



From Search to Research:

Developing Critical Thinking Through Web Research Skills

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Literacy and Critical Thinking in the Digital Age



More than 5,000 years ago, the first librarians, the Mesopotamians, began collecting clay tablets. In 300 B.C.E., the Ptolemies in Egypt created the Great Library of Alexandria by amassing copies of all known books in the world—500,000 scrolls. When the moveable type printing press was invented, by Bi Sheng in China in 1041 C.E. and by Johan Gutenberg in Germany in 1440 C.E., millions of books became available to the public, not just to scholars who could afford to travel to the public libraries. With the advent of the digital age in the last century, we are now experiencing another information revolution—this one global. The Internet has brought us an embarrassment of riches. We now have more information, more kinds of information, and more access to information than ever before in history.

In spite of these dramatic changes, the goal of collecting information and making it available to the public remains the same from ancient times to the present: to provide people with the quality sources they need to understand the world and to reflect carefully on existing beliefs and opinions. In other words, the goal of information repositories, digital or otherwise, is to support research, by providing access to the information necessary to foster the development of critical thinking. As our ability to gather and store information evolves, however, our skills in finding and analyzing information must also evolve. Today we need new critical thinking skills to help us be wise consumers of the data available to us.

Critical thinking is more than a buzz phrase; it's the ultimate goal of all education. In *How We Think* (1910), John Dewey defines critical thinking as "reflective thought" rather than routine thought; it's the process of "active, persistent, and careful consideration" of the credibility and conclusions of supposed knowledge or information. That's basically what we mean by research, which is defined as "careful or diligent search, studious inquiry or examination, especially investigation or experimentation aimed at the discovery and interpretation of facts and revision of accepted theories" (*Merriam-Webster Dictionary*). As teachers, we don't simply pour facts into empty vessels; we nurture minds to become adept at this kind of critical interaction with information.

In 1605, Sir Francis Bacon, the father of scientific thinking, outlined the habits of minds skilled in research. Such minds are (paraphrased):

- "Nimble and versatile" enough to see relationships among things, in addition to subtle distinctions between them.
- Inquisitive.
- Patient enough to doubt and ask questions.
- Fond of reflecting.
- Slow to assert and ready to consider multiple points of view.
- Careful to support their points of view and to formulate an argument with reasons and evidence.
- A slave neither to passing trends nor to established traditions but capable of judging the credibility of sources and making independent judgments about information.
- Alert to all deception.

What Is Critical Thinking, and How Can We Teach It?

For an excellent introduction to what critical thinking is and how to teach these transferable thinking skills directly and explicitly, read the introductory chapter to Alec Fisher's 2001 book *Critical Thinking*. Fisher includes, among other useful information, contemporary scholar Edward Glaser's list of the basic competencies that underlie critical thinking, such as the ability to:

- Recognize problems.
- Find workable means to meet those problems.
- Gather and marshal pertinent information.
- Recognize unstated assumptions and values.
- Comprehend and use language with accuracy, clarity, and discrimination.
- Interpret data.
- Appraise evidence and evaluate statements.
- Recognize logical connections between statements.
- Draw warranted conclusions and generalizations.
- Test the conclusions and generalizations arrived at.

Developing a habit of questioning is basic to critical thinking. Knowing the right questions to ask is the key. For a list of fundamental questions students should bring to every source, discussion, or argument, read "[The Role of Socratic Questioning in Thinking, Teaching, & Learning](#)."



These are the kinds of minds we still want to develop in our students today, no matter what subject or skills we are teaching. As Dr. Richard Paul of the Center for Critical Thinking emphasizes, this model of thinking can be applied universally. If we teach it to our students, they can apply it to everything—reading, writing, discussions—whether in person, in books, or on the web. [Watch a five-minute video of Dr. Paul](#) ▶ outlining “Critical Thinking and the Basic Elements of Thought.”



More Resources on Critical Thinking and Research Skills

For access to more resources that can help you teach students critical thinking skills, visit these websites:

[Critical Thinking Toolkit](#) ▶. A list of nine practical, everyday strategies for students to help them develop into critical thinkers, including: Identify a problem a day, keep an intellectual journal, deal with your ego, and recognize group influences on your life. An excellent resource.

[Information Skills Rating Scale](#) ▶. A critical thinking checklist developed by Washington state librarians to assess the research skills of students. Includes questions about the students’ questioning, planning, gathering, sorting, synthesizing, evaluating, and reporting skills.

[Critical Thinking on the Web](#) ▶. Offers definitions of critical thinking and links to quality resources on topics such as argument mapping, assessment, cognitive biases, critical reading and writing, experts and expertise, and much more.


[The Fallacy Files](#) ▶. Named one of the Top Ten by [Austhink: Critical Thinking on the Web](#) ▶ and one of the [Top Rationality blogs](#) ▶ by *The Daily Reviewer*.

[International Society for Technology in Education \(ISTE\) Critical Thinking Compendium](#) ▶. A wiki, managed by Howard Rheingold and other educators, that collects resources for teaching critical thinking and Internet literacies. Members can add to the list of tools and vocabulary.

Why We Need Critical Thinkers Now

Today, when we are almost drowning in information, we face serious global crises, and we need discerning citizens, it is even more urgent that we train students in these habits of critical thinking. Such habits can give them the life skills they need to thrive in our world.

Information explosion. Web search engines, for example, return tens of thousands of resources from a staggering variety of sources, many of which are out of date, incomplete, or otherwise not credible. To use this information well, we don't need passive consumers of information or "processors" of data; we need minds that are trained in healthy, productive skepticism, actively engaged in relating and evaluating data and sources, and capable of thinking independently and constructing a solid argument to support their conclusions.

Global challenges. The United Nations has identified as its [Millennium Goals](#) : ending poverty and hunger and promoting universal education, gender equality, healthy families, medical research, environmental sustainability, and global partnership. A just and sustainable global society is built not on fact-finding but on research and development skills—the skills of critical thinking. If we hope to respond to these challenges, we need to train global citizens who can question assumptions, evaluate potential solutions, and think creatively.

Discerning citizens. By far the majority of people under 25 now get their news online. Some of that information is not reliable and may even be deliberately misleading, even though it may be "hot off the press" or virtually simultaneous with the events themselves, even when it is repeated by many sources across the Internet, and even when it sounds logical and seems to be supported by solid evidence. We need to train students to evaluate the reliability of web sources and to identify bias, logical fallacies, and deceptive arguments so that students will not fall victim to false or biased information and so that they will be able to construct well-reasoned and well-supported arguments to contribute to the public conversation.



We have technological search engines at our disposal; we need to cultivate students as the decision-makers who interact critically and creatively with those search engines.

We know what challenges we face; we need to give the next generation the skills to be able to respond to them creatively.

Now that we have access to more information worldwide than ever before, we need to teach our students to evaluate information and arguments so they can become active, intelligent, and persuasive participants in politics, science, business, the arts, and society.

Who Will Train Our Future Citizens in These Life Skills, If Not Their Teachers?

For better or worse, the web has become our primary source of information. Now that students no longer rely on librarians and teachers to help them research, it is up to them to sort through the available sources to find and determine what is relevant and what is useful. The educator's role now is to train students in the research skills and habits of mind that will enable them to find, identify, evaluate, and use high-quality information in independent and high-level ways.



