Critical Thinking in the Information Age:
How the Internet Is Shaping the Way Students Think

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Abstract

In the last 15 years, the Internet has revolutionized our traditional modes for information access. This recent period of evolution in information accessibility has been dubbed the "Information Age". The transition from the library, a physical center to store and locate information, to the Internet, a virtual space for information storage, has given us instantaneous access to more information than a network of every library in the world could amass. So what does this new access to information mean for Internet users of the Information Age? Peter Norvig, Director of Research at Google Inc., would have you believe that it makes us better thinkers. In a *New York Times Upfront* article presenting a debate between Norvig and Nicholas Carr, author of *The Shallows: What the Internet is Doing to Our Brains*, Norvig states, "Just as a car allows us to move faster and a telescope allows us to see farther, access to the Internet's information lets us think better and faster" ("Google" 1). In truth, access to the Internet's information does not necessarily let us *think* better and faster; instead it allows us to retrieve information better and faster. As Albert Einstein famously quoted, "Information is not knowledge."

It is fairly safe to state that as academics we have an inherent desire to be informed. In our quest to become informed, we are exposed to different perspectives that help us gain knowledge. However, *access* to information, no matter how quick or expansive, does not induce knowledge: It is in understanding, interpreting, and evaluating the information we access that allows us to become better and faster thinkers. Thinking critically stretches far beyond brainless fact checking. In this respect, information and knowledge are correlative, not causal. For example, contemplate the different results for the following two separate search engine queries: (1) How many legal executions

occurred by death penalty in Texas in 2008, and (2) Is the death penalty effective? While the first answer is static and factual, the answer is simply 18 executions by death penalty, the second answer is entirely subjective and requires substantial critical thinking. We certainly require accurate information to make informed decisions, but if we cannot harness effective critical thinking skills, information itself is useless.

In order to further develop our skills in critical thinking, we must understand the different ways in which we think. The human thought process is often broken down into two modes of thought: (1) creative thinking, and (2) critical thinking. Creative thinking is the generation of novel and abstract ideas. In his article *Gifted Education: Thinking (With Help From Aristotle) About Critical Thinking,* David A. White, Ph.D., describes critical thinking as a process that "aims at understanding, interpreting and evaluating information that already exists" (14). In the evolution of humankind, both modes of thought have transformed and progressed with the development of new technologies. While innovations in technology have been credited with sparking the production of creative thought, there has been much criticism regarding the affects of technology on critical thinking abilities. Although scientists often dismiss these criticisms as overly cynical misapprehensions, it is important for the scientific community to explore the Internet's effects on our critical thinking abilities.

In his aforementioned article, White attempts to determine whether critical thinking varies depending on the medium to which it applies. As the analysis is a heavy rhetorical undertaking, he breaks down the process of critical thinking into four scientifically constructed phases: (1) the recognition of information, (2) the analysis of information, (3) the evaluation of information, and (4) and the consideration of

alternative information (White 15). If we apply White's model for critical thinking, we can offer a deeper analysis of how the Internet has affected our ability to think critically. Specifically, we can attempt to understand how the Internet has changed the ways we recognize, analyze, evaluate and consider alternative information. In this paper, I analyze the Internet's effects on our thought processes through White's critical thinking paradigm.

CHAPTER 1

Introduction

Studying the influence of technology on the critical thinking process is not an entirely new idea. In his defense of Google, Norvig references Plato's *Phaedrus*, which documents a dialogue between the classical philosopher Socrates and his companion Phaedrus in 360 BC. In this text, Socrates predicts that if "men learn [writing], it will implant forgetfulness in their souls: they will cease to exercise memory because they rely on that which is written, calling things to remembrance no longer from within themselves, but by means of external marks" (157). Clearly, Socrates perceived the recording of information as a societal crutch. He believed that writing interfered with our inherent *need* to remember information, and that we would forget information crucial to critical thinking. More specifically, people would lack information they need when attempting to understand, interpret and evaluate new information.

