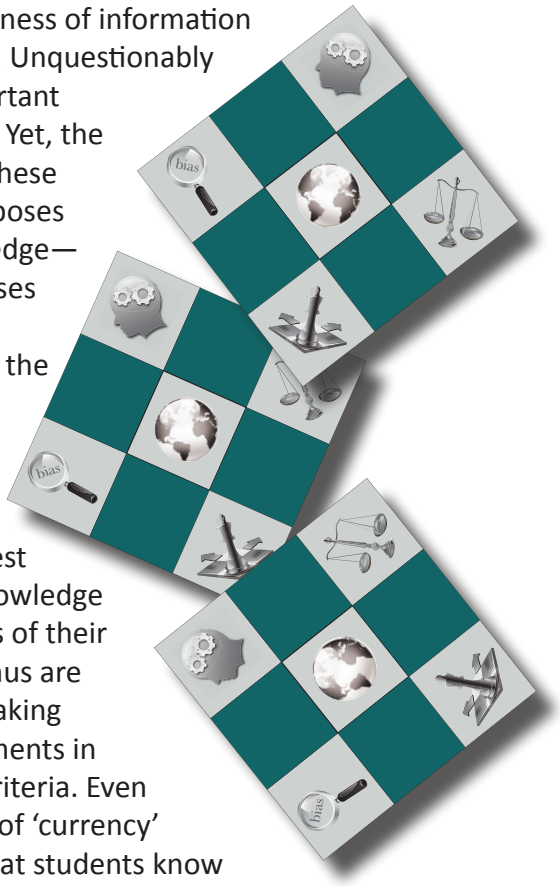
Making critical thinking an integral part of electronic research

— Roland Case, Executive director, The Critical Thinking Consortium

The call to help students think critically about the content and use of electronic information technologies is a common educational refrain. Regrettably this call has not been answered adequately. This shortfall occurs even in the area of evaluating the credibility of website information—an area that is the focus of most of the work on supporting critical thinking about the Internet. Not only are many efforts in this area inadequate, but other aspects of electronic information and research—from focussing an inquiry to communicating findings—receive even less critical attention. In this article I highlight inadequacies in common teaching practices around evaluating the credibility of Internet sources. I also consider in passing other aspects of electronic research that should be the focus of students' critical reflection. On a more positive note, I offer ideas developed by teacher-librarians working with The Critical Thinking Consortium (TC^2) that have helped students think more critically about various aspects of electronic research, but especially about the evaluation of information.

Critical evaluation of Internet information

It is not surprising that the predominant efforts to support students in thinking critically about electronic research have focused on evaluating the credibility of Internet information. The dubious reliability of this source has been widely documented and only heightens the importance of adequately preparing students to make sound judgments about the information they obtain. The tendency has been to provide evaluation checklists for student use in judging the credibility of information. Although this is a potentially useful strategy, many of the checklists, developed initially for university audiences, are inappropriate for elementary and secondary students. For example, checklists often invite students to judge the accuracy, currency and comprehensiveness of information found on a site. Unquestionably these are important considerations. Yet, the application of these criteria presupposes student knowledge—and in some cases considerable knowledge—of the research topic. Unfortunately, students typically lack even modest background knowledge about the focus of their research and thus are incapable of making informed judgments in light of these criteria. Even an assessment of 'currency' presupposes that students know about developments in the field since the work was published. In the absence of this background knowledge, student typically base their assessment of currency on the publication date. This is a highly unreliable indicator—a 50-year-old article on DNA or gravitational physics may be far less dated than a one-year-old article on Iraqi governance



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or contagious diseases in Toronto. In the language of the TC^2 model of critical thinking, students lack the requisite background knowledge—one of five types of intellectual "tools" involved in thinking critically.

The absence of relevant critical thinking vocabulary—another of the tools that many students lack—further undermines their ability to effectively apply evaluation checklists. For example, students are often asked to detect whether or not a website is biased without being helped to develop an adequate understanding of the concept. Many students incorrectly believe that any expression of an opinion is evidence of a bias and, conversely, that any site which contains only factual statements is necessarily without bias. Clearly students need to understand the concepts that are central to thinking critically about Internet credibility, before they can make informed judgments.