Overviews of Web Literacy and Research Skills:

[Crap Detection 101](#) ▶

A Stanford professor reviews the challenges of web literacy and research and provides guidelines and tools for meeting them.

["Teaching Zack to Think"](#) ▶

Groundbreaking 1998 essay by Alan November, senior partner and founder of November Learning, on Internet lies and why we need to teach students how to think critically as web researchers. Includes instructions for using the "Wayback Machine" to access outdated links in the original article.

[FactCheckED.org](#) ▶

A resource for teachers that includes excellent lesson plans on how to distinguish between premises and conclusions and explanations and arguments, how to build a better argument, and how to detect arguments that are used to deceive or mislead.

2



A New Set of Skills: Essential Web Research Skills



To become genuine researchers, that is, intelligent information gatherers, interpreters, decision-makers, and innovators, students today need to be proficient in the following essential web literacy skills. Many of these skills are traditional (for example, distinguishing sources and understanding plagiarism), but they have taken on new urgency and new forms with the advent of the web.

Essential Web Research Skills

Search efficiently and effectively

Students should not be dependent solely on a search engine's view of "relevant" sources but should also be able to navigate on their own to the sources they determine are relevant for their topic. Just as in the past reference librarians and teachers helped students jumpstart their research but did not hand them a complete list of materials, so search engines are but a starting point. Knowing how search engines work and how to think through a web search on one's own helps students not to remain passive recipients of search engine results and enables them to become actively engaged in the search process. This can, in turn, help them find appropriate sources and direct their own search.

Just as students in the past had to learn the Dewey Decimal classification system to help them navigate library collections, students today have to learn the basics of web processes and architecture, including:

- Key Internet terms, such as *spam*, *malware*, *noise*, *advertorial*, *pay-per-post*, *crowd sourcing*.
- How search engines find websites—the basics of crawling and indexing.
- What "the 10 blue links" are.
- What sponsored (paid) links are and how they work alongside unpaid links.
- How search engines (Bing, Yahoo!, and Google) make money from results.
- How websites market themselves in search engine results.
- How to parse a link/URL and what domain names mean.
- How to read a webpage.
- How to overcome researcher bias by learning to look beyond one's familiar and comfortable sources and to listen to different voices, perspectives, and opinions.

Distinguish kinds of sources, and analyze a source's validity and reliability

- Students should be able to confirm sources by using technology to verify domain names and to discover who authored particular web pieces.
- Students should also be able to distinguish between primary and secondary sources and between the different kinds of primary sources and secondary sources on the web (for example, an online copy of a primary source, news article, or op-ed piece, and social media, such as blogs, Facebook, and Twitter). They should be able to distinguish .edu, .com, .net, and .org sites and to determine the content sources used for a webpage. Who benefits by putting this content out?

Developing these skills will help students meet the [2007 ISTE National Education Technology Standards \(NETS\) for Students](#): ➤

- 1 Creativity and innovation
- 2 Communication and collaboration
- 3 Research and information fluency
- 4 Critical thinking, problem solving, and decision making
- 5 Digital citizenship
- 6 Technology operations and concepts

- They should understand the difference between free sources (government and education institutions) and sources one pays for (Consumer Reports, LexisNexis, law libraries, and journal collections). Do you have to pay to get comprehensive and reliable information?
- “Innocent until proven guilty” is a cornerstone of the United States justice system. For web research, the guideline should be: “Untrustworthy until proven reliable.” Students must be able to work through a defined set of procedures to determine the validity and reliability of a source. Is it current? Is it a genuine site or a hoax? Does the information come from social media (in which case the author may be no more knowledgeable than the searcher)? If the source is not from social but from professional media, does the author have authority to speak on the topic? Is the publisher commercial or non-commercial? Is the information the source contains accurate? What is the purpose of the source? Is the source biased or objective?

Resources for Teaching Web Evaluation Skills

- The [ISTE list](#) tells you what to look for when evaluating a webpage.
- [Backlink Watch](#) enables you to check the quantity and quality of backlinks (links to a site), which is one indicator of a site’s validity.
- The [Faculty Scholarly Productivity Index](#) assigns a score to academic institutions based on faculty publications.
- At the [Publish or Perish Website](#), you can download free software that uses [Google Scholar](#) to retrieve academic citations and then analyzes the citations to determine the impact an author has had.
- Hoax-debunking sites, like [Snopes.com](#) and [Museum of Hoaxes](#), make it easy to check suspect URLs, and they provide good examples for teachers to use to illustrate and model their points.
- The Microsoft Education team, working closely with Bing search experts, has developed a comprehensive curriculum for teaching web research skills and critical thinking skills. The curriculum is available at <http://www.microsoft.com/education/criticalthinking>.
- [Thinking Critically about Web 2.0 and Beyond](#) can help you teach students how to evaluate the social media sites that seem to crop up faster every day, such as social networking sites, blogs, wikis, virtual worlds, mashups, and file-sharing sites.
- Don’t forget to teach students how to check the accuracy and credibility of photos on the web. [Media Awareness Network’s Photographic Truth in the Digital Era](#) is a great primer. [Ethics in the Age of Digital Photography](#), a site of the National Press Photographers Association, offers a more advanced look at the credibility, ethics, and manipulation of images.



Make a habit of cross-checking facts, even from reliable sources

The authority and reliability of author and publisher are no guarantee of the accuracy of information. As scientist Carl Sagan argues in [“The Fine Art of Baloney Detection”](#), even “authorities” can mislead and experts make mistakes, so wherever possible there must be independent confirmation of “the facts.” Journalists follow the same guideline. Like these professionals, students should learn how to triangulate or cross-check facts—not simply to determine whether a source is valid but also to make sure the information is correct.

Conscientiously and properly attribute the words and ideas of others

The problem of plagiarism, always a temptation, has increased with the web. Students don’t always know the style rules for quoting, a great deal of information floats around the web without proper attribution, and the abundance of information on the web leads people to believe it is unlikely that someone will uncover a source they wrongly used. It’s essential that we train students in this basic rule of good citizenship: Do not steal the words and ideas of others. No one expects students to be copyright experts, but they must know the fundamental rules about when and how to quote others’ words and how to properly attribute the ideas that are not their own. This includes style rules (for example, how to offset quotes of more than two lines) and the ethics of journalism, in addition to copyright and fair use laws.

Learning to Use Creative Digital Content Ethically

Need help navigating the world of rights and permissions related to creative content on the web? The [Digital Citizenship and Creative Content](#) program can help you teach your students the rules that guide the ethical use of software, movies, music, and other digital files, and it can help them understand why these issues are important. The curriculum aligns with standards from the following education organizations:

- National Council of Teachers of English (NCTE)
- International Society for Technology in Education (ISTE)
- National Council for the Social Studies (NCSS)
- Center for Civic Education
- National Council on Economic Education (NCEE)
- American Association of School Librarians (AASL)

This free, online program includes a curriculum outline, access to curricular units, and a student activity website.

[Download the curriculum outline](#).

[Register to access free curriculum units](#).