In his article, "Is Google Making Us Stupid? What the Internet is Doing to Our Brains" Carr suggests that Socrates was shortsighted in that he could not predict how writing would enhance the creation of ideas and expand knowledge through the spread of information (63). Since Socrates presented his argument against technological tools for recording data over 2000 years ago, more recent innovations in media technology have met similar criticisms. Carr describes early concerns with Gutenberg's printing press, citing 15th century Italian humanist Hieronimo Squarciafico and his foreboding against tools of mass media production. Carr writes, "Squarciafico worried that the easy availability of books would lead to intellectual laziness, making men 'less studious' and weakening their minds" (63). Other authorities identified a separate problem introduced

by Gutenberg's instrument—just as Socrates overlooked how writing would help to disseminate information, the printing press created an opportunity for widespread *misinformation*. Critics questioned the reliability of a machine that took the accuracy of information out of the hands of its producers. The printing press started a trend of isolating authors from their work. Technologies like the printing press have helped to shape an environment where a publication now extends from an author's keyboard to the multitudinous platforms of media that exist today.

Fast-forward almost 600 years and the limits of media in both time and space are seemingly boundless. With the advent of the Internet, we are ever connected with instantaneous access to a web of information. Within the last decade, accessibility has become increasingly mobile through the prevalence of smartphone technology and tablet devices. Social networking applications have exponentially elevated connectivity between users of the web to the extent that potential employers can evaluate a candidate's Net worth on LinkedIn, fans can contemplate a celebrity's outer-most thoughts via Twitter, and acquaintances can judge individuals' social success by their relative accumulation of friends on Facebook.

Although this environment offering instantaneous access to an incredibly vast virtual network is ripe for critical analysis, the most common criticisms of the Internet focus on the content it conveys. Activists concerned with morality might suggest that the increased accessibility of pornography to a large population of Internet users is desensitizing society. Anthropologists can describe the affects of the Internet on human-to-human interaction: i.e., cyberbullying and toxic online disinhibition effects (Suler 1). However, society consistently overlooks a major role that the Internet plays in our lives

as an extension of our thought process. Much as Socrates failed to anticipate an obvious affect that writing would have on the evolution of human progress, modern leaders in technology are ignoring a large facet of human-computer interaction that is shaping the way individuals think.

In his defense of Google, Norvig quickly dismisses any need for consternation by subtly reminding us of Socrates's unnecessary anxiety regarding writing. We must look beyond this reasoning and think critically about this newfound relationship between human and technology, our brains and the Internet. With all innovation—even newer iterations of old technologies—new problems arise. It is often difficult to grasp the effects of a problem that involves a technology as ubiquitous and pervasive as the Internet, especially if society does not perceive the tool as a viable threat.

Norvig's justification for his antecedent claim follows logic parallel to that of the normalcy bias, a social psychological condition that describes how people often react to large-scale disasters in society. In this condition, people rationalize that because nothing bad has happened before in a potentially disastrous situation, nothing bad will happen again in a situation with similar variables. The normalcy bias is one theory that we can offer to explain why government officials and citizens were so poorly prepared to deal with repercussions of Hurricane Katrina. In response to Norvig's defense, we cannot fall victim to this logic and we cannot hide behind defensive rhetoric that infers all critics of Google are simply overly skeptical cynics. The Internet is a relatively new technology in society, which warrants a full investigation into its effects on our critical thought processes, especially as we continue to use the Internet as a primary source for research.

In conclusion, the relationship between critical thinking ability and the Internet is an important one to explore. There was a time pre-Google when students in high schools relied heavily on the Dewey Decimal System for research assignments. This laborious process of collecting, interpreting, understanding, and evaluating information seems like extraneous legwork by today's standards. However, there is an aspect of this antiquated informal retrieval system that is valuable—it is a *process*. Similarly, critical thinking is a process that relies on recognizing, analyzing, evaluating and considering alternative information (White 15). If we compare traditional methods of research with the modern sociological research trend of collecting electronic data, we can immediately identify major differences in each of the four critical thinking phases. In acknowledging and examining these differences, we can begin to discuss the affects the Internet has had on the critical thinking process by students.

In the next chapters of this paper, I explore the effects of the Internet on White's four defined phases of critical thinking—the recognition, analysis, evaluation, and consideration of alternative information (15). I then discuss how to move forward from here—if we acknowledge these effects—by implementing a set of simple solutions that could have an immediate influence. I propose that more long-term qualitative and quantitative research of the Internet's effects on critical thinking processes can help us design interactions and interfaces that will enhance information retention in a well-structured methodology.

