Search Engines

Lesson Focus
Lesson focuses on exploring how the development of search engines has revolutionized Internet. Students work in teams to understand the technology behind search engines and explore how they can retrieve useful information using search engines.

Lesson Synopsis
The "Search engines" lesson explores the technology that makes a search engine possible, and takes a look at its variations. Students work in teams to build their own search queries. Students study how different search engine algorithms work.

Age Levels
8-18

Objectives

✦ Learn about basics of a search engine
✦ Learn how to query search engines
✦ Learn how to find relevant material using advanced search options
✦ Learn about teamwork and problem solving

Anticipated Learner Outcomes
As a result of this activity, students should develop an understanding of:

✦ teamwork
✦ impact of search engines on world wide web (www)
✦ techniques to build efficient search queries

Lesson Activities
Students build search queries. They learn efficient method of retrieving information. Students compare different search engines. Working in teams of two or three students, the students explore effective teamwork skills.

Resources/Materials
✦ Teacher Resource Documents (attached)
✦ Student Worksheets (attached)
✦ Student Resource Sheets (attached)
✦ Computers with Internet access

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Internet Connections

- ✦ Google Guide (http://www.googleguide.com/)
- ✦ Search Engine Algorithms (http://searchenginewatch.com/article/2064476/Search-Engine-Algorithms-Research)
- ✦ Stanford Page for Search Engines (http://infolab.stanford.edu/~backrub/google.html)
- ✦ Helpful Guide (http://www.monash.com/spidap.html)

Recommended Reading

- ✦ An Introduction to Search Engines and Web Navigation (ISBN: 0321306775)
- ✦ Understanding Search Engines (ISBN: 0898715814)
- ✦ Search Engines: Information Retrieval in Practice (ISBN: 0136072240)

Optional Writing Activity

Write an essay (or paragraph depending on age) about how the invention of search engines has impacted World Wide Web.

Credits

- ✦ This lesson plan was developed by **Herat Gandhi**, an IEEE Graduate Student Member from Ahmedabad, India (Region 10), as part of the IEEE TryComputing.org Lesson Plan Competition.

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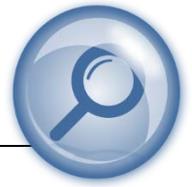
Search Engines

◆ **Lesson Goal**

This lesson will introduce search engines to students. If students understand search engines better then they may utilize search engines' power to retrieve necessary information. This lesson is organized in such a way that first students are explained working of search engines and different algorithms for search engines. Then students test their gained knowledge to build search queries.

◆ **Lesson Objectives**
  ✦ Learn about basics of a search engine
  ✦ Learn how to query search engines
  ✦ Learn how to find relevant material using advanced search options
  ✦ Learn about teamwork and problem solving

◆ **Materials**
  ✦ Computers with Internet access
  ✦ Popular search engines like Google, Yahoo, Bing, etc. should not be blocked.
  ✦ Student worksheets and resource material (attached)

◆ **Procedure**
  1. Show students the student resource. These may be read in class or provided as reading material for the prior night's homework.
  2. Divide students into groups of 2-3 students; provide one set of worksheets per group.
  3. Explain that students must work as a team to build search queries.
  4. Students need to compare search results of different search engines for same search queries.
  5. Explain that students should make a report or a chart of relevancy of search results of different search engines.

◆ **Time Needed**
  ✦ One or two 45 minute sessions.

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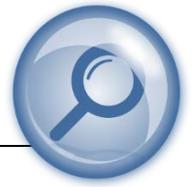
Search Engines

◆ Concept

A search engine is a set of programs which are used to search for information within a specific realm and collate that information in a database. Search engines help people to organize and display information in a way which makes it readily accessible.

◆ Why do we need search engines?

The World Wide Web is different from anything we have known. For instance, if I wanted to buy a book, I would go down to the local book store, select one I like, pay for it, and go home. The book store is usually in a visible place and has a sign out front, making it relatively easy to find.

But in cyberspace, there's no place to "turn." I have only my computer screen in front of me. Somehow, I need to find a place to purchase the book I want. There's no street on my screen so I can't drive around on the Web. Sometimes it's obvious: type in the name of the bookstore, add a .com (as in barnesandnoble + .com) and it's a pretty good bet you're going to end up where you want to go. But what if it's a specialty bookstore and doesn't have a Web site with an obvious URL?

One solution to this problem is the search engine. In fact, it's probably one of the most widely used methods for navigating in cyberspace. Considering the amount of information that's available from a good search engine, it's similar to having the Yellow Pages, a guide book and a road map all-in-one.

Search engines can provide much more information than just the URL of a Web site. They can also locate reviews, help to compare prices, and even find if there have been any reported problems with the product or the manufacturer. For many people, using search engines has become routine. Not bad for a technology that's not even 20 years old.