Students' acquisition of yet another requisite tool is inadequate because website evaluations typically occur as isolated assignments and not as matters of routine. In fact, it is becoming increasingly common to pre-screen sources (as is done with WebQuest) to avoid having students assess sites for themselves. This well-intended practice may actually lull students into a false sense of trust, the effect of which is to undermine what we regard as another important tool of a good critical thinker, namely the possession of a questioning attitude or "habit of mind." Rather than screening sites, we will have greater success in nurturing a habit of critical scrutiny in our students if we consistently insert dubious Internet sites into our reference lists. Only if students know to expect erroneous sources will they develop vigilance in searching them out. Another popular but potentially counterproductive practice is to invite students to offer "yes or no" assessments to questions, such as "Is the information complete?" or "Are sources for factual information clearly listed?" In our experience this "all or nothing" approach encourages simplistic, one-sided conclusions. Instead, we should nurture "tolerance for ambiguity," defined as a willingness to work with nuanced, not black-or-white answers.

Teaching the tools

As the above discussion illustrates, we are concerned that many of the essential tools needed to prepare students to think critically about Internet use are not adequately taught. As illustrated in the chart of sample tools, students' ability to think critically about every aspect of electronic research, not simply evaluation of information sources, requires the possession of different types of tools: criteria for judgment, background knowledge, critical thinking vocabulary, habits of mind and thinking strategies.

Sample tools for thinking critically about electronic research

Background Knowledge - the information about a topic required for thoughtful reflection

Students cannot think deeply about a topic or technology if they know little about it. Two questions to ask in developing this tool are:

- What background knowledge do students need for them to make a well-informed judgment on the matter before them?
- How can students be assisted in acquiring this information in a meaningful manner?

Criteria for Judgment - the criteria or grounds for deciding which of the options is the most sensible or appropriate

Critical thinking is essentially a matter of judging which alternative is most sensible or reasonable. All judgments are based on criteria of some sort or another. Although students will not always agree on identical criteria, they need help in thinking more carefully about the criteria to use when judging various alternatives.

- Are my research questions focussed and relevant?
- Are the search parameters restrictive and sufficiently inclusive?
- Are our sources reliable?
- Is my interpretation plausible?
- Is the website appealing and functional?

Critical Thinking Vocabulary - the range of concepts and distinctions that are helpful when thinking critically

Students require the vocabulary or set of concepts that permit them to make important distinctions among the

different issues and tasks facing them. These include conceptual distinctions such as:

• bias and point of view
• various informal fallacies (e.g., false appeal to authority)
• primary and secondary source
• evidence and implication

Thinking Strategies - the repertoire of procedures, models, organizing devices and hints that may be useful when thinking through a critical thinking problem

Although critical thinking is never simply a matter of following certain procedures or steps, there are strategies that are useful for guiding performance when thinking critically:

• Research models: Are there steps or procedures to follow that would guide students through the factors they should consider?
• Search strategies: What techniques and hints might help students conduct more effective searches?
• Information organization: Would a graphic organizer (e.g., webbing diagrams, Euler diagrams, "pro and con" charts) be useful in representing student knowledge?

Habits of Mind - the values and attitudes of a careful and conscientious thinker

Being able to apply criteria and use strategies is of little value unless students also have the habits of mind of a thoughtful person. These include:

• Open-minded: Are students willing to withhold judgment when warranted? Are they willing to consider evidence against their view and to revise their view should the evidence warrant it?
• Tolerance for ambiguity: Are students accepting of answers that are not black-or-white?
• Inquiring or "critical" attitude: Are students inclined to question the clarity of and support for claims and to hold justified beliefs and values?
• Intellectual work ethic: Are students willing to expend the effort required to complete the thinking tasks competently?

In our approach, we consider the range of tools that students will need for the task and assist students in acquiring them. For example, we do not presume that students will understand all the criteria and vocabulary for evaluating information and so would teach these tools through a practice activity, such as the one found in the chart "How reliable and why?" Notice also in this example our use of a rating scale. In moving students away from a forced dichotomy, we hope to encourage a more nuanced assessment and thereby reinforce tolerance for ambiguity.

We would use several approaches to ensure that students have the requisite background knowledge to competently apply the criteria for evaluating information sources. The most obvious although not necessarily the easiest method is to provide students with pre-reading containing the contextual information they will require. Another strategy is to invite students to make relative assessments of the credibility of two or three sites (students would judge whether each site is more/less current or comprehensive than the others). This kind of comparative assessment requires less background knowledge than is needed to judge how current or comprehensive a site is in absolute terms. Another strategy is to teach students to assess the credibility of sites using "non-substantive" criteria—that is, criteria that do not require knowledge of the subject matter. In the chart reproduced on the next page, students consider a set of four "circumstantial" criteria (credentials of the author, care in preparation, type of site sponsorship, trail of evidence) that can be competently applied even if students know very little about the specific topic. Other notable features of this evaluation chart are the expectation that students provide reasons for and against their assessment on each criterion and the use of two critical thinking concepts—evidence and implications. Students are aided in probing more deeply into the credibility of each site by inviting them to distinguish "evidence" found on a site (e.g., the author has a Ph.D. from Harvard) from the possible and potentially competing "implications" that the evidence may have for the site's credibility (e.g., a Harvard Ph.D. may mean the author knows a lot about the topic; it may also suggest that the site has an American perspective).
As the term implies, nurturing "habits" of mind requires ongoing and persistent opportunities for students to engage in critical scrutiny. Because of the demands on teachers to "cover" the curriculum, Internet use must be embedded into the teaching of subject matter