CHAPTER 2

Recognizing Information

The first phase of critical thinking is the recognition of information. This recognition is imperative to the collection of effective and relevant material. After gathering useful data, it is possible to determine how the pieces will inform conclusions. Rapidly collecting an array of sources is something that Google does very well. Students rarely go through the painstaking process of perusing the saturated stacks of their campus library; Google's information retrieval process is both simpler and faster. Search engines also offer recent and plentiful information. However, this simpler and faster mechanism for retrieving the information does not necessarily help us to *recognize* effective and relevant information.

As technology progressed in the late 1980s, librarians envisioned a "supercatalog" of electronic databases, each containing a wealth of information. Even then, experts could foresee how simple and fast it would soon become to retrieve data. In the early 1990s, the idea of the electronic supercatalog became a reality. As experts in the field of gathering sources, librarians were excited with this prospect. However, as the World Wide Web emerged, speculation grew amongst researchers. A new concerning condition of the Internet came into focus: The Internet failed to fill a void previously held by librarians as professional curators of information.

As facilitators of research, librarians help to organize a tumultuous sea of information in guiding academics. The search engine offers a virtual center for information retrieval, but the crucial advisory role of the librarian is absent. Therefore, recognizing information on the Internet is contingent on the user's fundamental

knowledge of the topic at hand. This seems contradictory to the critical thinking process in which we attempt to collect relevant sources in order to think more critically about unfamiliar topics to gain knowledge. How can we recognize useful information if our criteria for assessing relevance is baseless? If we consider additional environmental factors that influence search engine results (i.e., search engine optimization (SEO), targeted marketing, customization, etc.) recognizing valuable information becomes even more confusing process.

In her publication in *Library Trends*, Cerise Oberman coined the phrase "cereal syndrome" to describe a problematic condition of interconnected online electronic databases. Oberman explains the cereal syndrome through an experience by one of her friends in the supermarket. She writes:

> [My friend] had gone to the grocery store to pick up his favorite cereal. The endless aisles of different types of cereals so overwhelmed and frustrated him—he could not find his favorite brand—that he abandoned his cart mid-aisle and went to a small corner grocery that had far fewer choices. He was a victim of the "cereal syndrome" (190).

Oberman uses this metaphor to describe the Web, a network of endless pages of information as expansive as the universe. We are awed by the limitlessness of the Internet. However, can the oversaturation of content available on an infinite Web—content that is often redundant, inaccurate, and unreliable—alienate researchers? Do the benefits of finding many sources quickly outweigh the burden of recognizing what is relevant in this capacious medium? Or are we confident enough in our competencies with Boolean logic and the reliability of Google's algorithms to parse through a boundless network and deliver authentic, relevant content?

In an article titled "Convenience or Credibility? A Study of College Student Online Research Behaviors," it is suggested that students college-aged and older increasingly rely on the Internet as their primary source for information research. Additionally, the authors claim that students are "confident in their abilities to discern [sources] using the Internet" (Biddix, Chung and Park 175). As students of the Net Generation have grown up using search engines as a primary tool for research, their comfort navigating and manipulating the Web is axiomatic. These descendants of Generation X are stereotyped for their innate compulsion to be connected—human-computer interaction in its most obvious form. Moreover, this familiarity with Internet technology has instilled a *confidence* in students to employ search engines for research. However, students seem to experience a certain level of satisfaction in generating a quantity of search results, with little regard to the pragmatic application of these sources. This is where we are missing the mark in the recognition of information. It is important to emphasize that searching for the *right* information is a skill—a skill crucial to critical thinking.

In another study (2011) on students online search strategies, researchers at the University of Washington Bothell concluded: "students did not have strong conceptual models of the search process or how search queries impacted results, and were often unable to recognize or troubleshoot problems with searches in order to improve results (Bussert 79)". Students used search engines for the majority of total online searches, and "attempts to expand or narrow searches were haphazard (Bussert 79)". Subjects repeatedly failed to add keywords or implement Boolean operators to narrow searches. Even when Boolean operators were exercised, errors often negated the narrowing or

broadening of results. Also, the majority of students who used Boolean logic tended to concentrate more on the searches themselves than the results generated (Bussert 78-80).

A disparity exists between students' confidence in their online research habits and their skills in conducting proficient searches. For effective critical thinking, we must first recognize reliable information, then interpret and evaluate it before we can form solid conclusions. Search engines provide access to more information, but as Tara Brabazon writes, "The concern is not with the banality of information – there has always been a plurality of sources in the analogue environment. The concern is the lack of literacy skills and strategies to sort the trash from the relevant" (157). It is essential for students to practice these literacy skills and strategies in pedagogical environments—especially if we expect them to recognize relevant information when conducting research online.