◆ Working of search engines

There are three aspects to search engines:

1. Crawling

Web crawling is a process of systematically going from web page to web page via the web links on what page to seek out new content. When a search engine crawls, it looks for new content which was not present during the last crawl, including updates to files and web pages. Web search engines work by storing information about many web pages, which they retrieve from the html itself. These pages are retrieved by a Web crawler, also known as a spider — an automated Web browser which follows every link on the site.

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Student Resource (continued):

2. Indexing

Then, the programs index the information, pulling out specific keywords to categorize it. On the Internet, for example, indexing relies heavily on keywords in web pages, and meta tags which provide information about the page.

Data about web pages are stored in an index database for use in later queries. The purpose of an index is to allow information to be found as quickly as possible. Some search engines, such as Google, store all or part of the source page (referred to as a cache) as well as information about the web pages, whereas others, such as AltaVista, store every word of every page they find.

3. Searching

When a user enters a query into a search engine, the engine examines its index and provides a listing of best-matching web pages according to its criteria, usually with a short summary containing the document's title and sometimes parts of the text. The index is built from the information stored with the data and the method by which the information is indexed.

Most search engines support the use of the Boolean operators AND, OR and NOT to further specify the search query. Boolean operators are for literal searches that allow the user to refine and extend the terms of the search. The engine looks for the words or phrases exactly as entered.

The usefulness of a search engine depends on the relevance of the result set it gives back. While there may be millions of web pages that include a particular word or phrase, some pages may be more relevant, popular, or authoritative than others.

Most search engines employ methods to rank the results to provide the "best" results first. How a search engine decides which pages are the best matches, and what order the results should be shown in, varies widely from one engine to another. The methods also change over time as Internet usage changes and new techniques evolve.
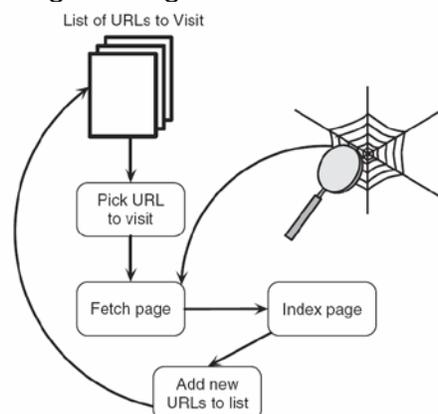
Background Process of a Search Engine

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Search engine algorithms are unique to every search engine. Basically, a search engine algorithm is a set of rules, or a unique formula, that the search engine uses to determine the significance of a web page, and each search engine has its own set of rules. These rules determine whether a web page is real or just spam, whether it has any significant data that people would be interested in, and many other features to rank and list results for every search query that is begun, to make an organized and informational search engine results page. The algorithms, as they are different for each search engine, are also closely guarded secrets, but there are certain things that all search engine algorithms have in common.

1. Relevancy

One of the first things a search engine algorithm checks for is the relevancy of the page. Whether it is just scanning for keywords, or looking at how these keywords are used, the algorithm will determine whether this web page has any relevancy at all for the particular keyword. Where the keywords are located is also an important factor to the relevancy of a website. Web pages that have the keywords in the title, as well as within the headline or the first few lines of the text will rank better for that keyword than websites that do not have these features. The frequency of the keywords also is important to relevancy.

2. Individual Factors

A second part of search engine algorithms are the individual factors that make that particular search engine different from every other search engine out there. Each search engine has unique algorithms, and the individual factors of these algorithms are why a search query turns up different results on Google than Bing or Yahoo. One of the most common individual factors is the number of pages a search engine indexes. They may just have more pages indexed, or index them more frequently, but this can give different results for each search engine. Some search engines also penalize for spamming, while others do not.

3. Off-Page Factors

Another part of algorithms that is still individual to each search engine are off-page factors. Off-page factors are such things as click-through measurement (the frequency in which users select to click a web link to sites from those identified by a specific search string) and linking. The frequency of click-through rates and linking can be an indicator of how relevant a web page is to actual users and visitors, and this can cause an algorithm to rank the web page higher. Off-page factors are harder for web masters to craft, but can have an enormous effect on page rank depending on the search engine algorithm.

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The search that you create in a search engine is a reflection of how you think. Start with a big vision and add more detail as your search continues.

1. Terms and Strings

The words that you enter in the basic search box of a search engine are called terms. As you look for information, try to use terms that are commonly used and that are absolutely essential to your question.

A group of terms is called a search string or a search query. Try building your search one term at a time, just as you would add beads to a string. You don't need to add a + or the word and between the terms, but you must leave a space between each term and the next. Be as specific as you can.

Let's take a scenario. You live in New York and you want to eat ice cream. You may use search engine to find some good ice cream shops nearby you. The search query suitable for you is: ice cream new york.