Cite sources accurately and appropriately

Though citing sources may be the least favorite chore of any researcher, it is one of the most important. One of the ways we can help students with this is by teaching them how to take complete and accurate notes during their research. A tool such as Microsoft Office OneNote®, for example, enables students to capture URLs automatically when copying and pasting web content into a [OneNote notebook](#) ➤, helping them to maintain a detailed list of the web sources they've used which they can easily return to later. OneNote is also useful in keeping track of many different kinds of formats in a single notebook for easy access later. In addition, the [References tab in Microsoft Office Word](#) ➤ provides many tools for finding, citing, and managing sources.

Stay safe on the Internet

The accessibility of information on the web makes the Internet vulnerable to misuse. Students must be taught the rules of Internet safety, from the basics of not giving out personal information or any identity markers, to taking care about the kinds of online conversations they enter into when using social media. If they use discussion groups, blogs, and bulletin board sites, for example, to obtain information, students may be asked to provide data that will expose them to adults and put them at risk. Learning to identify these kinds of sites and their risks is essential. [Safe Passage](#) ➤, a Media Awareness Network site for teachers, describes the [dangers of websites](#) ➤ and of social networking and virtual environments. It is also a good resource for teaching about cyberbullying, spam, predators, privacy invasion, pornography, violent and hateful content, gambling, and other risks. [Microsoft Online Safety and Privacy Education](#) ➤ provides comprehensive help for protecting families, computers, and communities, including tools and tips for fraud protection and data protection, plus minimizing social-networking risks.

Interact with others online honestly, respectfully, fairly, and clearly

The combination of anonymity, the immediate publication of one's opinions, and a seeming tolerance of inappropriate web behavior have made it easier for people to dispense with common courtesy, the practice of weighing one's words before speaking, and other aspects of civil discourse that promote the common good. Whether you call it online *netiquette* or good *webizenship*, learning how to speak honestly, fairly, and with respect, clarity, and brevity, along with understanding why this is important in a society, especially a democracy, are essential for students. The [Common Sense Digital Literacy and Citizenship Curriculum](#) ➤, designed for 5th–8th graders, includes a unit on building respectful one-on-one and community relationships online. It also covers digital responsibility, privacy, self-expression and reputation protection, and respect for creative work—one's own and that of others.



A New Curriculum to Teach These Web Research Skills

Microsoft and ISTE have collaborated to create a curriculum to help develop and apply critical thinking skills through web research. This comprehensive set of lesson plans and student activities walk students through the steps of learning and practicing essential web research skills while applying critical thinking skills throughout the process. The lessons are aligned with NETS standards and include: teacher modeling demonstrations, student handouts, search tips, and sets of guidelines for teachers, parents, and students. Each unit also includes materials designed for beginning, intermediate, and advanced students that can be applied across K–12 grade levels and subjects.

"Critical thinking' used to be one of the goals of a liberal arts education, but wasn't always a high priority, especially in the age of 'teaching to the test,' but now that the answer to any question is available through a web search—but the accuracy of the answers can only be determined by the questioner—the ability to assess the credibility of web information, and the mindset that encourages critical analysis, has become an essential survival skill for the Digital Age."

— HOWARD RHEINGOLD, EDUCATOR, AUTHOR, *SMART MOBS*

"Sending a kid out onto the Internet these days without teaching them critical thinking skills is like asking them to go to bat at home plate with a giant goldfish. The results are squishy, the kids have the chance of taking damage, and worse—they can't hit the ball out of the intellectual park."

— BETSY AOKI, BING SENIOR PROGRAM MANAGER

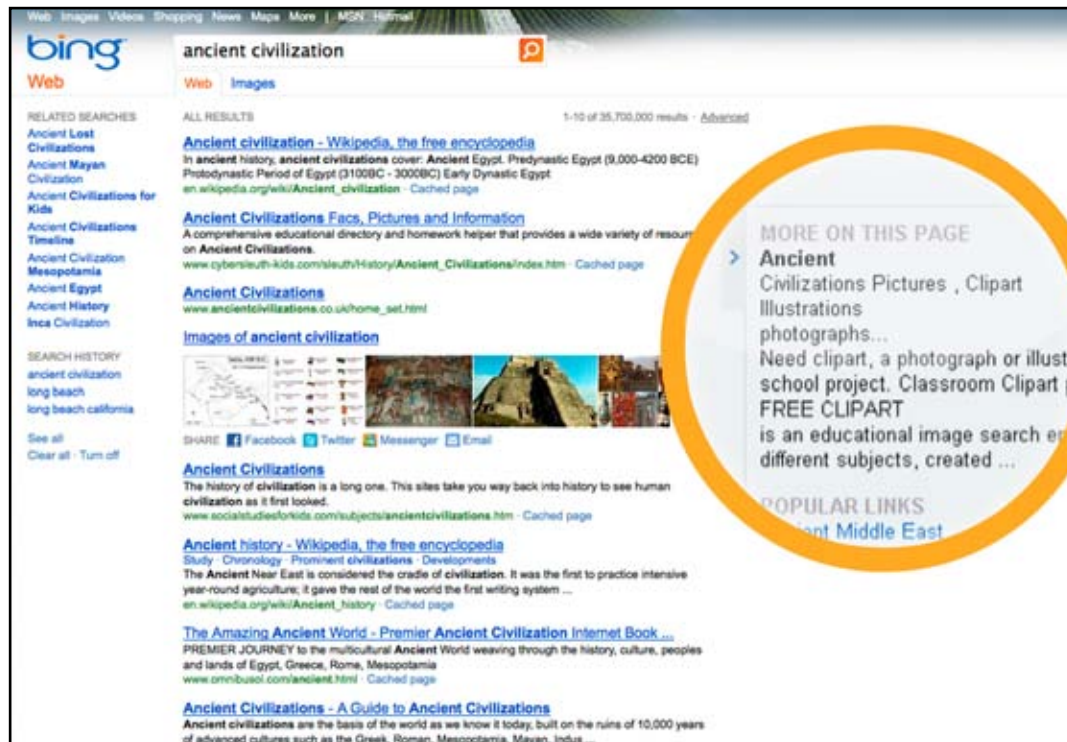
The components of the curriculum are:

- 1 Mechanics of searching
- 2 Validity and reliability
- 3 Citing web sources
- 4 Civil discourse
- 5 Plagiarism

Review the curriculum to see how you can integrate these valuable materials into your teaching. The curriculum is available at <http://www.microsoft.com/education/criticalthinking/>.



Essential Tools to Support and Develop New Web Research Skills



When you use hover preview, the Bing search results page displays a preview of webpage content.

To help students develop these new web research skills, we need to give them not only a curriculum that teaches these skills but also tools that specifically help promote these skills and critical thinking. A wide variety of digital tools is now available for efficiently collecting and storing information. Tools that help students learn how to become intelligent researchers, however, have to go beyond this by enabling them to think critically about the information they gather. Following are several examples of how certain tools support these new skills.