CHAPTER 3

Analyzing Information

After we recognize and collect pertinent information, we can begin to analyze its content and form to determine how the work supports or challenges our underlying contentions. For proper analysis, we must provide a thorough interpretation of the author's arguments. We must also remain objective in our pensive considerations. Information analysis is a comprehensive, intimate exercise crucial to the critical thinking process. To this point, does the Internet foster the deep level of consciousness required for a careful and effective analysis?

Jakob Nielsen, widely considered the "father of usability," published a column in 1997 titled "How Users Read the Web." The first line of this column reads, "They **don't**". In the late 1990s, scientists began using eye scanners to measure how Internet users read web pages. In Nielsen's study he concluded, "79 percent of test users scanned any new page they came across" (1). Additionally, it seemed that participants consistently scanned content in an F-shaped pattern. Based on this study, Nielsen created usability metrics for web writing to account for the large percentage of users who scan information online. Of course, scanning cannot offer a thorough interpretation or deep analysis of an author's work. Likewise in 2005, researchers with the independent eye-tracking research firm Eyetools published the "Google Eye Tracking Report." This used more modern technology and eye scanning techniques than were available to Nielsen in 1997. Nevertheless, the results of the study confirmed Nielsen's findings that Internet users scan content in an F-shaped pattern (Chapman 1). It is obvious that Internet users are neglecting large quantities of written content online. Consequently, we are not thorough in our interpretations and our analyses suffer.

The British Library and Joint Information Systems Committee (JISC) authorized a study in 2007 that explored students' online reading habits. The research for the study was performed by CIBER (Centre for Information Behaviour and the Evaluation of Research). Williams and Rowland, the authors of this report, claim that university students and staff tend to browse in a horizontal, shallow behavior, which is described as "power browsing" (19). They write, "Power browsing and viewing are the norm for all: reading appears to be only occasionally undertaken online, more often offline or not at all (Williams and Rowland 19)". The study also suggested that many students "do not explore information in any deep or reflective manner" (Williams and Rowland 19). Students cannot analyze content effectively with mere shallow interpretations of the information they access.

There are many theories that have attempted to describe why students are quickly scanning information and power browsing through web pages in a horizontal progression. Much as Oberman proposes, the abundance of information available on the Web could overwhelm the student into scanning pages quickly, expecting that better resources are only a click away. This cereal syndrome discourages the student from committing to one source. Also, a student's computer is riddled with distractions—iTunes, iChat, casual gaming, etc. On the Internet, hyperlinks, pop-ups, advertisements, Facebook, and email all compete for the user's attention. Focusing on one page is not a natural function of Internet browsing, which can leave them feeling unproductive.

Yet, many students view the Internet as a viable solution for completing homework as quickly and painlessly as possible. This new slacker culture is a major threat to the critical thinking process. It is difficult to place blame on the medium, as

Internet browsers simply display information and we always have the option to output a web page to a printer. In this sense, the choice of medium for reading information from the Internet is ultimately left to the user. As consumers of content, however, we are moving away from print technology and trending toward energy efficient and environmentally sound media. This socially conscious response to save paper only adds to the inevitably that comes with technological advancement—the *if we build it, they will use it* mentality. Mobile devices—feature phones, smart phones, tablets, etc.—are the number one source for information exchange in the Information Age. We send texts, write emails, read blog posts, browse our favorite websites, and correspond with our friends and family all from a single device. Electronic media is dominating the communication of information through electronic interfaces and non-electronic interfaces are becoming increasingly obsolete. If students continue to power browse through the Internet while only scanning web pages for content, their critical thinking abilities will certainly continue to diminish.

CHAPTER 4

Evaluating Information

After a proper analysis, we can evaluate the credibility of an author's work. As readers, we try to identify any biases the author might have and determine if the author has justified all major claims. In this respect, we can gauge the authenticity of a work and the reliability of its author. With the presence of online blogs, wikis, etc., deciphering authenticity and reliability is a challenge in the virtual sphere. Evaluating credibility is an often-arduous task, especially with the lack of gatekeeping on the Web. There is no magic button that will return only reliable publications, although there are techniques and tools that can help us sort through the conglomeration of chaotic content. As we have already discovered, most students lack the fundamental skills necessary to recognize, analyze and evaluate information.