2. Try a Phrase Search

Sometimes the best way to find information is to search for two or more words in a certain order. Put those words in quotation marks to do a phrase search.
For example, you might search "peanut butter"

But be careful! Use a phrase search only for proper names and common or standard phrases. For example, if you want to eat ice cream of some particular shop say Baskin-Robbins then your search query is: "baskin robbins".

3. Exclude some of the results

Sometimes your results include a term that you definitely do not want. Add a minus sign to that term to create a negative term. Then add the negative term to your search string so that it does not appear in your search results.

For example, if you do not like butterscotch ice cream and you want to exclude results which have butterscotch in them, then try: ice cream –butterscotch new york.

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Student Resource (continued):

◆ **Let's find the answer**

Question:
If you can't see clearly, you may want to use my invention to evaluate the status of your eyes. Who am I?

How to find answer:
From the question, we may infer we need to find the name of person who invented some procedure to test our vision. So search: vision test. You will find that it is done with some kind of chart. Now search: vision test chart. You will learn that it is called "Snellen chart" and it was developed by Dutch ophthalmologist Hermann Snellen in 1862.

Answer:
Hermann Snellen

◆ **How search engines make money?**

On the surface, a search engine, no matter its popularity, doesn't seem like the most profitable of ventures. You type in your query, hit enter and then find your results without making any payment. The oft-overlooked money-making machine for a search engine is advertising.

Most Web search engines are commercial ventures supported by advertising revenue and, as a result, some employ the practice of allowing advertisers to pay money to have their listings ranked higher in search results. Those search engines which do not accept money for their search engine results make money by running search related ads alongside the regular search engine results. The search engines make money every time someone clicks on one of these ads.

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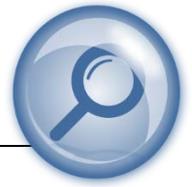
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This worksheet contains some questions. Each team of students needs to build search queries. Students will also use internet connection to find answers and teacher may evaluate answers later. Students need to note both answers and search queries.

1. Find meaning of word: "imbroglio".

    Answer:

    Search Query:

2. Find a web page that contains the word "salsa" but NOT the word "dance".

    Answer:

    Search Query:

3. Find web pages that contain the exact phrase "I have a dream".

    Answer:

    Search Query:

4. Find the location that has the record for most snowfall in a year.

    Answer:

    Search Query:

5. Find a web page that contains the words "biking" and "Italy".

    Answer:

    Search Query:

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Note: Lesson plans in this series are aligned to one or more of the following sets of standards:
* U.S. Science Education Standards (http://www.nap.edu/catalog.php?record_id=4962)
* U.S. Next Generation Science Standards (http://www.nextgenscience.org/)
* International Technology Education Association's Standards for Technological Literacy (http://www.iteea.org/TAA/PDFs/xstnd.pdf)
* U.S. National Council of Teachers of Mathematics' Principles and Standards for School Mathematics (http://www.nctm.org/standards/content.aspx?id=16909)
* U.S. Common Core State Standards for Mathematics (http://www.corestandards.org/Math)
* Computer Science Teachers Association K-12 Computer Science Standards (http://csta.acm.org/Curriculum/sub/K12Standards.html)

◆ Standards for Technological Literacy – All Ages
The Nature of Technology
✦ Standard 1: Students will develop an understanding of the characteristics and scope of technology.
✦ Standard 2: Students will develop an understanding of the core concepts of technology.
Abilities for a Technological World
✦ Standard 12: Students will develop the abilities to use and maintain technological systems.
The Designed World
✦ Standard 17: Students will develop an understanding of and be able to select and use information and communication technologies.

◆ CSTA K-12 Computer Science Standards Grades K-3 (ages 5-8)
5.1 Level 1: Computer Science and Me (L1)
✦ Collaboration (CL)
1. Gather information and communicate electronically with others with support from teachers, family members, or student partners.
2. Work cooperatively and collaboratively with peers, teachers, and others using technology.
✦ Computer Practice and Programming (CPP)
1. Use technology resources to conduct age-appropriate research.
✦ Computers and Communication Devices (CD)
1. Use standard input and output devices to successfully operate computers and related technologies.

◆ CSTA K-12 Computer Science Standards Grades 3-6 (ages 8-11)
5.1 Level 1: Computer Science and Me (L1)
✦ Computer Practice and Programming (CPP)
7. Use computing devices to access remote information, communicate with others in support of direct and independent learning, and pursue personal interests.

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◆ **CSTA K-12 Computer Science Standards Grades 3-6 (ages 8-11)**

5.1 Level 1: Computer Science and Me (L1)

8. Navigate between webpages using hyperlinks and conduct simple searches using search engines.

✦ Computers and Communication Devices (CD)

1. Demonstrate an appropriate level of proficiency with keyboards and other input and output devices.

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