and should not be tied exclusively to large-scale (and therefore time consuming) independent research projects. We try to offer instruction on evaluation of Internet sources or for that matter on other steps in the research process as mini-lessons integrated into content instruction. For example, in one of our resources, students add to their knowledge of the Canadian North as they learn the tools for framing thoughtful questions of an e-mail pal. So too, students learn to think critically about information needs as they undertake a mini-project on space exploration.

Two primary teachers using our model helped their grade two and three classes think critically about web design while integrating curriculum outcomes from four subjects (see bibliography for a further description of this project). Prior to creating a class website to publish their own written work, the teachers invited students to develop criteria for a good website by analyzing three toy manufacturers' sites—Beanie Baby (www.ty.com), Barbie (www.barbie.com and Tonka (www.tonka.com) and two educational sites for young children —"yucky" facts about the human body (www.yucky.com) and the "kid's" corner of the National Geographic website (www.nationalgeographic.com/kids). After much thoughtful discussion, the upshot of their comparative analysis was a list of student-developed criteria:

- has an interesting subject
- can be enjoyed by girls and boys
- is full of colour
- is informative
- is not slowed down by too many pictures and graphics

Using these criteria as the foundation for decision making, each class negotiated the design and development of its site.

Because of factors such as limited access to equipment, time constraints and unpredictable results, it is often impractical to expect students to evaluate multiple sources of information gathered from open-ended searches. As the previous primary example suggests, it is often more efficient for the teacher to select a handful of websites for comparative assessment. For the reasons suggested earlier, we regularly include flawed sites so that students develop the habit of critical scrutiny. Although flawed sites are available on the Internet, it is unrealistic to expect age-appropriate sites on a wide range of curricular topics. (Amusing but effective examples of flawed websites on cloning that we have used with our students can be found at "Clones-R-Us" http:/www.d-b.net/dti/ and "How to Clone a Human" http://www.biofact.com/cloning/human.html). A more reliable approach is to accumulate sets of key sites on various curricular topics and deliberately doctor (or invite students to doctor) one site in each set so that it is no longer reliable. Initially, make the flaws very obvious, but with older students the flaws can be increasingly subtle. In our experiences, students enjoy finding the "fraud" and typically examine the documents more closely than they would otherwise.

Although there is much more to be said on the issue, I have endeavoured to illustrate the important need for a more systematic and integrated approach to preparing students to think critically about electronic information and research. Our group believes that the key to greater progress towards this goal is the careful identification and deliberate instruction in the requisite tools for each task in the research process.

How reliable and why?

How reliable is each source for the research topic?	Reliability rating of source	Reasons for rating
Research topic: Lung cancer Source of information: A website created by the tobacco industry	low high 0 1 2 3 4 5	
Research topic: University requirements in preparation for attending school next fall Source of information: A website created in 1994	low high 0 1 2 3 4 5	
Research topic: Canada's Olympians Source of information: A website created by the Canadian Olympic Association	low high 0 1 2 3 4 5	
Research topic: The Industrial Revolution Source of information: A website created by a Grade 7 class	low high 0 1 2 3 4 5	
Research topic: What type of car to purchase Source of information: A website created by Nissan.	low high 0 1 2 3 4 5	

	Reasons for confidence		Reasons for doubting	
	Evidence from site	*Implications for believability*	*Evidence from site*	*Implications for believability*
Authorship What do we know of the creators of the site that might affect the believability of its contents?				
Sponsorship What do we know of the individual(s) or group(s) who sponsored the site that might affect the believability of its contents?				
Sources of ideas What do we know about how information was obtained and verified that might affect the believability of its contents?				
Indicators of care Does the site's presentation style, tone and format provide clues about the believability of its contents?				

References

Thinking Critically About the Internet: Surfing the Net in the Primary Grades
Rempel, K. & Brunner, S. (Spring 2001). *Primary Leadership* 4(1), 56-59 (special "Critical Thinking" issue)