In her article, "The Google Effect: Googling, Blogging, Wikis and the Flattening of Expertise," Tara Brabazon writes, "There has never been a greater need to stress the importance of intelligence, education, credentials and credibility. The problem is not only the accuracy, but also the mediocrity initiated through the Google Effect" (158). The Google Effect is a term used by many to describe the effects of the Internet on human memory. As Nicholas Carr discusses in his book *The Shallows: What the Internet is Doing to Our Brains*, some research suggests that reliance on the Internet as an information resource is rewiring our neural pathways, causing decreased attention spans (130-131). Less controversial is the rise of the amateur on the Internet, a place where any user with an Internet connection can post anything. This environment has created an information depot of diluted content. As it becomes harder to distinguish between

amateur and expert on the Web, ambiguity makes the evaluation of authentic and credible information more difficult.

Even supporters of this online freedom, who praise the Internet for its democratization of authorship and creativity, acknowledge the disadvantages in allowing all users to post content on the Internet. In their book *Born Digital,* the authors Palfrey and Gasser write, *"*It's not all good—diversity can lead to too much information and information of dubious quality; there may be too few intermediaries to help us to choose, and we might face social fragmentation over time as multiple perspectives gain acceptance (126)". As there are few standards for publication on the Web, assessing the validity of a source requires proficiency. In determining the credibility of an author, the student must classify impartial experts yet identify the skilled rhetoricians with an agenda. To complicate this process, students must differentiate between fanatics, cynics, self-described gurus, and the misinformed. There is no system of checks and balances on the Internet to ensure the fidelity of information.

Advocates for collective intelligence mechanisms (e.g., wikis and forums) suggest that the cumulative opinion of Internet users yields an acceptable level of credence. The controversial use of wikis regarding information credibility is a topic of frequent debate in the field of human-computer interaction. The stability of these structures, Wikipedia for example, is contingent on the prolonged, high-threshold participation of many users. If few users engage in a wiki, the ratio of amateurs to experts can be skewed. Nonetheless, if a wiki has many users and active participation, reaching a reliable conclusion is often a lengthy process. Again, in *Born Digital*, Palfrey and Gasser touch on some of these criticisms: "There are real concerns about cheating, plagiarism, lack of

credibility, defamation—and much more—to which Wikipedia gives rise" (118,120). Wikis can muddle the provenance of a source leaving it almost impossible to pinpoint the origin of an idea. For this reason, collaborative environments are frequently targeted for concerns with plagiarism.

In order to investigate the reliability of an author it is important to understand exactly where a source came from, including the author, date of publication, etc. Wikis blur the provenance of information so that identifying the origin of an idea is either impossible, or it requires extensive labor. Even with proper research techniques, it is not always possible to determine an idea's originator in a collaborative environment. Obviously, this has ethical implications—such as plagiarism—but more importantly, we cannot adequately assess the reliability of an author or several authors in collaboration; thus, we cannot ensure that a work is credible.

Evaluating the nuances of a source is difficult even to the seasoned professional, but this evaluation can be nearly impossible for a student. The Internet has provided us an increased access to information, but the nature of this information is now much broader in quality. This leaves us with several questions: Does the democratization and diversity that the Web offers as an outlet for expression cause an excess of redundant content and misinformation? Can we rely on wikis and other collaborative environments to deliver reliable content? More importantly, has this virtual space helped students to evaluate the credibility of authorship?

CHAPTER 5

Considering Alternative Information

For well rounded critical thought, we must consider alternative perspectives that will support or challenge our conceptions. By examining a diverse collection of information, we can ensure that we do not ground future determinations in misapprehensions that were poorly formed through myopic research. Because the Internet is so incredibly vast, one might assume that the abundance of information available on the Web makes considering alternative perspectives simpler—this is a popular misconception. In order to contemplate ideas that will test our beliefs, we need to push our comfort zones and listen to viewpoints that we would have never considered on our own. Unfortunately, search engines do not promote impartiality in research.