Search engine tools. Not all search providers are created equal. Yes, all search engines sort by relevance to the keyword one enters and do not discriminate among the sources they display. Some, however, like Bing, are *decision* engines: Their goal is to present relevant information, in context, so that you can complete a task or make a decision. Many Bing search features support the development of critical thinking skills. For example, Bing includes source filter tools on [video search result pages](#), so that users can decide whether they want to see videos from a news organization or a user-generated content site like YouTube, and a special [Visual Search](#) feature that enables users to visually sift through results before getting to the data behind the answers. The attention of Bing to visual presentation and clarity can also help students assess the search results. For example, when Bing returns a list of search results, it includes an arrow to the right of every listing and a flyout preview of further content from that webpage. Using this hover preview feature, you can quickly determine whether a source is relevant—without navigating away from the search results list.

Bing Search Features That Support and Develop Web Research Skills

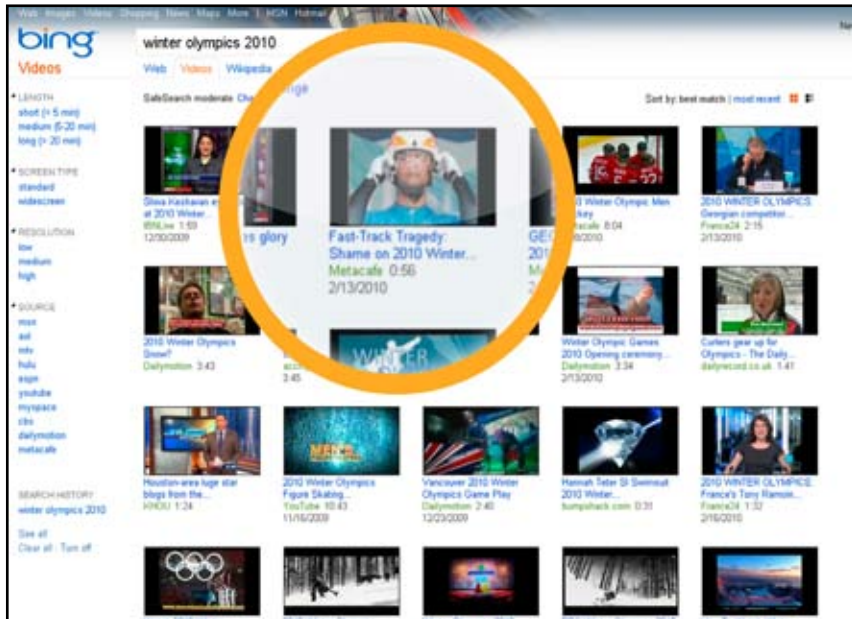
The screenshot shows a Bing search result for 'Periodic table'. The search bar at the top contains the text 'Periodic table'. Below the search bar, there are several filters and statistics: '118 Periodic table', '25 Most popular on Bing', '25 Top 25 in human body', '25 Top 25 in Earth's crust', '25 First discovered', '25 Newest', and '6 Noble gases'. The periodic table is displayed below, sorted by atomic number. A yellow circle highlights the Magnesium (Mg) element, which is selected. A hover preview for Magnesium is shown, displaying the following information: Symbol: Mg, State: Solid, Classification: Metal, Formation: Primordial, and Atomic weight: 24.305 g/mol. The preview also shows the element's position in the periodic table (No. 12).

With Visual Search, you can sort search results to find the kind of information you need, such as an interactive table or graph.

Bing is a decision engine that finds, organizes, and displays information in ways that enable students to search more intelligently and efficiently and help them become skilled information decision-makers.

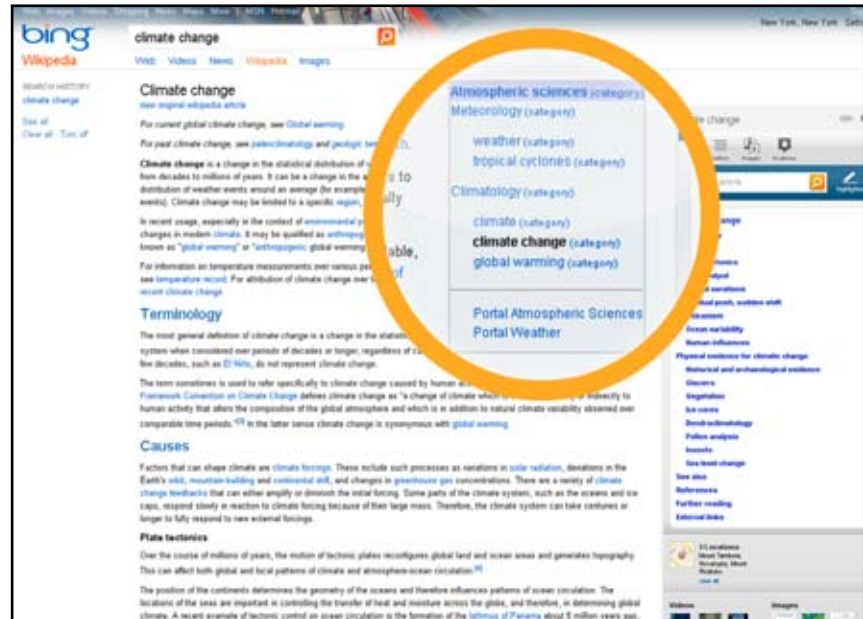
In addition to the hover preview feature, Bing provides other tools that support and develop web research skills:

- [Bing Help](#) (👉), located in the lower-right section of the page, provides a primer in web research. It explains how Bing searches and why a particular search wasn't successful, in addition to how to improve search results, customize searches, control search history, find specific kinds of information, and much more.
- When Bing returns results, it organizes them on the page so that you can find what you need faster. For example, when you search for information on *Abraham Lincoln*, the results appear conveniently sorted into categories, such as News about Lincoln, Kid Facts, Timelines, Speeches, Childhood, and Images of Lincoln.
- [Bing Search History](#) (👉), also known as Saved Searches, can also speed up research, especially when students are working as a team. Downloading the Silverlight™ component allows you to save searches, organize using folders, take notes, and share them with others in your Windows Live™ SkyDrive™ or on Facebook. History settings are very clearly marked, and the user can delete items or turn off tracking at any time. [Learn more about the Saved Searches feature](#) (👉).
- The [Visual Search](#) (👉) feature of Bing enables users to visually sift through results before getting to the data behind the answers. Using this feature to research the [Periodic Table](#) (👉), for example, displays the table so that you can click each element separately to find more information. Also, a regular Bing web search automatically returns one link with images related to your search.



You can use video search results pages to quickly identify the source of video content.

- On the [video search result pages](#), Bing includes source filter tools so that users can decide whether they want to see videos from a news organization or from a user-generated content site like YouTube.



Bing Reference search results highlight the natural language related to your search in Wikipedia articles.

- The Bing Reference feature makes use of natural language (also called “semantic search”) technologies to provide a different kind of search experience. Bing Reference displays a list or group of Wikipedia articles related to your search question, with the search terms highlighted in a way that shows you the relationships between the Wikipedia articles containing the search terms. As you skim through the results, you see how the search terms are presented, which can give you a more contextual understanding of the terms.
- Bing works as a dictionary, too. Type a word in the **Search** box, and Bing provides the definition from the Encarta® World English Dictionary.
- Bing even helps solve math problems. Type an equation, and Bing helps you solve it, with results provided by Wolfram|Alpha.






