean operators and field limiting.</td>
<td>Results accompanied with subject subdivisions based on words in search results, intended to give the major themes. Click on these to search within results on each theme.</td>
</tr>
<tr>
<td>Dogpile</td>
<td>Searches Google, Yahoo, LookSmart, Ask.com, MSN search, and more. Sites that have purchased ranking and inclusion are blended in. Watch for Sponsored by... links below search results.</td>
<td>Accepts Boolean logic, especially in advanced search modes.</td>
<td></td>
</tr>
</tbody>
</table>

- Invisible or deep web: What it is, how to find it, and its inherent ambiguity (searchable databases on the Web). There are still some hurdles search engine crawlers cannot leap. Here are some examples of material that remains hidden from general search engines.

5. Conclusions:
Quality education implies the acquirement of professional skills in the shortest time and at the highest level. As for higher education, in order to achieve these desiderata, individual study and continuing education are constituents based on information literacy. The information literacy presupposes the joint efforts of the Faculty, Library and Administration. Engineering students all over the world are progress factors and they are eager to master the fields of specialization, of high skills and knowledge.

References:
- Information Literacy Tutorials, http://infolit.library.dal.ca/tutorials [cited in 28.03.2008]