We must exercise a perfect amalgam of conditional search terms for optimized results. However, regardless of how we form our search terms, our results permeate through a personalized filter, which political activist Eli Pariser has dubbed a "filter bubble". At a TED (Technology Entertainment Design) talk in 2011, Pariser described this condition:

> Your filter bubble is your own personal unique universe of information that you live in online. And what's in your filter bubble depends on who you are, and it depends on what you do. But the thing is that you don't decide what gets in. And more importantly, you don't actually see what gets edited out. If I search for something [on Google], and you search for something, even right now at the very same time, we may get very different search results. Even if you're logged out, one engineer told me, there are 57 signals that Google looks at—everything from what kind of computer you're on to what kind of browser you're using to where you're located—that it uses to personally tailor your query results.

We browse on a Web that has been customized to match our assumed preferences. Additionally, most of us cannot fathom the significance of this phenomenon because we do not see other users' search results for identical queries. If these algorithms are returning only the information that Google forecasts will please us, how can we consider alternative information that will challenge our ideas? How can students push the envelope? As author Steven M. Cohen claims, "98 percent of Google users do not go past the top 10 [search results]" (1). Given these constraints faced by students when using Internet search engines for research, it is not possible that the results generated by these mechanisms are challenging students with a sufficient level of alternative viewpoints.

Some argue that the use of search engines inhibits any eclectic experience. Tara Brabazon claims, "Googling is a self-absorbed action, rather than an outward and reflexive process. It is not a search of the World Wide Web, but the construction of an Individual Narrow Portal. A persona is constructed and summoned through Google that is not a neutral avatar, but configures a self on the basis of popularity" (159). This self-indulgent behavior limits the potential for outside influence. If we assess how these egocentric behavioral patterns restrict students' exposure to new ideas in conjunction with Pariser's filter bubble observation, we can only conclude there is little opportunity for students to consider alternative sources.

In another vein, it is difficult for student researchers to consider alternative information available on the Internet because we are intrinsically limited by what we know. As students scan information rapidly and do not properly analyze

issues, it is hard to find counter arguments for topics that they do not fully understand. This ignorance elicits shallow power browsing, as students make an effort to grasp different elements of an idea from many sources. Students collect information, briefly scan the material, and then quickly browse for related literature. Rather than a fluid critical thinking process, students jump from one phase to another, wandering around aimlessly.

Without considering alternative information, we refrain from deep understanding and merely touch upon shallow ideation. This is cyclical, as we are the producers of content on the Web. Of course, not *everyone* follows a shallow research pattern; however, this trend is certainly on the rise. We purport that the Internet has given access to a breadth of information that keeps us more informed than ever in history. However, in our self-centered motives for exploration on the Web, we continuously seek out resources that support our preconceptions. Customization algorithms limit our opportunities to find resources that will challenge our perspectives, and we are repeatedly fed information that has been tailored for our approval. How are we considering alternative information? More importantly, how does this challenge our critical thought?

CHAPTER 6

Conclusion

Let us revisit Norvig's initial claim in his debate with Nicholas Carr: "Just as a car allows us to move faster and a telescope allows us to see farther, access to the Internet's information lets us think better and faster" ("Google" 1). This statement is a fallacy, but it is a widespread misconception that many hold as truth. In fact, telescopes do help us to see farther, as they were designed for this specific purpose. The relationship between the telescope and sight is causal—telescopes *cause* enhanced depth in sight. However, the Internet was not designed to make us better and faster thinkers, and it does not *cause* us to become better and faster thinkers. As we know, information is not knowledge. I have access to countless classical Greek texts online, but to me they have no meaning. This is because I cannot (1) recognize, (2) analyze, (3) evaluate, or (4) consider alternative texts written in Greek (White 15). To process information, we must engage in these fundamental critical thinking phases. The Internet does not foster sufficient opportunities to think critically about the vast information it provides.

In the early 1990s, students transitioned away from physical libraries and moved toward online mechanisms for research. These research systems on the Web lacked virtual librarians to help students' harness the techniques necessary to recognize relevant information. Also, there were no longer gatekeepers to curate this newfound abundance of information. The first step in critical thinking—recognizing pertinent information—was left entirely to students. In the words of Tara Brabazon, students are now left with the burden of "sort[ing] the trash from the relevant" (158). The Internet is oversaturated with redundant and dubious content, and it is soaked with misinformation. In this "cereal

syndrome", students cannot possibly recognize accurate information efficiently (Oberman 190). Although students have shown supreme confidence in their abilities to use search engines effectively, studies on student performance in this area have continuously demonstrated that students are ineffective in their abilities to recognize relevant information online (Biddix, Chung and Park; Brabazon; Williams and Rowland).