Note-taking tools. Microsoft Office OneNote enables students to gather multimedia information in one place and to save their information automatically. It also helps them find their information faster and organize their ideas, and it encourages them to work with their information in multiple ways to [match their learning style](#) ➤. It can even help to elicit new approaches in learning—from creating mind maps with drawing tools to working with flow charts and diagrams or learning with audio files. It also enables students to collaborate with one another on projects. A far cry from index cards and traditional outlines, OneNote helps students not only to gather sources but also to think with those sources in new ways. [Read more about OneNote](#) ➤, and browse through sample notebooks. [Download the OneNote Teacher Toolkit](#) ➤.

Research and reference features in Microsoft Office Word. The References tab in Office Word includes many tools that can help students find, cite, and manage quotes and other information properly and easily. The Search Libraries feature of the Insert Citation tool displays a Research pane, enabling students to search reference books and sites while working in Word, and the Add New Source feature lets them quickly enter all bibliographical information for the sources they find. They can use the Style tool to specify which citation style (out of 10 standard styles) Word uses to format the information, and they can use the Bibliography tool to generate a complete bibliography. [Read how to create a bibliography in Office Word](#) ➤. They can also browse all of their sources, checking for placeholders and cited sources, using Manage Sources. [Get help using the Reference tools in Office Word](#) ➤.

Academic search engines and reference sites. Certain search engines and websites perform a first step for students by winnowing out all information not relevant to academic research and returning only reliable results. On the [Microsoft Academic Search](#) ➤ site, for example, students can search by keyword for the most relevant and top-ranked papers by topic, by author, at conferences, and in journals. A search for top-ranked authors displays the number of citations each author has received, providing one indicator of the author's reliability. An author search shows the titles of journals the author has published in, providing an indicator of the author's expertise.



New tools for visualizing the web. Microsoft Live Labs™ is experimenting with [Pivot™](#) , a new way of collecting and interacting with web data that goes beyond the traditional search engine architecture. It displays information in innovative visual ways, uncovering hidden patterns of relatedness and association. Used as a complement to other web research tools, it may not only help reveal different sources but also spur students to make different connections among the information they gather and to find or create new ways to structure their ideas. [Download Pivot](#) , and check out the [Pivot Collection Gallery](#)  for examples, such as the Endangered Species or World Leaders collections.

Web research templates. Using templates as graphical organizers and checklists for web searches can reinforce the learning of the essential web literacy skills. Various checklists are available that are geared toward different levels of web research and different grade levels, in addition to different learning styles. Consult the list on the next page for forms that you can adopt as is, adapt for your class, or use as the inspiration to design your own forms customized to your students' needs.

Forms and Templates for Web Research Checklists

Elementary School

- You can use Microsoft Office Word to create your own simple table that guides your students through the process of collecting key information from a website: URL, type of webpage, date, author, and more. [Get help creating a quick table in Office Word](#).
- [Website Investigator](#). Designed by Marilyn Arnone and Ruth Small to help very young children make initial appraisals of websites they visit: Was the site interesting? Easy to navigate? Did it contain the information you need?
- Internet Detective's [QQuality Information CheckList](#) is a fun, colorful, highly visual, eight-item checklist for beginners.
- [Elementary CCs for Evaluating Internet Sites](#). A checklist of more than 22 questions to ask about a website.



Middle School and High School

- You can use Microsoft Office Word to create your own table in which students can enter information about a website and then add their comments and analysis. [Insert or create a table in Office Word](#). To teach students a different approach to thinking critically about website information, use the Drawing Canvas in Office Word to create a visual map of the webpage structure, which students can then use to enter information. [Get help using the Drawing Canvas](#).
- [University of Southern Maine's one page Checklist for Evaluating Web Resources](#). This handy checklist includes items related to the authority, scope, format and presentation, cost, and accessibility of web content.
- [Five Criteria for Evaluating Webpages](#) from Cornell University. This one-page checklist includes tips for interpreting the basics of accuracy, authority, objectivity, currency, and coverage of webpages.
- [Thinking Critically about World Wide Web Resources](#). From the UCLA Library, this well-designed set of questions about content and evaluation, source, date, structure, purpose, and references could serve as a thorough checklist.
- [Evaluating Webpages: Techniques to Apply & Questions to Ask](#). From U.C. Berkeley, the five questions of this clear, thorough, and concise tutorial on decoding a webpage both visually and mentally could easily be used as an evaluation checklist.
- [Thinking Critically about Web 2.0 and Beyond](#). The UCLA Library's list of questions for evaluating social networking sites, blogs, wikis, virtual worlds, mashups, file-sharing sites, and other social media would also make a helpful checklist.
- [Infofilter's website review sheet](#). From the University of Southern California, this sheet invites users to enter information about sites, including footnotes and other references.

3

Ideas for Teaching Web Research Skills and Critical Thinking in Grades K–12



Learning how to read a webpage is like learning how to read a book: Students have to learn the ABCs and basic rules of grammar before they can understand the difference between stories and other kinds of writing. Web research skills build on one another, so it is important to introduce students to them in a well-thought-out order. Before students can understand *bias*, for example, they need to know how to determine the author and sponsor of an article.

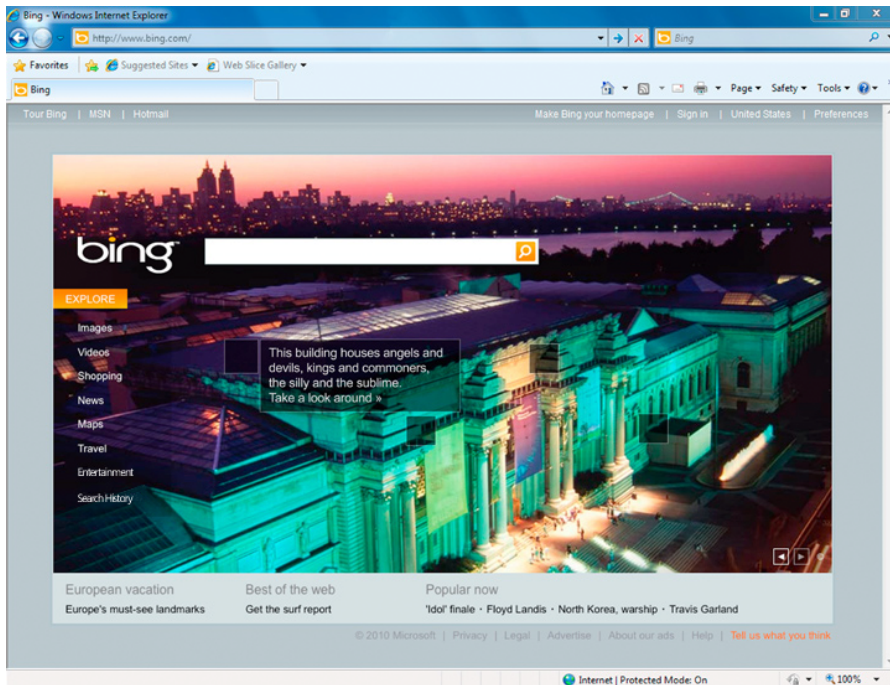


Developing web research skills, however, takes more than simply adding new skills to those they have already mastered. It's also important to introduce students to as many of the essential skills as you can, as early as possible, so they can begin practicing them right away and become familiar with the web decoding process. Then, as their minds develop, they can progress from basic to more sophisticated and challenging applications of those skills.