Students feel pressured by the abundance of information available on the Internet, and they power browse through the network of pages on the Web in a rapid, horizontal succession (Williams and Rowland 19). If a student can summon the patience to remain static on a page for a short time, it is only to scan through the page in an F-shaped pattern (Nielsen; Eyetools). In this struggle, we never bother to gain a deep understanding of a work; rather, we merely develop shallow ideation. As non-electronic interfaces disappear and our neural pathways are rewired, scanning is now a social norm (Carr 130-131). The Internet is not supporting proper analysis of information; it is hindering the fundamental aspects of critical thinking.

As the wiki model becomes more prominent on the Web, collaborative environments are now common avenues for research: We rely on a collective intelligence to deliver reliable content. However, wikis blur the provenance of information. Determining the authenticity of a work is nearly impossible, as it is difficult to assess the origin of an idea—which includes the author of a work and its date of publication. Wikis have ethical implications, such as an increase in plagiarism. With the prevalence of wikis and blogging on the Internet, there is a rise of the amateur on the Web. Students must gauge reliability in a sea of misinformation and mediocrity. Evaluating a work's credence has never been more important, yet it is never been more difficult. The Internet has made

the evaluation of information a significant challenge for students, and in this way, it is halting critical thinking processes.

Lastly, we are severely limited in our opportunities to consider alternative prospects. We search for information in a filter bubble, where Google's algorithms only return results that it calculates will appease our interests (Pariser). Search engines are not pushing our comfort zones, and our self-centered exploration habits on the Web are inhibiting holistic perspectives. Astonishingly, as Steven M. Cohen states, "98 percent of Google users do not go past the top 10 [search results]" (1). The Internet is limitless, but we are repeatedly accessing only an incredibly small portion of its network—a portion that has been tailored to match our assumed preferences. In this way, the Internet does not assist students in considering alternative information; instead, it keeps us locked in customized cycle.

Now, let us revisit David White's claim on critical thinking: "[it] aims at understanding, interpreting and evaluating information that already exists" (14). Clearly, the Internet is not cultivating our abilities to understand, interpret, or evaluate information. Likewise, it is not helping us to become better and faster thinkers. So where do we go from here? Do we design for the conditions that now exist—scanning in F-shaped patterns, filter bubbles, etc.? Or, do we try to fix these conditions to nurture students' critical thinking skills. As I will outline in my discussion, I think we can integrate both of these strategies.

CHAPTER 7

Discussion

This paper raises several concerns regarding the Internet's affects on the critical thinking processes of students. In order to develop long-term approaches that foster students' abilities to think critically, more qualitative and quantitate research into the scope of these effects in each level of education must be completed. However, there are immediate strategies available that can help provide structure to the chaotic ways students research online. In learning effective online research methods, students will rediscover the procedural benefits of critical thinking as a *process*.

It is important that students be made aware that the Internet is affecting their critical thinking abilities. There should be an academic offensive to publicize this condition widely. Additionally, it should be mandatory for students to complete at least one full course in Information Literacy at the secondary, undergraduate and graduate levels of education as part of a multidisciplinary curriculum. An expert in online research methods—such as a librarian— should instruct the course, and it should teach students proper techniques for using Internet search engines. The course should also emphasize which online information systems are reliable—for example, the use of electronic research databases vs. wikis.

In Information Literacy learning environments, we can design interactions to reinforce the different critical thinking phases. For example, in elementary and secondary education settings we can program browser add-ons to limit the number of searches students are allowed to execute in a single session. These limitations would prevent power browsing and would force students to learn effective search skills. If a student

exceeded the total number of search possibilities and did not find any useful sources, the instructor could gauge the student's ability to refine Internet searches and make adjustments accordingly.

Similarly, we can design electronic research databases for students that supplement the critical thinking process. To elaborate, databases used by elementary and secondary schools might only show students research abstracts. The student could search through abstracts and choose an article. To help student's read more carefully, the article's text would then populate line-by-line when prompted by the user's interaction. This forced concentration would prohibit student-scanning patterns, and would instill the fundamental skills necessary for critical thinking.

Designing new interfaces and interactions might only serve as a Band-Aid to an overarching cultural problem, but it is a start. If we acknowledge that the Internet is affecting students' critical thinking skills and we conduct further research into these effects, we will establish the groundwork necessary to conceive practical methodologies that harness students' critical thinking in online environments.

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