Following are some suggestions to get you started as you help your students learn the new web literacy skills they need. Also, to ensure that you cover all the essential skills and help students develop greater proficiency as they mature, take advantage of one of the new web literacy and critical thinking curricula that have recently become available.

- [21st Century Information Fluency](#) includes a comprehensive set of self-paced courses and themed kits to teach and learn information fluency.
- [Internet Detective](#) provides interactive tutorials on evaluating the quality of web sources.
- [Wolfgram Memorial Library](#) offers “Evaluating Webpages”—tutorials and exercises on recognizing the kinds and quality of web information.
- At the [FactCheckED.org](#) site, you can find lesson plans that teach how to analyze arguments and how to build better arguments.
- For a description of the new Microsoft Education Critical Thinking Curriculum, see [Chapter 2 in this e-book](#).

Kindergarten (5–6 Years Old)



Hotspots on the Bing home page help people discover new information about the subject of the image.

If students are using the Internet (and many are—as early as preschool), it's not too early to introduce them to the basics of web research and to start them thinking critically about what they're doing. Critical thinking is a habit; the sooner they learn it, the better researchers and students they will become as their minds develop. There are many ways they can be exposed to these skills and the habit of skepticism, while still having fun. Try the following activities, for example:

How Many Questions Can You Ask? Start developing and encouraging students' questioning muscles.

- Show them a webpage, and see how many questions they can ask about the information on the page. Have them think backwards from what they want to know about the information to how to ask the question. After you have a list of their questions, group the questions into types (questions about the source, the purpose, and the kind of information, for example). Then, ask students to identify the questions that are “good” questions, that is, which questions make you think harder about the information?
- Use the photograph on the [Bing home page](#) as a question-generator at the start of your class day. Students can ask what the image is, where it is, or why they focus more on one part of the photo than on another. To find the identifying information for the image, hover over the copyright mark © in the lower-right section of the photo. You can also use the beginning, intermediate, and advanced questions that accompany each day's photograph to help build your students' critical thinking skills and to give them practice searching the web for different kinds of information in different ways.

Dissect a Webpage—Dead or Alive. Choose a webpage (a live one or one you have designed) that will interest your students (for example, the [Save the Manatee Club page](#)), and display it for the class. Tell them you are all going to be doctors who are dissecting the body and brain of the page to see how old it is and how it works. First, help them figure out how old the body is. When was it born? Where's the date? Next, take the page apart, piece by piece, starting with the head (title and author), moving to the main body (text and images), the legs (related links and information), the feet (copyright), and ending with the brain (the URL). As you find each part, remove it from the page and place it in a Word document. This will help them visualize all the separate parts. If the page is missing a part, say so, and note that in your Word document, like a good scientist. When you have finished your dissection, have the students help you put each piece you removed back where it belongs on the page.

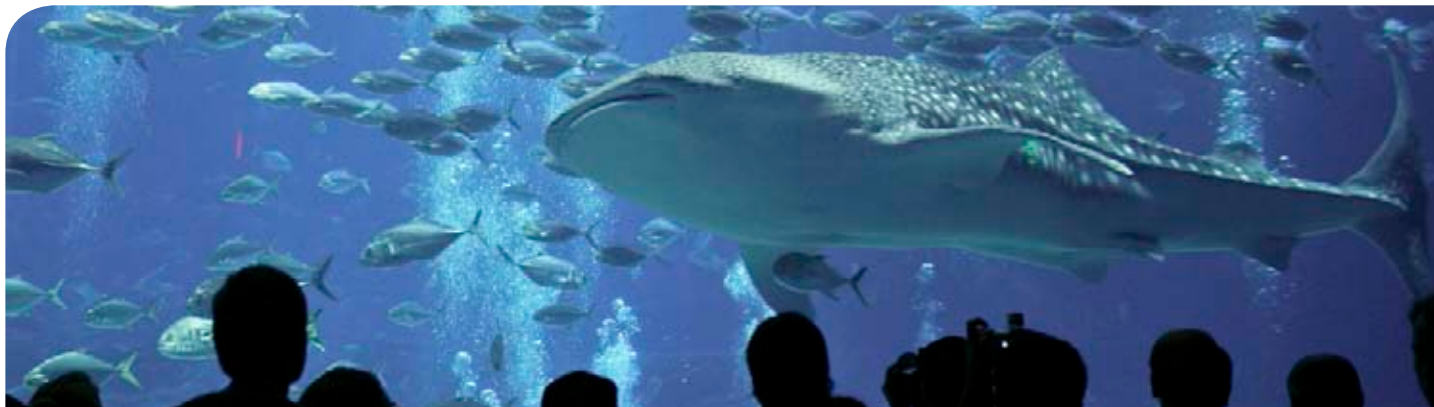
Dissect a Web Brain. Have students look briefly at several different yet related pages and then look carefully at the URL for each page, dissecting each into its separate parts. For example, you might use several sites related to manatees to help students see and understand the difference between an .edu page, an .org page, a .net page, a .gov or leg.state.us page, and a .com or commercial page. They don't need to dissect the title information just yet, only the page designation.

- Save the Manatees Club: [http://, www., savethemanatee, .org/, manfacts.htm](http://www.savethemanatee.org/manfacts.htm)
- Sea Grant, Florida: Manatees: [http://, stjohns.ifas.ufl, .edu/, Sea/manatees.html](http://stjohns.ifas.ufl.edu/Sea/manatees.html)
- Florida Statutes on Manatees: [http://www, .leg.state.fl.us/statutes/index.cfm?StatuteYear=2009&AppMode=Display_Results&Mode=Search%2520Statutes&Submenu=2&Tab=statutes&Search_String=manatee](http://www.leg.state.fl.us/statutes/index.cfm?StatuteYear=2009&AppMode=Display_Results&Mode=Search%2520Statutes&Submenu=2&Tab=statutes&Search_String=manatee)
- Manatees: [http://, www., manatees, .net/](http://www.manatees.net/) (a site sponsored by an animal-rights organization)
- Swim with the Manatees Orlando Tours: [http://www.orlando-tours, .com/ ?event=offer.detail&offerId=10659&startDate=04/01/2010 &endDate=04/30/2010](http://www.orlando-tours.com/?event=offer.detail&offerId=10659&startDate=04/01/2010&endDate=04/30/2010)

When you have finished with the tour of page types, put several other URLs on the board and ask your students to guess what kind of page each will show and what kinds of content they will find on the page. They should be able to distinguish a commercial from a non-commercial site, for example. This will help with predictive thinking, as well.

Play detective, and hunt for clues. Give students a webpage tied to one of your units and a handout that lists all the clues they have to find: the date, the author, the publisher, the URL, and the kind of site it is (such as .edu or .com). You can make this a race to find all the clues for one page, or you can give students a list of 10 URLs and see who can fill in the most clues in 10 minutes.

Weed Your Garden. Give students a topic to find out about. Tell them they have to find five good sources that they can use to give a report to the class. Explain that a search engine works by crawling through information and picking up everything that looks like it fits. That means that it brings up a lot of information, but much of it may not be useful to you. These may be weeds instead of the kind of plants that students want to grow. Tell the students that they are going to plant some seeds for their garden by typing their topic into a search engine. Then, on the search engine results page, have them identify at least five links which are weeds and five which are good plants that they want to tend.





Find Out How Web Literate Your Students Are



Not sure where to begin with your students? Want to gauge their web research skill level at the beginning of the year or assess their progress during the year? Or maybe you just want to show them how much fun web literacy and critical thinking can be? Try these activities:

- Give your students [the CRAP Test](#) ▶. Hand out a list of five websites with this quick checklist for web source Currency, Reliability, Authority, and Purpose/Point of view, and see how skilled they are at evaluating sources.
- Give your students the [Information Literacy quiz](#) ▶ at the November Learning site to see if they are somewhat savvy, moderately savvy, or downright web nerds.
- Have them take the “Hoax/Not a Hoax” challenge. Dr. Mary Ann Bell’s site, [Teaching webpage evaluation using hoax sites](#) ▶, is a good source for finding hoax sites to use as challenges.
- Have students take the “[Fake or Foto](#)” challenge ▶ to see how skilled they are in detecting manipulation of digital images.

Elementary School (6–11 Years Old)



Beginner

- Reinforce the basic skills and activities listed in the ["Kindergarten" section](#) >.
- Learn basic Internet vocabulary at the [ISTE site](#) >. Introduce and practice using different kinds of web sources. Review the differences between commercial and non-commercial sites and the different web addresses (like .edu or .org). Add to this an introduction to social media sites. In the same way that you help them understand the difference between fiction and non-fiction or between biographies and diaries, help your students begin to see the differences between news articles on the web, discussion groups, and marketing copy.
- Teach them basic Internet safety across all forms of communication on the web. A great source to use is [Safety and Dangers on the Web: Don't Let the Web Catch You](#) >. It's a set of explanations and exercises created by elementary school students for students their own age.
- Have students learn basic fact-checking by verifying information in reference tools.

Intermediate

- Encourage your students to familiarize themselves with the tools for evaluating the credibility and reliability of websites. A good place to begin is the [ISTE list of tools](#) >, which includes sites that help you confirm or deny hoaxes, determine audiences, check facts, determine the accuracy of politicians' statements, find connections between companies and authors, evaluate blogs, and more.
- Help the students to learn the basics of evaluating photos they find on the web. Have the images been digitally altered in any way? Does the alteration change the meaning of the image? [Photographic Truth in the Digital Era](#) > is a great place to begin looking at manipulation of images on the Internet. It includes examples of appropriate and inappropriate alteration, discussion questions, activities, and links to more resources.
- Have them sort through a carefully selected set of websites to determine which ones are valid and which are hoaxes. You can find lists of good sites for teaching the differences between them to elementary school students at [Teaching webpage evaluation using hoax sites](#) >.

Advanced

- **Lost and Found.** To whom do these words belong? Give students a webpage that has an unattributed quote or a quote for which no citation is given. Have them track down who said it and the original reference and citation, along with the original wording. Have them compare the wording in the article to the original. Internet quotes are often sloppy, more like paraphrases than actual quotations.



Middle School (12–13 Years Old)



Beginner

- Reinforce the basic skills and activities listed in all of the grade-level sections.
- Have students play the Internet version of the game “Telephone,” in which one person whispers a sentence to the next, who in turn whispers it to another, with the end result usually being wildly different from the original sentence. Give students a list of quotations, famous or obscure, and have them track down how the quotation passes from one web source to another or have them collect as many variations on the “quotation” as they can.

Intermediate

- Have students evaluate more challenging hoax sites.
- Show students how to verify an author’s credibility.
- Have students learn how to check facts by triangulation.
- Introduce students to bias/objectivity by analyzing the language of deception. Try using [this tutorial](#) ► to teach students how to spot emotive language that is used to deceive.
- Discuss the concept of *logical fallacies* with your students. Read [a list of common fallacies](#) ►.
- Introduce students to University of Ottawa Professor Roland Paris’s [C.L.E.A.R. model for analyzing arguments](#) ► in a text, website, or video: **C**laims the author is making; **L**ogical structure of the argument (Does it make sense or is author using fallacies?); **E**vidence provided; **A**ssumptions the author makes; **A**lternative arguments (Be a “devil’s advocate,” and pretend that you agree with the author’s assumptions and evidence but disagree with his or her claims).

Advanced

- Have students go on a “web bias hunt.”
 - 1 First, have them gather examples of:
 - As many different kinds of bias as they can find.
 - Obvious bias.
 - Extremely well-hidden bias.
 - 2 Then, using the specific examples they gathered, have them write a set of “tell-tale clues” to look for when determining bias.



High School (14–18 Years Old)



Beginner

- Reinforce the basic skills and activities listed in all the grade-level sections already listed.
- Try to stump students by giving them extremely difficult URLs or websites, and see who can find the hidden author or publisher.

Intermediate

- Have students design their own web source evaluation checklist. Ask them to include the skills they think are essential and place them in the order they think is most helpful or efficient.
- “Hoax” challenge. Working in teams, students generate a list of 10 websites that other students and the teacher have to correctly identify as valid sites or hoaxes. The team that fools the most people wins. For example, [gatt.org](#) is one of most sophisticated hoaxes on the Internet. Have students analyze that site and others and come up with their own checklist for how to determine if a site is valid or a hoax.
- Give students much more sophisticated practice in detecting bias/objectivity. For example, have them write copy for a webpage that has a clear but hidden bias to see how well they can hide it and how astute their peers are in finding it.
- Give them practice in validating their point of view from multiple sources.
- Expand their awareness of the logical fallacies. Have students read Max Shulman’s short story “[Love Is a Fallacy](#),” a brief but entertaining story about the students’ conversations (as told by the character Dobie Gillis). The story demonstrates basic logical fallacies, such as *ad hominem* and “poisoning the wells,” in a way that students are apt to remember. The site that contains the entire short story links to pages that include exercises for restating the fallacies, giving examples, and other activities.
- Have students build their [argument mapping skills](#). Use the Austhink argument mapping tutorials to give them practice mapping multi-reason, multilayered, and complex arguments.

Advanced

- Get a [comprehensive list of logical fallacies](#) authors use, and see how many examples of them that students can find in web content.
- Have students study the history of logic and logical fallacies. The [Fallacy Files](#) site lists many resources, both educational and entertaining, as a guide.
- Ask students to work in teams to construct arguments that contain well-concealed fallacies and then to identify the fallacies in the arguments of other teams. Have them make a list of which fallacies are easiest to spot and which are most likely to fool readers, and why.



Resources



"...Since we can't know what knowledge will be most needed in the future, it is senseless to try to teach it in advance. Instead, we should try to turn out people who love learning so much and learn so well that they will be able to learn whatever needs to be learned."

— JOHN HOLT, 21ST CENTURY C.E.

Overviews

- [Crap Detection 101](#) ➤. Succinct review of the challenges of web research and the new tools needed to meet them.
- [Kathy Schrock's Guide for Educators](#) ➤. Three useful resource pages: [basic information about the Internet, HTML tools, and graphics](#) ➤; [search engines, metasearch engines, and the invisible web](#) ➤; and [Internet subject directories](#) ➤.
- ["Evaluating Quality on the Net"](#) ➤. A speech by Hope N. Tillman discussing the relationship of Internet evaluation criteria to evaluation of traditional materials, how to assess Internet evaluation materials, and more.

Decoding and Evaluating Webpages

- [November Learning: Information Literacy Resources](#) ➤. A list of websites for students to evaluate, along with instructions for how to read a web address, find the publisher and history of sites, and check external links.
- [Evaluating Information Found on the Internet](#) ➤. Clear instructions for evaluating authors, publishers, bias, referrals to other sources, verifiability, currency, propaganda, the mechanics of URLs, and other aspects of the web.
- [Evaluating Webpages: Techniques to Apply & Questions to Ask](#) ➤. An exceptionally clear, thorough, and concise introduction to how to decode a webpage, both visually and mentally.
- [Kathy Schrock's Guide for Educators: Teacher Helpers—Critical Evaluation page](#) ➤. Links to the critical evaluation surveys she designed for elementary, middle, and high school, plus a list of sites to help teach evaluation of web sources.
- [Thinking Critically about Web 2.0 and Beyond](#) ➤. The UCLA Library's list of questions for evaluating social networking sites, blogs, wikis, virtual worlds, mashups, file-sharing sites, and other social media.
- [Media Awareness Network's Photographic Truth in the Digital Era](#) ➤. A great primer on how to determine the credibility of photographs.
- [Ethics in the Age of Digital Photography](#) ➤. A more advanced look at credibility, ethics versus taste, and the manipulation of digital images.

Curricula and Lesson Plans

- [Microsoft Critical Thinking and Web Research Curriculum](#) ➤. Organized by beginner, intermediate, and advanced; applicable across subjects.
- [21st-Century Information Fluency](#) ➤. Includes the Digital Information Fluency Model.
- [21st-Century Literacies: Information Literacy Curriculum](#) ➤. Lesson plans for grades K–12.
- [FactCheckED.org](#) ➤. Lesson plans to teach informal logic and critical thinking.
- [Internet Detective. Interactive tutorials for evaluating the quality of Internet information](#) ➤.
- [Wolfgram Memorial Library: Evaluating Webpages](#) ➤. Tutorials and exercises on recognizing the kinds and quality of web information.
- [The Common Sense Digital Literacy and Citizenship Curriculum](#) ➤. Designed to teach 5th–8th graders ethical behavior in a digital world and mapped to ISTE Digital Citizenship standards. Lesson plans use interactive content and role-play to teach living a responsible digital life, managing privacy online, building respectful relationships online, expressing yourself while protecting your reputation, and respecting creative work.
- [NewsTrust for teachers](#) ➤. Resources for teaching students how to recognize good journalism. Includes overviews, tutorials on reviewing news articles, and teacher guides. The [Education Resources page](#) ➤ links to lesson plans, journalism codes of ethics, organizations, journals, and many more resources for the classroom.

Discussion Groups

- [ISTE Critical Thinking Discussion Group](#) ➤, with Howard Rheingold.
- [UBC Wiki](#) ➤. A discussion forum of the University of British Columbia Support Critical Thinking Online site.
- [Critical Thinking Forum: For Argument's Sake](#) ➤. Lists the latest discussions by topic (such as corroboration, counter-assertion, and how critical thinking improves results).
- [Student Involvement and Critical Thinking](#) ➤. Adult literacy education wiki.
- [Argumap](#) ➤. An e-mail discussion forum for people interested in the theory and practice of argument mapping.

Critical Thinking, Logic, and Fallacies

- [Information Skills Rating Scale](#) ➤. A checklist to evaluate the research or critical thinking skills of students. Includes questions about students' questioning, planning, gathering, sorting, synthesizing, evaluating, and reporting skills.
- [ISTE Critical Thinking Compendium](#) ➤. A wiki that maintains a list of world-class resources for teaching critical thinking and Internet literacies. Members can join Howard Rheingold and other educators and add to the list of tools and vocabulary.
- [Foundation for Critical Thinking](#) ➤ and the [Center for Critical Thinking and Moral Critique](#) ➤. Online courses, definitions, links to critical thinking in the news, in addition to a link to their own [Critical Thinking YouTube channel](#) ➤.
- [Thinking Critically about World Wide Web Resources](#) ➤. Comprehensive help for developing web research skills: questions for evaluating webpages; resources for evaluating social networking sites; links to research aids, such as frequently used databases, e-resources, and research help; and information on services, such as access to the UCLA Library for AP high-school students.
- [UBC Wiki: Supporting Critical Thinking Online](#) ➤. Thorough and well-organized wiki designed for educators. Includes learning objectives for critical thinking, readings, learning activities, assessment materials, and guidance for online discussions (for example, how to ask good questions).
- [Critical Thinking on the Web](#) ➤. Offers definitions of critical thinking and links to quality resources on topics such as argument mapping, assessment, cognitive biases, critical reading and writing, experts and expertise, and much more.
- [The Fallacy Files](#) ➤. Named one of the Top Ten by [Austhink: Critical Thinking on the Web](#) ➤ and one of the [Top Rationality blogs](#) ➤ by *The Daily Reviewer*.

Hoaxes

- [Encyclopedia of Claims, Frauds, and Hoaxes of the Occult and Supernatural](#) ➤. Alphabetical list of hoaxes that can be used as a quick reference check.
- [Teaching Webpage evaluation using hoax sites](#) ➤. A good source for finding hoax sites to use as examples.
- [November Learning](#) ➤. Provides a list of fun and challenging hoax sites that are especially good to use with students.
- [Museum of Hoaxes](#) ➤. An archive of hundreds of articles on hoaxes, from the Middle Ages to the present Digital Age.
- [Snopes.com](#) ➤. Debunks urban legends, common fallacies, and other deceptions. You can search by topic.

Online Safety and Education

- [Microsoft Online Safety and Privacy Education](#) ➤ provides comprehensive help for protecting families, computers, and communities, including tools and tips for fraud protection and data protection, plus minimizing social networking risks.



5

Conclusion





*"You cannot step twice into the same river,
for other waters are continually flowing in."*

— HERACLITUS, ca. 500 B.C.E.

The Internet is a river of information that seems to grow wider and flow faster every day. Web content, including this e-book, reflects this ongoing process of expansion and change. To stay current, you have to intentionally keep moving along with it. Online web literacy discussions are great places to find the latest tips, techniques, examples, and strategies for teaching students essential web literacy skills that help them develop as critical thinkers capable of engaging the world intelligently and creatively. The [ISTE Critical Thinking Discussion Group](#) , with Howard Rheingold, is just one example. You can find others in our "[Resources](#)"  section and by researching the web. Join a discussion today, and become part of the digital revolution.

"Education is the most powerful weapon which you can use to change the world."

— NELSON MANDELA, 21ST CENTURY C.E.

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